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The Engineering Generation: the Story of the Technicians Who Enabled American Cold War Foreign Policy, 1945-1961

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Abstract

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The Engineering Generation: the story of the technicians who enabled American Cold War foreign policy, 1945-1961

Thesis directed by Professor Thomas Zeiler

This project explores how American engineers born at the end of the1800s were conditioned to hold important places in American Cold War policymaking. Growing up during an unprecedented era of visible technological achievement, young American men turned to engineering as a way to professionally satisfy their tinkering and problem-solving inclinations. After contributing much to the Allied effort in World War Two, these individuals stood on the front lines of a Cold War U.S. foreign policy that sought to compete with the Soviet Union via technology on a number of levels. From Third World development to American defense initiatives, engineers deployed their mentalities to extend American power's reach around the world in an effort to keep it oriented away from the USSR. Using both state records and personal papers of American engineers of the era, this project shows that the experience of engineering in the early Cold War became tightly wedded to the federal government. In the end, the Cold War brought engineers closer to American state administration, a relationship best described through the engineering concept of the positive feedback loop; as the government employed engineers on an increasingly frequent basis to further American policy ends, the status of engineers in society grew in concert, cementing a permanent and mutually beneficial relationship that endures to this day.

Acknowledgements

I would first like to thank the History Department at the University of Colorado Boulder for giving me an opportunity to further my professional goals, and for providing financial support for my research trips. Thank you to Tom Zeiler for his mentorship and guidance on the project. I suspect I am not entirely finished taking his advice about how to navigate this field. My thesis committee delivered helpful feedback regarding how I might shape the project into a book. I appreciate their input and belief in the project. Finally, Scott Miller in the CU History Department's graduate office kept me on the straight and narrow, helping me submit required material on time. He did so without griping to my face once.

My research process was spurred on by a number of great librarians and archivists. Leanne Walther at Colorado's Norlin Library was patient with my endless questions about locating sources. The staffs at the Truman and Eisenhower Presidential Libraries provided me clear direction for the project. I especially thank the Truman Institute for giving me a travel grant to visit the facility, and dig deeper into the legacy of the Truman administration's relationship with engineering. Also, the staff at the National Archives at College Park, Maryland suggested I look at collections that led me down new and productive research paths.

Thanks to Jenifer Monger at the Rensselaer Polytechnic Institute Archives, who answered emails and created a welcoming environment during my stay in Troy. The staff at the Burlingame Historical Society in Burlingame, California thankfully set aside time to let me peruse some of their more obscure collections, from which I gained a great deal of information for this project. The Hoover Institute staff at Stanford made it easy to research on short notice. The personnel at the Huber Machinery Museum in Marion, Ohio allowed me free reign of the

defunct company's records. I hope that this thesis at least partially honors the memory of the company that many believed in so strongly. As the gatekeepers for the Pat Gifford papers, Kathy and Richard Swift, along with Greg Gifford, welcomed me like family to scour the extensive and uncatalogued Gifford records in Saint Louis. They housed me, fed me, and took me to my first Cardinals game at Busch Stadium. What else can a researcher ask for?

The most important support came from my family. My parents always supported my graduate school goals, despite being unfamiliar with what lay in store for me. Like my venture into the sport of wrestling as a child, my parents did not always know what to make of my endeavors. But, they encouraged me wholeheartedly, anyway. Most importantly, my wife, Shannon, hitched her wagon to me even in the face of the life-changing move from Ohio to Colorado. More than anyone, she believed that I would achieve my goals even when I was sure something would go terribly wrong on the way. Her dedicated love and warmth, and willingness to pick up my share of the housework when my writing reached its most intense stages, were the most important keys to the completion of this project. More than anything, her presence constantly reminded me that there are much more important things in life than historical analysis.

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Introduction

In downtown Marion, Ohio's Hotel Harding, Clayton Elwyn "Pat" Gifford took his place at the front of the room to give an account of his experiences working as a mechanical engineer overseas. The man appeared middle-aged, of average height and weight, bespectacled, with an almost permanent contemplative affect. He stepped behind the podium, drew a notecard from his suit jacket, and proceeded to address the small group of Rotary Club members in flourishing prose. Gifford focused much of his talk on the sights and sounds of one country in particular: the Republic of Turkey. Gifford explained his awe in seeing first-hand the Christian ruins in Tarsus and castles that dated to before the Crusades. He noted the curious juxtaposition evident in a country so delicately toeing the line between traditional and modern ways of life. In that vein, Gifford was quick to point out that the new city of Ankara seemed deeply "progressive" compared to all that surrounded it.[1] Gifford traveled to 21 different countries in total over a three year span, but he spent most of his time in Turkey.

In many ways Gifford was unremarkable. He lived a quiet life in the small Midwestern town of Marion, owned a humble home on Summit Street, went to the local Methodist church, and grew a big family that encouraged even his three daughters to attend college in the 1940s. By the time he presented to the Rotary Club that May afternoon in 1953, his children were all grown up, his wife had passed away a couple of years earlier, and he served as the head development engineer at one of the largest firms in Marion, the Huber Manufacturing Company. In recent years, international engineering had seemingly become an ever-larger part of his life.

Not that this bothered him. In reality, Gifford really lived his passion as an engineer. Even as a child, Gifford thought and acted like an engineer, and over time he grew in his knowledge to pursue the field as a career. Now at age 57, Pat Gifford undoubtedly stood at the

[1] "Marion Man Tells About Trip Overseas," *The Marion Star,* May 14, 1953, 10.

top of his field, with a number of patents to his name. He held numerous professional memberships, at one point holding an officer position in the Marion chapter of the Ohio Society of Professional Engineers.[2] Even in his leisure time, he tinkered around his home's drafting room, drawing up designs for things as complicated as a road grader, or as domestic as wrought iron fencing for his backyard. In sum, his life story provides clear evidence that Gifford lived and breathed engineering.

Despite a humble lifestyle, Gifford experienced more than the average Marionite, a fact reinforced by the travel account he relayed to the attendees at the Marion Rotary Club luncheon. He visited Turkey for one specific and important purpose: to teach Turkish engineers how to use new and modern road building equipment produced by Huber. From the date that the Truman Doctrine received approval in 1947, the U.S. instituted a new kind of foreign policy focused on the "plight" of poor countries. Lying at the intersection of Cold War geopolitics and the proverbial "Third World," Turkey began receiving various types of aid from the United States as a method of warding off communist influence. The Truman Doctrine aimed "to support free peoples who are resisting attempted subjugation by armed minorities or by outside pressures" by sending military assistance to Greece and Turkey.[3] And yet, military aid was just the beginning. From 1947-on, the U.S. continually found ways to grant or lend money and supplies to tackle all manner of issues plaguing Turkey internally. From military aid came economic aid, some of which became the seed for a special Turkish highway project that spanned nearly the entirety of the country.

The Turkish road system truly had its troubles at the time. Much like the Greeks, the Turks needed new roads long before 1947, but lacked the financial and human capital to make it

[2] "Professional Engineers Elect Walter R. Warne," *The Marion Star*, March 10, 1959, 12.
[3] United States Department of State, *Department of State Bulletin*, (Washington, D.C.: Government Printing Office, 1947), 534.

happen. The dearth of all-weather infrastructure had hampered the movement of goods and military supplies through the young republic since well into the Ottoman period. Turkey's unpaved roads would easily wash away in heavy rain, and become untraceable under snowfall. For a country that might serve as the front lines in a Cold War confrontation with the Soviet Union, having an infrastructure that only worked three-quarters of the year proved problematic. Postwar aid changed all that, and brought along with it engineers from the United States to ensure that modern ways of constructing highways could be appreciated by Turks.

The Turkish roads project was administered by the U.S. Bureau of Public Roads in conjunction with the Turkish Public Works Ministry as a part of broader postwar American development policy, which may seem surprising considering the agency focused on domestic roads. But the Cold War compelled the engineer-run Bureau also to look abroad. Huber sold the Bureau hundreds of vehicles needed to build a road system that would withstand the elements, especially in the relatively remote Anatolian plateau. The problem came in implementation. The Bureau worked alongside the Turkish Minister of Public Works to design the road system, but the Turkish engineers and workers had little exposure to Huber's newfangled equipment. The Bureau summoned Gifford to instruct those engineers in how to effectively implement the new equipment that would ultimately transform the Turkish landscape from Istanbul to Erzurum in the East.

In Turkey, Gifford became a sort of ambassador for Huber and the United States all at once. He was the engineering "face" of the company, responsible for a number of Huber's top-of-the-line heavy construction equipment pieces that saw use all over the world. Who better to transfer that technical knowledge than the man himself? More than his roles as an engineering "ambassador" for the U.S. and Huber, Gifford's most instructive role came as an actual expert

technician. As an engineer, Gifford belonged to a broader discrete community of “experts” with a greater-than-average importance to the postwar development process. That community of engineers and their foreign policy significance is the focus of this thesis.

The profile of Pat Gifford is not meant to suggest he was somehow more important than other engineers who took part in overseas development. His importance to the story is quite the opposite; because he was one of many in the faceless whole of “experts,” he is precisely the type of figure who needs further explication. Gifford never became rich, famous, or politically powerful in the engineering community. Even on the scale of the roads program, he played a minor role. His background as a relatively humble man from the Middle West, educated- but not too educated- positions him as just the sort of development engineer who has long deserved attention from a historical community engaged in a bottom-up view of humankind.

In a way, engineers embodied America. Their modernist, democratic, and humanitarian characteristics aligned perfectly with general American values. Like their European colonial counterparts, Americans long held romantic notions of civilizing backward peoples and places. “Modern” ways of thinking have gone hand in hand with those actions, and engineers carried those ideas with them across time. The notion of the “modern” brings with it a variety of implications for humanity and statecraft. Regarding government, historian Nils Gilman writes that modern states came tied to ideas of welfare, of democracy, and progressive taxation. But modernity also meant that those modern governments would emphasize certain intellectual values, which regarded science and technology as necessary partners for societal progress.[4] The practice of engineering serves as the archetype of modern knowledge in its use of science and mathematics to solve problems. As a companion to scientific reasoning, engineers attempted to

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[4] Nils Gilman, *Mandarins of the Future: Modernization Theory in Cold War America* (Baltimore, MD: JHU Press, 2004) 1-2.

harness the power of nature for human use in an endless variety of contexts around the world and across time. Chandra Mukerji writes in *Impossible Engineering*, that the design and construction of the ambitious Canal du Midi in medieval France came about as a thoroughly modern enterprise: "[The canal] was surely a modern effort – a claim about what was possible by combining new knowledge of nature with classical engineering."[5] Thanks to their equally ambitious canal and aircraft projects, twentieth-century American engineers carried forth those nature-harnessing ideas of modernity into a new age.

Researchers in many disciplines have focused on engineering in some form. Some write about actual people, while others paint engineers as a faceless mass of "technical experts." Work by Timothy Mitchell and more recently, Christopher Sneddon, treat engineers as the mass, an indiscriminate group of technocrats executing "techno-politics" in development projects at home and abroad. In these scholars' eyes, engineers are deeply important. Their research contributed importantly to this thesis, and helped guide the arguments made, but they give little insight into why engineers think and act the way they do.[6]

Even though plenty of scholars have mentioned that engineers were important to postwar development processes, engineers like Gifford are an underestimated portion of the postwar aid narrative in one specific respect. The engineer *mentality* undergirded development in ways unseen in previous research. Although readers know that "technocrats," "experts," and U.S. foreign policy became wedded in the latter half of the twentieth century, we know little about who those experts are, how they calculated their roles in society, their beliefs, and their backgrounds. To ignore the engineering mentality in development is to miss the human element

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[5] Chandra Mukerji, *Impossible Engineering: Technology and Territoriality on the Canal Du Midi*, Reprint edition (Princeton, NJ: Princeton University Press, 2015) 5-6.
[6] Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley,CA: University of California Press, 2002); Christopher Sneddon, *Concrete Revolution: Large Dams, Cold War Geopolitics, and the US Bureau of Reclamation* (Chicago: University of Chicago Press, 2015).

in favor of the big picture. Instead of focusing only on the ends of engineering in development, we should know more about the means and the people on the ground who made it happen.

Objective

The first goal of the thesis is to address U.S. postwar foreign policy through the *mentality* of transnational engineers by giving them a face and a voice with regard to their roles in U.S. policy. It is the central argument of this thesis that engineers constituted a cohesive group of practitioners and thinkers that aided American postwar foreign policy by reinforcing the already-present notions of technological supremacy and modernity that existed in the minds of American policymakers. In other words, the allying of policymakers and engineers was an easy marriage due to their already relatively aligned worldviews on how advancement was to operate. These engineers shared a mentality, backgrounds, and experiences that launched them into positions of importance in postwar U.S. foreign policy, with significant authority. Further, their alignment with U.S. foreign policy mirrored domestic developments. As American engineers were flung into Third World settings after the war, they simultaneously found new avenues of advancement in and through the government at home. By the end of the 1950s, engineers became more visible and useful for the American government than they ever could have thought as budding technicians. In other words, engineers became partners with the federal government on a number of levels, development being only one significant example.

Engineers of Gifford's era grew up in a time of great movement in the scientific and technological world. Born in the final decades of the 1800s, people of Gifford's age, what will be called the "engineering generation," parlayed their expertise into large-scale and important projects that would have been unheard of in their childhoods. The world had changed a great

deal since they were children, and science and engineering had a big part in explaining those differences. Those shared experiences growing up in the early twentieth century would later become an integral part of post war American foreign policy. Members of the engineering generation did not all share career destinations. Some ended up near the top of American government, while others remained in the drafting rooms they set out to work in when they became engineers. Other more military-inclined engineers studied at the U.S. Military Academy at West Point or Naval Academy at Annapolis, and later served in the Great War. This type of engineer held high leadership positions in the military's engineering arms during and after World War II. Engineers advised presidents, made important decisions about aid allotments, and most notably, designed important technology to fulfill federal policy aims.

The engineering mentality linked these individuals. To be a member of the engineering generation was to view the world in a certain light, value certain principles, and understand oneself to have a certain role in the world and in the nation. They believed technology brought good into the world, and that as engineers, they possessed unique mastery over the concept. That sentiment could then be traced through their commentaries and responses to national and global crises.

A key to this engineering story comes in understanding from where engineers come. A second argument the thesis makes is that Marion manufacturing served as a window into a broader culture of innovation that existed in twentieth-century Ohio. Marion itself became a center for engineering in the state. Because of its resident heavy manufacturing firms, Marion contained a disproportionate amount of engineering expertise, who designed and innovated at a fast pace in the first half of the twentieth century. Huber was only the beginning of the story. The Marion Steam Shovel also called Marion home. Known colloquially as the "shovel" in Marion,

Marion Steam Shovel built heavy dragline equipment that saw great use in the digging of the Panama Canal, and other large domestic and international projects by the turn of the twentieth century.

The small Ohio engineering town represented a statewide trend rather than an exception. Small towns like Marion peppered the state of Ohio in the twentieth century with their heavy manufacturing operations and engineers. The firms became important to postwar foreign policy because they designed the modern equipment used to remake roads in Turkey, and beyond. People like Gifford employed by the small town manufacturing firms, innovated with the best of big-name firms and cities like Detroit or today's Silicon Valley. As will be shown, Ohio became a sort of bastion of engineering thought and practice in both underestimated and important ways for American foreign policy after World War II.

The third goal for the thesis is situating engineering into Presidents Harry Truman and Dwight Eisenhower's foreign policies. It is a rare thing for a president's foreign policy to extend far beyond his administration, and Truman and Eisenhower are two of the few. Just as Woodrow Wilson introduced the notion of liberal internationalism to a world still wrangling with it almost a century later, Truman and Eisenhower's postwar development and technology policies shaped the interactions between engineers and the government in ways still in operation to this day. Although differences existed between the two administrations' policies, their methods of empowering engineers reflected more similarity than difference.

As historians like Elizabeth Spalding have pointed out, Truman's administration was first and foremost concerned by the geopolitical threat of the Cold War.[7] This thesis will argue that Truman's enacting of the postwar development, research, and space programs in which engineers

[7] Elizabeth Edwards Spalding, *The First Cold Warrior: Harry Truman, Containment, and the Remaking of Liberal Internationalism* (Lexington, KY: University Press of Kentucky, 2006).

played important roles, came as a direct response to that geopolitical security threat rather than a revisionist market security concern. But, while the Cold War has ended, U.S. state-led development has not. To be sure, all of these aid programs had an "official" termination point, yet, they live on in other forms with different names. The Truman Doctrine transitioned some of its programs into the Marshall Plan under the Economic Cooperation Administration, and then led to the creation of the European Economic Community, and, eventually, the latter day European Union. The expiration of the Marshall Plan meant policymakers would scramble to continue certain projects under the Point Four program's purview or other administrations. After all this, Point Four became the United States Agency for International Development, an organization that continues to operate to this day.

Engineers were a large part of that world. Postwar foreign policy institutionalized engineering into official U.S. foreign policy to combat Soviet advances in technology and political influence. Engineers headed agencies like the Bureau of Public Roads and they continue to be a significant part of America's reach abroad. Under both Truman and Eisenhower, they also took on new importance at home by enabling policies that made Cold War programs like NASA possible. In many ways, engineers pervade modern culture, and provide an appealing avenue for professional advancement for the middle-class. That ubiquity and appeal gained steam through the work of the engineering generation, and government support.

In attempting to write the history of a generation of Americans, certain challenges emerge. Categorizing a generation assumes that defined lines can be drawn between those born before and after a certain year. Drawing temporal boundaries around the engineering generation is not an exact science. The scope of the engineering generation mostly addresses people born in the late 1800s, yet some engineers born in the years after 1900 share many of the same

characteristics, especially regarding the culture of technology in America in which they grew up. For this reason, this project profiles some individuals who may have been born after 1900, but still influenced important moments in American postwar policy.

It is also worth noting that studying the engineering profession up to the 1960s brings with it necessary exclusions. The story of the engineering generation is one defined by white American men, which in itself suggests a lot about the field. The American engineers involved in the Turkish roads program, and those in the Bureau of Public Roads generally at the time, were all white. The same goes for those advising Truman and Eisenhower on technology and science policy, and those working on the higher levels of American ballistics and space programs. Certainly some professions in the twentieth century set higher barriers to entry for racial minorities and women, and engineering has ranked among the highest of those fields. Although not necessarily excluded from engineering colleges, African Americans experienced low engineering enrollments nonetheless. Engineering colleges had plenty of international students even as far back as the late 1800s, but these students largely took their educations back with them to their home countries. Women for the most part had been excluded from engineering colleges altogether until World War II, but even then they were only accepted with conditions. When delving into the commentaries of engineers in professional associations, minority voices are usually nowhere to be found. As a result, this thesis will only tangentially touch on the status of female and minority engineers through the events of the twentieth century. Even so, the story of these ignored engineers deserves its own properly dedicated research in the future.

On a broader scale, this thesis argues that events of the twentieth century brought together the federal government and engineering into permanent, mutually beneficial relationship. As the government increasingly needed engineers to combat Soviet power in

foreign policy, the field of engineering enjoyed concurrently increasing status in American society. Their employment prospects, wages, and usefulness grew significantly from where they sat in the first decades of the twentieth century, and that growth in large part had federal programming to thank. The world today, one that continues to revere and emphasize Science, Technology, Engineering, and Mathematics (STEM) education, finds its roots in the work of individuals of the engineering generation. This writing aims to explain how that relationship between engineers and the government came to be, and who the individuals were that made up this body of skilled technicians.

Historiography

This thesis engages three disparate, but connected literatures: U.S. foreign relations history, technology engineering history, and development studies. U.S. foreign policy literature has recently taken development and modernization head on as a subject, with authors like Michael Latham leading the way. Books like Latham's *The Right Kind of Revolution* focus on a later segment of American development policy, the 1960s, which treats Kennedy-era modernization as a sort of climax in the story of American policy with the undeveloped world. Latham's work tracks the rise of American modernization as a pinnacle of liberal planning in the twentieth century. His book also moves beyond modernization to address the emergence of 1980s neoliberalism as a sort of backlash against liberal planning's failures. This dissertation will take the preceding years, 1947-1961, to argue that this was the true point of departure for U.S. policy with the undeveloped world.[8]

[8] Michael E. Latham, *The Right Kind of Revolution: Modernization, Development, and U.S. Foreign Policy from the Cold War to the Present* (Ithaca, NY: Cornell University Press, 2011).

A number of development histories describe how notions of "improvement" undergirded American actions toward the undeveloped world well before the 1960s. Older literature, such as Kendall Birr and Merle Curti's *Prelude to Point Four* discuss American technical expertise in the context of pre-WWI private missions to poor countries. Their work illuminates the private American enterprises that aided foreign farmers in growing more robust crops, and reforming wasteful economies. In effect, these private, transnational foreign missions served as early precursors to the state-led US development projects that this thesis will explore.[9]

Amanda McVety's *Enlightened Aid* tells an almost parallel story to this with regard to the development efforts in Turkey. McVety's focuses on Ethiopia, an East African nation that experienced many of the same early development processes as Turkey. The most obvious similarity was a road development program administered by the Bureau of Public Roads, and built with Huber machinery. The book provides a framework of sorts for setting up a case study of development history which this project attempts to incorporate.[10]

At its core, U.S. foreign policy's turn toward the undeveloped world was a result of the emergent threat posed by communism and the Cold War. As such, a number of diplomatic histories of the Cold War have been consulted to draw in the broader context of Turkish development and engineering. As Nick Cullather argues in *The Hungry World,* Cold War development efforts were geared toward drawing undeveloped populations into the American orbit. The Cold War threat to American ideology spurred the increase in American interventions into the parts of the world that previously drew little concern from American policymakers. Because of the fear of communism's spread, American officials saw the condition of the Third

[9] Merle Curti and Kendall Birr, *Prelude to Point Four: American Technical Missions Overseas, 1838-1938* (Madison, WI: University of Wisconsin Press, 1954).
[10] Amanda Kay McVety, *Enlightened Aid: U.S. Developmentas Foreign Policy in Ethiopia* (New York: Oxford University Press, 2012).

World as a big problem to be solved. American power and money could be used to strengthen economies, thereby reducing the appeal for social uprising and communist revolution. Thus, the Cold War was the catalyst to development policy. This thesis will argue that America's foray in to the Third World was a result of national security concerns over revisionist market security arguments.

According to Odd Arne Westad's *Global Cold War*, the "Third World" suffered most during the Cold War. While the tension of the era stemmed from the US and USSR, that tension manifested itself in increased suffering for Third World populations, producing "extreme inequality" in poor regions.[11] The fight over the "hearts and minds" of undeveloped populations prompted increased American interventions that often resulted in more violence rather than anything that resembled "development." This project traces the origins of those Third World interventions to the paradigmatic "birth" of a coherent U.S. development policy after World War II. It can be safely argued that the violence that plagued the less developed world beginning in the 1950s had little resemblance to what Truman had in mind when he redirected U.S. foreign policy toward "fixing" a vulnerable and needy undeveloped world.

The tragic story Westad describes, that of high ideals descending into chaos on the ground, has emerged as the dominant interpretation of Western development efforts writ large. Development scholars, especially those outside of the history field, have almost unanimously panned mainstream development as a failure. This dissertation does not attempt to refute that notion. Instead, this project will revisit the era that America, as development scholar Arturo Escobar says, suddenly "discovered" the undeveloped world. To achieve this is to emphasize the primacy of the immediate postwar era as a watershed moment for American foreign policy- not

[11] Odd Arne Westad, *The Global Cold War: Third World Interventions and the Making of Our Times* (Cambridge, UK: Cambridge University Press, 2007).

for understanding the origins of the Cold War, but as an explanation for a far longer-enduring struggle: fixing the undeveloped world.

Jason Parker's *Hearts, Minds, Voices* argues that Soviet and American attempts to win over the Third World sometimes worked against superpower interests. Instead of pulling poor parts of the world closer to the orbit of the two superpowers, American public diplomacy efforts gave rise to discrete identification among the Third World, at times empowering them to go their own way. This thesis will show that Turkey alternately aligned itself with American interests, while also asserting its own power when convenient for its own sovereign interests. Turkey at times exhibited the tendency to play American and Soviet aid offers against one another, but stopped short of fully aligning itself with the nonaligned movement that Parker discusses at length.[12]

The foreign policy literature on the Truman administration has seen a revival, with the general result that Truman was effectively "tough" on communism. Wilson Miscamble's 2008 work *From Roosevelt to Truman: Potsdam, Hiroshima, and the Cold War* argues that Truman inherited a messy foreign policy burden from Franklin Roosevelt, but sought in the end to project strength in dealing with the Soviet Union. In this sense, this thesis seeks to take the Truman Cold War story step beyond, by suggesting that his foreign policy provided a show of strength. His development mission in utilizing technology and engineering as foreign policy arms constituted a new tactic in projecting power in the world. Through the debates in the State Department and Congress, the enacting of the postwar development policies not only embodied the first state-led development efforts, but more closely married engineering and national security for good.[13]

[12] Jason C. Parker, *Hearts, Minds, Voices: US Cold War Public Diplomacy and the Formation of the Third World* (Oxford, UK: University Press, 2016).
[13] Wilson D. Miscamble, *From Roosevelt to Truman: Potsdam, Hiroshima, and the Cold War* (Cambridge: Cambridge University Press, 2008). For more on the topic see the conference notes of

Truman's role and legacy are both implicated in the enduring story of foreign aid in Raymond Geselbracht's *Foreign Aid and the Legacy of Harry S. Truman.* The edited volume uncovers how aid became institutionalized in American foreign policy, including the problems associated with that process into the 1970s. Selected essays track the shift of U.S. aid from a disconnected set of intermittent projects to a cohesive foreign policy vision. That issue of Truman's institutionalization of aid and development sits at the center of this project's assumptions about engineering and diplomacy, and attempts to show how engineers were similarly institutionalized in the process.[14]

Eisenhower's historiography reveals that his administration incorporated scientists engineers at a number of levels into policymaking. Gregg Herken's *Cardinal Choices* provides

[14] Raymond H. Geselbracht, editor, *Foreign Aid and the Legacy of Harry S. Truman* (Kirksville, MO: Truman State University Press, 2015). Of particular interest in the volume are David Ekbladh's "Harry S. Truman, Development Aid, and American Foreign Policy," and Thomas Zeiler's "Genesis of a Foreign Aid Revolution." Other useful work on Truman's early Cold War foreign policy and development have been Melvyn Leffler's *A Preponderance of Power* (Stanford, CA: Stanford University Press, 1995); Michael Hogan's *A Cross of Iron* (Cambridge, UK: Cambridge University Press, 1998), Robert McMahon's *Dean Acheson and the Creation of an American World Order* (Washington D.C.: Potomac Books, 2009); John Lewis Gaddis, *Strategies of Containment*, Revised edition, (New York: Oxford University Press, 2005), and *We Now Know* (New York: Oxford University Press, 1997); Arnold A. Offner *Another Such Victory: President Truman and the Cold War. 1945-1953* (Stanford, CA: Stanford University Press, 2002); Denise M. Bostdorff, *Proclaiming the Truman Doctrine: The Cold War Call to Arms* College Station, TX: Texas A&M University Press, 2008). Also Regarding the Eisenhower administration's Cold War policy, see Saki Dockrill's *Eisenhower's New Look National Security Policy, 1953-1961*, Kathryn C. Statler and Andrew L. Johns eds, *The Eisenhower Administration, the Third World, and the Globalization of the Cold War;* Richard H. Immerman, *John Foster Dulles and the Diplomacy of the Cold War* (Princeton, NJ: Princeton University Press, 1990); Joann P. Kreig ed. *Dwight D. Eisenhower: Soldier, President, and Statesman* (New York: Hofstra University Press, 1987); Robert J. Donovan, *Confidential Secretary: Ann Whitman's 20 Years with Eisenhower and Rockefeller* (New York: Dutton, 1988); Herbert Parmet, *Eisenhower and the American Crusades* (New York: Collier MacMillan, 1972); Blanche Wiesen Cook, *Dwight David Eisenhower: Antimilitarist in the White House* (St Charles. MO: Forum Press, 1974); Peter Lyon, Eisenhower: *Portrait of the Hero* (Boston, MA: Little Brown, 1974); Charles C. Alexander, *Holding the Line: The Eisenhower Era, 1952-1961* (Bloomington, IN: Indiana University Press, 1975); Gary W. Reichard, *The Reaffirmation of Republicanism: Eisenhower and the Eighty-Third Congress* (Knoxville, TN: University of Tennessee Press, 1975); and Elmo R. Richardson, *The Presidency of Dwight D. Eisenhower* (Lawrence. KS: University Press of Kansas, 1979), Robert A. Divine. *Eisenhower and the Cold War* (New York: Oxford University Press, 1981); Robert A. Divine, *Blowing on the Wind: The Nuclear Test Ban Debate, 1954-1960* (New York: Oxford University Press, 1978); Steven Ambrose, *Eisenhower The President* (New York: Simon and Schuster, 1984); Townsend Hoopes, *The Devil and John Foster Dulles* (Boston, MA: Little Brown, 1973); Dwight D. Eisenhower, *At Ease: Stories I tell to Friends* (New York: Doubleday, 1967); John Lewis Gaddis, *The Long Peace: Inquiries into the History of the Cold War* (Oxford, Oxford University Press, 1989); Martin J. Medhurst, *Eisenhower's War of Words: Rhetoric and Leadership* (East Lansing, MI: Michigan State University Press, 1994); Peter Roman, *Eisenhower and the Missile Gap* (Ithaca, NY: Cornell University Press, 1995).

insight into Eisenhower's incorporation of engineers into government and policymaking, at a number of levels. The navigation of the Cold War world brought engineering as a necessity, and across his administrations, he took the advice of councils and organizations populated by engineers to form new policy.[15]

Burton Kaufman's *Trade and Aid* examines the Eisenhower White House's economic posture with the greater globe. Kaufman argues that Eisenhower attempted to pare down the use of foreign aid started under Truman under a "trade not aid" mantra, preferring to use free markets and trade as a means to help improve the global economy. Yet, the realities of the Cold War demanded the continued use of aid as an expedient response to containing communism and buttressing vulnerable poor nations against that threat.[16] In this thesis, those Cold War pressures will prove important for explaining how Eisenhower treated places like Turkey.

Richard Immerman's and Robert Bowie's *Waging Peace* argues that the Eisenhower administration presided over a transition from Truman's straight-ahead containment approach to dealing with communism, to a foreign policy of deterrence otherwise known as the "New Look." In doing so, the authors argue that the Eisenhower administration truly, and not Truman, set the tone for the longer struggle between the U.S. and Soviet Union. Indeed, the New Look became a central guiding feature of Eisenhower foreign policy, especially with its emphasis on nuclear armaments. The authors further note that the administration also put greater emphasis on policymaking with the assistance of councils and expert committees. The Eisenhower administration's focus on committees and New Look policy approach would both have long-run

[15] Gregg Herken, *Cardinal Choices: Presidential Science Advising from the Atomic Bomb to SDI. Revised and Expanded Edition*, (Stanford, Calif: Stanford University Press, 2000).
[16] Burton Kaufman, *Trade and Aid: Eisenhower's Foreign Policy ,1953-1961* (Baltimore, MD: Johns Hopkins University Press, 1982).

implications for America’s stance with poor parts of the world, and engineering more specifically.[17]

Technology and Engineering

Technology history itself stands alone as its own significant historiography, and naturally ties into the history of engineering. Perhaps most articulately discussed by Michael Adas in *Dominance by Design*, technology has always been linked to American notions of superiority. From the early stages of American expansion across North America to today, expansionist Americans leveraged technology to further U.S. foreign policies. Technology was power to modernist thinkers in the U.S. government, and America’s ability to impose its will in places like the Philippines and on Native Americans was evidence of their position on the “right” side of history. This thesis will build on that discussion by suggesting that American policy turned current technology into a more widespread imperative, a sort of cementing of state-of-the-art technology in foreign policy as something that there was no turning back from. In the case of Turkey, new road building tools sped the construction of an expansive new highway system. But Americans believed that those tools and American expertise, once introduced, could not be removed without rolling back the progress made in Turkey. As a result, U.S. experts struggled to completely remove themselves from their own projects.[18]

Books like John Kasson’s *Civilizing the Machine* elaborates on the evolving place technology held in American society from the late eighteenth-century forward. The book shows an increasing fascination with machinery through exhibitions and man-made landscape-altering

[17] Robert R. Bowie and Richard H. Immerman, *Waging Peace: How Eisenhower Shaped an Enduring Cold War Strategy* (New York: Oxford University Press, 1998).
[18] Michael Adas, *Dominance by Design: Technological Imperatives and America’s Civilizing Mission* (Cambridge, Mass.: Belknap Press of Harvard University Press, 2006).

innovations like railroads. Those of the engineering generation grew up surrounded by this culture deifying those individuals who could bring such fascinating marvels into the world. That context Kasson illustrates becomes important backdrop for the history of the engineering generation in this thesis.[19]

Once the narrative reaches the 1950s, books about military and NASA research programs become important as well. Many of them describe the increasingly important role engineers had at home and their relationships with higher policy. Notably, James E. David's *Spies and Shuttles* helpfully illustrate the relationships between engineers housed in NASA and the CIA. As an example of engineering's importance at home, the work of engineers enabled new intelligence gathering and further ingrained engineering to foreign policy.[20]

Engineering historians have noted that, especially since the Scientific Revolution, the intellectual status of certain subjects lent special authority to those fields. Science-based education has taken up that mantle today in the face of labor demands in modern economies, which was equally true during Gifford's rise in the field. Eugene Ferguson argues that entire state policies hinge on the belief in science's superiority. As he states, "From [Francis] Bacon's time to the present-more than 350 years- promoters of the mathematical sciences have convinced their patrons that science is the way to the truth and that it is also the chief source of the progressive inventions that have changed the material world. The myth that the knowledge incorporated in any invention must originate in science is now accepted in Western culture as an article of faith."[21]

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[19] John F. Kasson, *Civilizing the Machine: Technology and Republican Values in America, 1776-1900* (New York: Hill and Wang, 1976). For more on American science and technology history, see Cowan's *A Social History of American Technology and* Adas' *Machines as the Measure of Men.*
[20] James E. David, *Spies and Shuttles: NASA's Secret Relationships with the DoD and CIA* (Gainesville, FL: University Press of Florida, 2015).
[21] Eugene Ferguson, *Engineering and the Mind's Eye*, (Cambridge, Mass.: The MIT Press, 1992), 155.

For engineers, this has been a boon; their status as a field distinct from, but partly based on, scientific principles, allows engineers to benefit from the social status of a field that has high status, which attracts new "converts" consistently. Science, and by consequence engineers, enjoyed that status during the Progressive Era of Gifford's upbringing.[22] Science was celebrated in a number of ways during this era. Theodore Roosevelt and Gifford Pinchot espoused a sort of scientific management of natural resources in the era, while others sought to manage more efficiently the workplace to ensure greater return on pay and time.[23] Science-based problem solving emerged everywhere in America from the beginning of Gifford's life, a dynamic which influenced him and his engineering generation colleagues.

Those engineering impulses effectively communicated a quite rigid idea of modernity that pulled American society at large along a clear path toward that modernity. Progress implied teleological movement toward more advanced, better tomorrows. As Anders Stephanson showed in *Manifest Destiny*, the telegraph, steam engine, steel industry, and automobiles all served as evidence that if anyone was achieving modernity, it was Americans.[24]

One recent piece of scholarship addressing the wider importance of technology in American society comes in Robert J. Gordon's *The Rise and Fall of American Growth* . Gordon argues that the American standard of living in the twentieth century improved significantly through technological innovation until the 1970s. One of the main reasons for that increase had to do with the growth of technologies that brought great changes to everyday American life. Those engineered devices that came to dominate American society, like the internal combustion engine, dramatically changed how Americans lived and related to one another. Rural-dwelling

[22] Ibid. Ferguson tries to examine points at which "technologists" were marginalized while "scientists" were uplifted in modern society – I argue that the Progressive Era celebrated both.
[23] Ruth Schwartz Cowan, *A Social History of American Technology* (New York: Oxford U. Press, 1997), 212.
[24] Anders Stephanson, Manifest Destiny: American Expansion and the Empire of Right (New York: Hill and Wang, 1995).

farmers and those living in parts of towns not serviced by rail infrastructure, found new mobility in the internal combustion engine thanks to the vehicles that took advantage of their power in the first three decades of the 1900s. Comparatively, technological developments of the second half of the twentieth century have brought change on orders smaller than the shifts brought by internal combustion engines and other technology like electricity. As will be shown, engineers provided a significant amount of the expertise needed to implement these technologies, and the engineering generation stood at the forefront of that effort.[25]

Government officials believed that modernity through technology brought good, and the products of those concepts came about through the labors of engineers. Whatever engineering touched turned to gold, as evidenced by the public works projects that put engineering feats on full display- the Panama Canal, Brooklyn Bridge, Hoover Dam, among others. Those projects became celebrated as victories for American society through world's fairs and popular press. America contained a wealth of resources and human capital that could create anything it wanted out of the natural world. Those ideas and displays of technological superiority will be discussed more at length in this thesis as way to explain how engineers became engineers.

The most effective study of engineers as stand-alone figures comes from the field of sociology. Robert Zussman's *Mechanics of the Middle Class* delves into the world of engineers, specifically as members of a discrete community of professionals. He writes that engineers occupied the "middle levels" of the American work force, sharing characteristics of both labor and management, while remaining a part of larger industrial workplaces rather than striking out

[25] Robert J. Gordon, *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War* (Princeton, NJ: Princeton University Press, 2016).

on their own independently.[26] Zussman later elaborates on the common characteristics engineers shared which helped form them in to an occupation with certain interests regarding politics and society in the twentieth century. Many of those characteristics helped form the profile of the engineering generation outlined in this project.

Another significant genre this thesis considers is American engineering memoirs. In an attempt to grasp the individual thought processes of engineers, memoirs reveal first hand evidence of the ways technicians internalized their work and roles in society. Richard Meehan's *Getting Sued and Other Tales of the Engineering Life* served as one significant such volume. Tracing his own experience in engineering school and his contributions to the field afterward, Meehan embodied many of the characteristics used to build the conception of the engineering mentality. Books like this offered a wealth of information regarding a complicated, yet distinct subset of American society.

One specific important engineering concept for this project comes in the form of the positive feedback loop. The concept posits that a change to a system of equilibrium can produce a cycle of increase that continually builds, until another force of change causes it to slow, die, or reverse. In the context of this thesis, the positive feedback loop helpfully explains the relationship between the government and American engineers in the twentieth century. Engineers' opinions of their roles in society were continually built up by government programming utilizing their services. The more the government employed engineers to reach Cold War policy aims, the more important engineers became, affecting their status and centrality to a functioning American foreign policy.

[26] Robert Zussman, *Mechanics of the Middle Class: Work and Politics Among American Engineers* (Berkeley, CA: University of California Press, 1985), 1-5.

Development Studies Literature

Development studies scholars produced analyses of development that explain the effects of instituting changes to poor countries. Those changes produced often unintended outcomes, at the level of the individual, state, and international level. Economists, geographers, and political scientists have emerged as some of the main voices analyzing development in current scholarship. On the individual level, Amartya Sen's *Inequality Reexamined* suggests that the impulse to solve the problem of poverty has too often subordinated an individual's personal freedom to the interests of the greater good. Sen suggested that more than simple numbers and income levels, development should consider the individual's quality of one's daily life to adequately address problems in poor places.[27] Indeed, Americans' impulse to make change in the Third World since Truman has incorporated ideas of both egalitarian and libertarian development, with mixed and place-dependent results.

Arturo Escobar's *Encountering Development* suggests that development policy spawned in the postwar era has not empowered the Third World to improve itself. In fact, the development wave that began in the 1940s has produced exploitative and oppressive relationships between and within poor countries. The forms of knowledge produced by development discourses, such as the modern notion of the economy, became a cause of problems in poor countries. As will be shown, for Escobar and many others, experts play a large role in that "top down" process of finding and applying solutions to the economy, which leaves the actual people it is meant to help, out of the picture.[28]

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[27] Amartya Sen, *Inequality Reexamined* (Cambridge, MA: Harvard University Press, 1992).
[28] Escobar, Arturo. *Encountering Development: The Making and Unmaking of the Third World*. (Princeton, NJ: Princeton University Press, 1994), 44.

A number of development studies scholars including Escobar have discussed engineers as a key part of the development process. One of the most influential in the field of development studies is Timothy Mitchell's *Rule of Experts,* required reading for anyone researching development at any level. Mitchell articulates the post-structural perspective on development processes, arguing that the notion of development is based on ideas like the economy that are constructed by rulers to reinforce their own power in the Third World. Engineering also plays a role in his analysis. The feats of engineering so proudly shown by colonizers (he uses the Aswan Dam as an example) were enormous but justifiable expenses through the various reports and studies so-called experts produced. Engineers became a part of that group of report-producers, and as such were complicit in the imperial effects that development assumed.

At one point, Mitchell suggests that readers of his book will "meet the engineers who built the Aswan Dam, the administrators who defined the law of property, the scientists and public hygienists who attacked epidemic disease…" and so forth.[29] In saying this, Mitchell told a half-truth. Readers of his book will meet "the engineer," but this engineer is a faceless one. What concerns most scholars about engineering is that engineers participated in development in some general way, but never dig into who they are precisely.

Other development studies scholars build on that notion of faceless engineers, while revealing a bit more texture to the profession. A recent book by geographer Christopher Sneddon *Concrete Revolution* looks more specifically at the phenomenon of American dam building worldwide. His work gets closer to a personal sort of engineering story by profiling a particular engineer as a representative of the engineering whole, and does so effectively within his narrative. In fact, the scholarship is rather accurate in its depictions of engineers working as

[29] Timothy Mitchell, *Rule of Experts*, 15.

coherent whole, but stops short of fully disclosing who engineers are. This thesis attempts to rectify that omission in the field.

A number of academics have written well-researched and articulate arguments about modernity as a driving force behind American development in Turkey, specifically. Some have even taken on Turkish roads as a subject of study in this context. Begum Adalet writes that the Turkish roads program was a contested project between American and Turkish engineers and the "meanings of modernization, expertise, and diplomacy."[30] In this case, the broader picture of modernity is articulated as a give and take between American and Turkish figures. This is nothing new, and rather conventional in the broader picture of American foreign relations history. This thesis argues that American engineers in Turkey bought into a modern belief in technological triumphalism, but did not interrogate their own assumptions on the topic. Engineers did not internally contest what "modernity" meant, by sitting and dissecting the theoretical impulses behind their actions. This is precisely what makes engineers a fascinating case. Their belief system, as difficult as it is to distill, took modernity and progress as articles of faith that had universal application. Rare was the dissenting voice among their ranks on this issue even in Turkey. This singular belief allowed engineers to coalesce around specific ideals that backed development thinking in the postwar world as well. This thesis will analyze the ways in which engineers understood their roles in global crises as a cohesive body of technicians.

The Turkish roads program serves as a case study in the messy ways America instituted its ideals onto the Third World. Like other scholars discussing development, Adalet uses a broad

[30] Kılıç Kanat, Ahmet Tekelioğlu, and Kadir Üstün, editors, *Politics and Foreign Policy in Turkey: Historical and Contemporary Perspectives* (Ankara: The SETA Foundation, 2015),11.

brush when discussing “experts, social scientists, and officials,” in her analysis.[31] This thesis seeks to delineate at least one of these categories, that of the engineering technical “expert.”

The work that likely gets closest to the heart of the matter is an unpublished, but informative, thesis by Dallas Card, *Passionate Problem Solvers*. Card focuses on the non-governmental organization (NGO) Engineers Without Borders, a present day example of engineering’s role in development. By using first person interviews of NGO workers, Card helpfully illustrates that the individual engineer believes they belong to a kind of collective that informs their beliefs on their roles in development and society generally.[32]

But, Card’s thesis aside, scholars have largely sacrificed the micro scale profiles of the very people they explain, while focusing on the vitally important “big picture.” There is a backstory to these individuals’ path to development work, and general partnership with the government, that deserves investigation. The aim of this thesis is to move down to eye level with the engineer- not the heads of state, bureaucrats, or even the top engineers on-site, but the workaday technicians who were involved in development because it symbolized a job that needed to be done. Taking that step down reveals an entire ecosystem and logic behind engineering, especially with regard to how its technicians view themselves. These engineers have names, backgrounds, and beliefs that are worth understanding better.

The overarching point this thesis makes is that one cannot consider modernity without engineers. As evidenced by American postwar foreign policy, engineers became an unassailable and unshakeable part of development and broader American policymaking. To this day, engineers and “technical experts” provide a global force in the development apparatus (see Engineers without Borders) in much the same way other specialized and technical fields like

[31] Ibid., 83.
[32] Dallas Card, “Passionate Problem Solvers: An Archaeology of Engineers without Borders at the Intersection of Engineering and Development” (M.A. thesis, Dalhousie University, 2008).

medicine. To tell the story of American postwar foreign policy is to also tell the story of engineering in the world. Without them, American development policy would look decidedly different, if not a completely alternative concept altogether

Chapter Summaries

Chapter one sets up the context of the Cold War in which American policymakers operated. The section discusses the major foreign policy discussions leading to the formation of postwar aid programs, and the details surrounding Turkish relations with the U.S. in the interwar period and after. All of this is to show how a country like Turkey that had been mostly ignored before the war came to hold policymakers' attention after. The chapter outlines the differences and commonalities between the Truman and Eisenhower approaches to aid generally, and how their treatment of foreign policy influenced their engagement with aid programs.

Against that backdrop, chapter two introduces a few figures in the engineering generation, and describes their mentality as experts. The section first elaborates on the multifaceted notion of engineering, its meanings, and the ways it emerged in American society. On that basis, the section then describes the history of the profession in America, especially its organization into associations. The chapter then describes the era in which the engineering generation grew up. It explains how American culture and national and world events conditioned the generation to move toward engineering as a profession. As a part of that process, the section also discusses engineering education and its contributions to the engineering mentality. Finally, the chapter identifies World War One's effects on the engineering generation, and introduces the history of manufacturing in the Midwest as a burgeoning crucible of engineering.

Chapter three explains the field of engineering and its responses to economic prosperity, depression, and World War II. Engineers' thoughts about their roles in causing and fixing various national crises reveal a great deal about how they see themselves as a body of professionals, and what they might contribute to America's future. Their large roles in prosecuting World War II signaled that the postwar world would require engineering on large scales in a variety of contexts.

Chapter four explains the postwar American foreign policy shift toward the greater globe, and Cold War development. The section outlines the relationships between engineers and the government, and their incorporation into postwar foreign policy. That shift also caused engineers to respond to a newly internationalist America, in which they saw themselves playing a significant role. The chapter then details the passage of aid programs, and the beginnings of the Turkish roads project as a part of a reframing of American security concerns. The first waves of American aid came in the form of military assistance, but would later evolve into more general developmental projects. The roads program serves as a clear example of this transition. Engineers involved in the early planning of the project utilized their skills and impulses to identify the most effective methods to build the highway network, a plain example of the engineering mentality in action. The Turkish context also provides a single clear example of the melding of foreign policy and engineers in the era.

Chapter five profiles the roads project operations, equipment use, and the educational processes involving engineers. The roads program included a number of educational exchanges to bring Turkish engineers to the U.S., and the importation of American experts to Turkey for training on-site. The section discusses other development projects in Turkey and their commonalities with the roads program and engineering generally. The section also details how

the Turkish and American engineers interacted, and how engineers became a part of other development projects in the Republic. Under Truman the National Science Foundation found itself contributing to the work of engineers at home.

Chapter six discusses the end of the roads project and the broader defense and surveillance work engineers became a part of under Eisenhower. The section continues to discuss the effects of development on Turkish politics and economy, and the Republic's relationship with the U.S. As a microcosm of general developmental policy, after the Turkish highway program ended, American engineers found new problems to fix in Turkey and beyond on a rolling basis. The chapter continues to investigate how engineers pervaded Eisenhower Cold War policies in defense and space exploration. The section concludes by revealing how engineers emerged in nearly every major piece of Eisenhower Cold War policymaking, including some less-noticeable roles in executing Cold War policy.

The conclusion of this thesis discusses the end of the engineering generation and the state of the field they left behind. The world they entered as young technicians, and their roles in that world, looked very different than the one they operated in the interwar period. Today, much of the field still enjoys many of the advantages of engineering established during the Truman and Eisenhower administrations, and the section discussions the larger place of engineering in society and U.S. foreign policy. Their position with regard to government service, it seems, may be one that engineers themselves do not even realize.

The epilogue revisits Marion, Ohio as a place that holds a status very different from the one it occupied in the postwar years. The life engineering brought the town had wide effects on American policy and the reshaping of landscapes in far-away countries. Today, Marion has lost its engineering base and the business it helped create. It seems that in Marion, the engineering

generation represented a sustaining force for the town's vitality. At the generation's passing, Marion appears to have passed away along with it.

In the end, the project argues that the connection forged between the United States government and engineers in the first fifteen years of the Cold War represent a permanent change in American society. That relationship is best described as a positive feedback loop which produced a mutually reinforcing pattern for both sides; the government helped lift engineers to positions of importance and status, just as government employed engineers to further its own aims. The engineering generation did not set out to ingrain itself into policymaking when these men became engineers in the 1910s. The relationship built up over time, conditioned by geopolitical events, and supported by a shared progressive view that technology and scientific management brought improvement and solutions for problems of all types. When applied to foreign policy, engineers became natural allies for guiding a new approach to America's role in the Cold War world.

Chapter One: Setting the Cold War Stage

The story of American engineering's relationship U.S. foreign policy comes tied to the developments of the Cold War. With the emergence of the geopolitical threat of communism American policymakers turned to foreign aid programming and defense and surveillance initiatives to monitor and counterbalance Soviet influence around the world. Although engineers served roles in furthering American foreign policy aims intermittently before the Cold War, they became immovable parts of American policy beginning with the Truman administration.

Before delving into the engineering experience in the Cold War, a discussion of American foreign policy becomes necessary to illustrate the context in which engineers became ingrained in government service. In the course of illustrating that context, Turkey will emerge as a specific target for American policymakers. The Republic provides an example of how American engineers furthered U.S. security aims in poor nations, as a case study for how American foreign policy deployed engineering in the era. Certainly, Turkey possessed some unique characteristics regarding American aid programs. The Republic stood among the first recipients of postwar U.S. aid, and along with Greece, became the only country to receive aid from the Truman Doctrine, Marshall Plan, and Point Four programs. Its proximity to the Soviet Union made Turkey an early, and consistent, target for American aid and strategic defense discussions.

However, the discussion of the Republic is not meant to suggest that Turkey mattered more than other countries during the Cold War. American policymakers viewed the Republic as a secondary concern to the bigger struggle of the Cold War, and issues surrounding Turkey were subsumed by more urgent crises connected to other regions or countries. Attention given to the

Truman Doctrine in 1947 quickly shifted to the Marshall Plan's implementation in Western Europe later that same year. American aid contributions in Turkey in the early 1950s took a backseat to the Korean crisis and creeping communism. Furthermore, Turkey never received the lion's share of Truman Doctrine, Marshall Plan, or Point Four aid in a single year through the1950s; there always seemed to be a more pressing diplomatic issue than Turkey in the postwar era. The reason Turkey mattered was that it accurately represented the Third World in American officials' eyes. Turkey became an early site for policymakers to try out certain development and defense initiatives that would later be used in other poor and previously-ignored parts of the world. As American security interests grew to encompass more and more of the globe, the types of development and defense projects attempted in Turkey would see use on large scales elsewhere. Engineers readily took part in the expansion of American security interests into places like Turkey, and partly cemented their working relationship with the American government in doing so.

Before that relationship could be established, the emergence of the Cold War would dramatically reorient America's posture with the greater globe. The presidencies of Harry S. Truman and Dwight D. Eisenhower would be faced with situating American power in a changed global context that viewed communism as an imminent threat to American security. American power would subsequently be exerted over the rest of the world in ways that required engineering at nearly every turn. Truman and Eisenhower's choices in facing the Cold War set a stage on which American engineers would regularly perform technological high-wire acts, all in the pursuit of securing U.S. foreign policy interests against communist threats.

Truman Confronts the Early Cold War

It is likely that no single president inherited greater foreign policy burdens than Harry S. Truman when he took office in 1945. Harold Gosnell once wrote of Truman, "The public could not adjust itself to the fact that a plain Midwesterner with a flat voice and thick spectacles was sitting at a desk so recently occupied by one of the most charismatic and glamorous leaders in modern times."[33] Truman seemingly possessed little of the panache and presence needed to fill Franklin Roosevelt's void. And the deck stacked against him was made ever-larger by the choices his administration was positioned to make.

For Truman, ending the war with the Japanese Empire stood as only the first of his foreign policy challenges; planning for the postwar was just as monumental. Could there be a return to economic decline as before the war? Would the world have the capacity to recover itself after the conflict's devastation? How long would U.S. wartime economic regulations need to stay in place? Furthermore, America's allies in the war were left debilitated in more ways than one. What role would the U.S. play in assisting its British, French, and even Russian allies?

At the time Truman took the oath of office in April 1945, he likely knew nothing of the answers. He served as Roosevelt's vice-president largely on the sidelines of high diplomatic decision making in his eighteen months as Roosevelt's second-in command. As historian Melvyn Leffler states, "Truman faced unchartered waters" in his inheritance of the presidency, a reality that later becomes obscured by Truman's overall boldness in forming his foreign policy over the next four years. Those policies were reflective of a general concern with American strategic interests and a broad assertion that the postwar world would be best framed by American power

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[33] Harold F. Gosnell, *Truman's Crises: A Political Biography of Harry S. Truman*, First Edition edition (Westport, Conn: Praeger, 1980), 218.

relationships, especially in poor parts of the globe.[34] What drove that notion was the increasing threat of Soviet power over a vulnerable world.

Fear of Soviet ideology and American angst about handling a debilitated Europe produced a new perception of "American security." A world full of poor states without recourse to help themselves could produce results similar to those in interwar Germany and Italy, both destabilized by economic problems. Communism presented an ideology of modernity in conflict with Western norms, and as the system of the victorious Soviet Union, the ideology could influence neighbors much closer to Moscow than Washington. Free markets, democracy, and individualism needed to prevail over Soviet ideals of collectivism and central authority. American officials began to view economic weakness as a window for Soviet incursion to impose those ideals on weaker populations. Specifically, the so-called Third World that had remained unaligned with either sphere since World War I, could turn the world order definitively in favor of the Soviets, and eliminate a source of support for U.S. interests.

In other words, American security interests included more than just territorial security, as many historians have argued. Security meant ideological security, market security, and the ability to establish and hold military bases abroad.[35] The Truman administration formulated a foreign policy to deal with that potential threat. Truman and his advisers began proposing responses to these challenges with aid programs geared toward the stabilization of Europe and the greater globe. The first of his aid programs was the Truman Doctrine of 1947, followed by the Marshall Plan of 1948, and the Point Four Program enacted in 1950. Each of these three

[34] Leffler, *A Preponderance of Power*, 25-26.
[35] Ibid, 12-. Leffler has been only one of the many voices elucidating American goals during the Cold War. Nick Cullather, Walter LeFeber, and even William Appleman Williams posited important motivations for American Cold War policy. Yet, the story with regard to the Third World was overwhelmingly about national security and communist threats.

programs was tied to a geographic region, but, when taken together, they justified American intervention across nearly the entire inhabited world.[36]

In the view of these policies, Truman emerges as perhaps the most internationalist of presidents, proving willing, eager even, to position the U.S. at the center of world affairs. Turkey stands as a telling lens through which to understand the formation of Truman's development policy with what would become the "Third World."[37] American policymakers had rushed to intervene in Greece and Turkey in through the Truman Doctrine of 1947 due to the countries' unique geographical and political positions with regard to communism. Even so, the ways policymakers spoke about Turkey reflected much the same sort of angst they showed to the Third World in general. As attention toward the issues of Turkey grew, so did American awareness of problems in other poor countries, justifying similar programming in more far flung areas. In this way, Turkey was both unique and unremarkable, and the Republic's development experience contains elements central to understanding American development policy writ large. Consequently, Turkey serves as a launching point of sorts for development approaches that would eventually be used worldwide.

Early Diplomacy with Turkey

U.S. relations with Turkey begin with the Republic's establishment in the 1920s. With World War I behind it, the United States remained interested, but withdrawn, from the affairs of

[36] The Truman Doctrine regarded for Greece and Turkey, the Marshall Plan was for Europe, and the Point Four program was essentially for any other country that was seen as susceptible to Soviet ideology.

[37] Development scholar Arturo Escobar notes that the term "Third World" was a discovery of the postwar world- and that "poverty" was a notion that suddenly took hold in these places, helping to define what Third World really looked like in contrast to the West. The Third World came about as a response to the Cold War alignment of the West against the collectivist Soviet Union. The Third World arose as the group on non-aligned countries, which became targets for American and Soviet efforts to woo them to their respective sides; Arturo Escobar, *Encountering Development: The Making and Unmaking of the Third World* (Princeton University Press, 1994).

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greater globe as domestic concerns occupied the minds of policymakers. In this climate, Turkey in particular attempted to stabilize itself after its own revolution ended in 1922. If the fast pace of life in the 1920s defined life in the U.S., Turkey experienced fast changes in its own way. In the 1920s, Turkey rather suddenly went from the ranks of the Great War's defeated to a victor. It instituted a secular form of democracy, found a new and powerful leader, moved its capital to Ankara, and reformed its society to distance itself from the ruins of an outdated Ottoman legacy. Mustafa Kemal rushed to eliminate the Arabic script from the Turkish language, instead replacing Arabic script with Latin equivalents to form "modern" Turkish. In fashion, the Kemalists outlawed the traditional fez, and openly religious political parties were prohibited. In sum, the 1920s became a formative era in the life of the new republic.

Without a doubt, these drastic domestic changes in Turkey were unique. Unlike any Middle Eastern state before it, Turkish leaders founded the Republic on principles of secular democracy, a far cry from the autocracy that defined the Ottoman regime. Its president, war hero Mustafa Kemal, envisioned a new kind of state that drew inspiration from the American republican model. Although Kemal's reign as president was marked by authoritarian policies as the country stabilized itself, a new age had dawned in the old Sublime Porte. That new age was noticed by select few American political figures who understood the gravity of the emergence of what seemed to be a rather like minded regime in the Middle East.

Finding their way to each other, then, became the challenge for American and Turkish policymakers. The U.S. and Turkey had no official diplomatic relations, and building those ties became one of the few activities connecting the two nations in the interwar era. Once the Turkish War of Independence ended in favor of the Turkish nationalists in 1922, the Turks sought to seize back their territory, and dignity, from the formerly occupying Allied powers. To override

the Treaty of Sevres signed by the Ottoman Empire a few years earlier, the new Turkish delegation discussed armistice terms at Lausanne, Switzerland. At Lausanne, American diplomats simply served in an observer capacity. This discussion was strictly among the Allies and Turks, but would have implications for the U.S. as well. What would happen with American property claims in Turkey, and how would the two states trade with one another without diplomatic relations? American ambassador Joseph Grew lead the American delegation, hoping to receive insight into how the new Turkish state would assert itself as one of the newest countries in the world. Additionally, U.S. High Commissioner in Turkey Admiral Mark Bristol thought that it would be, "exceedingly difficult for us to carry on these negotiations as we will be faced by many Turks flushed with recent military and possibly diplomatic victory and we will have by little means of bargaining."[38]

Nevertheless, the United States became interested in what transpired at such an important conference, even if the observers could only watch at a distance. One concern of the Americans came in the abrogation of the capitulation which had been suspended during the Great War. This would eliminate for Turkey what it saw as excess foreign influence, and would hamper foreign philanthropy in the region. Also, the freedom of the Bosporus and Dardanelles Straits, which President Wilson saw as a vital American interest in his Fourteen Points, was still of American concern.

The discussion of a Turkish-American treaty became important for the Americans as well as Turks. Secretary of State Charles Evans Hughes explicitly laid out the interests of the United States in Turkey. He was concerned that the special privileges which had existed under the Ottoman Empire- the capitulations- be maintained to safeguard the "non-Muslim" interests in

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[38] U.S. Department of State, *Papers Relating to the Foreign Relations of the United States (herein FRUS)* (Washington, D.C: Government Printing Office, 1938, Vol. II: Turkey), 879; US Army Corps of Engineers, *The History of the US Army Corps of Engineers* (Alexandria, VA: Office of the Historian, 1998).

Turkey. Other concerns included the protection of American missionary institutions in Turkey, the freedom of "opportunity" for commercial enterprises, specifically the tobacco exports to the U.S. from the coastal towns of Izmir and Samsun.[39] Other concerns regarded compensation for damages to American property during the war, the protection of minorities, and freedom of the straits.[40]

Underlining all of these interests sat the desire of the United States to maintain what Hughes called the "open door." American "open door" diplomacy first emerged at the turn of the twentieth century in order to secure for the United States the same rights and economic advantages afforded to European empires in their colonies. The "open door" was an alternative to military and political action, in which American business would be able to compete equally with foreign private companies to increase American influence overseas.[41] The United States wanted that economic influence without the burdens European colonialism undertook. Historian Greg Grandin states that, "finance became a vital instrument of state, allowing Washington to spread its influence while limiting the kind of opposition that direct colonialism inevitably engenders."[42] Reforming the legal and political structures in poorer countries would allow the government to make the economic and political climates more favorable for American business. In essence, intervention would "open the door" in poorer countries for American business to step through.[43]

After the Allies signed the Lausanne Treaty, it was proposed to the American Congress in 1924. Quick approval would have instated American and Turkish diplomatic relations and

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[39] T.L. Hughes, "International Trade in Leaf and Manufactured Tobacco," U.S. Department of Commerce, 1925, 85.
[40] *FRUS,* 1923. Vol. II, 885.
[41] Joan Hoff, *American Business & Foreign Policy, 1920-1933* (Lexington, KY: University Press of Kentucky, 1971), 9.
[42] Greg Grandin, *Empire's Workshop: Latin America, the United States, and the Rise of the New Imperialism* (New York: Holt, 2007), 25.
[43] Ibid, 26.

granted Americans in Turkey legal rights afforded to other foreigners. As proposals to sign the Lausanne Treaty arose in Congress, a vocal anti-Turk minority in America repeatedly snuffed out the treaty effort by dominating public space with anti-Turk propaganda. This anti-Turk space was occupied primarily by Armenians living in the US, and pointed to the Armenian massacres as reason to keep the new Turkey at a diplomatic arm's length. Even in the face of outward support by President Coolidge, Secretary of Commerce Herbert Hoover, and Secretary of State Hughes ultimately, this anti-Turk influence held sway over Congress, and blocked the ratification of the treaty through stalled discussions, therefore denying an official diplomatic relationship between the two countries. Anti-Turk themes collectively emerged throughout the 1920s as an obstacle to cordiality, and perpetuated essentialist labels in spite of the great gains made by the Coolidge administration.[44] When the bill came back to the floor in 1927, the Senate voted 50 to 34 in favor of ratification, but fell short of the three-fifths majority needed.

As a form of pushback, Grew and the Coolidge administration continued to pursue relations with the Turks. The passing of notes, an often-overlooked method of establishing relations between two countries, served to abrogate the failure of the Lausanne Treaty in Congress. After the quick drawing up of drafts, the note exchange officially establishing diplomatic relations with the United States and Turkey occurred on February 17, 1927. It immediately went into effect. The text of the notes passed provided for the establishment of diplomatic and consular relations, regulation of commercial and consular relations, conditions of establishment and residence of nationals of the other party, and the submission of the Lausanne extradition treaty and claims for consideration at a later date.[45] The appointment of ambassadors commenced and was made official when Joseph Grew, the Undersecretary of State, was

[44] Ibid.
[45] Ibid, 794-795.

appointed by President Coolidge to the first post of American Ambassador to Ankara on May 20, 1927. On the other end, Turkey assigned Ahmed Mouhtar as the Turkish Ambassador to the United States and was approved by Secretary Kellogg on May 27. [46]

After years of work, a real diplomatic relationship with the United States and the new Republic of Turkey had finally been established. From this springboard, the United States had increasingly more contact with the Turkish Republic. The temporary most-favored nation status set forth in the 1926 exchange of notes was repeatedly renewed to continue smooth trade and commercial relations between the two nations.

But the situation between the two countries did not mean immediate wide-ranging alliances. Turkey existed on the margins of American foreign policy even after its northern neighbor, the USSR, took more stridently leftist and revolutionary moves in consolidating its power over of its border states. Through the 1930s, American policymakers had to balance their isolationist elements and what appeared to be foreboding political movements in Europe. America policymakers thus cast a wary eye toward Turkey as a way to monitor the nation's relations with the extremes.

Turkey's status on the margins of American policy at this time was predictable. Countries of Turkey's economic status usually occupied places of lesser importance in American policy discussions, and often were ignored entirely. Economically, the country exercised deeply protectionist policies, a rational response for a new economically distressed country. But, the country's economic relationship with the rest of the world remained rather stunted. Turkish goods rarely made it to Western Europe, much less North America. Those that did were typically unfinished or agricultural crops. That said, international and domestic events pressured the Turks

[46] Ibid, 804.

to liberalize economically, spurred on by Cold War pressures and the Republic's relationship with the West.

The Truman Doctrine

Policymakers turned serious attention to Turkey after the end of World War II as the Truman administration took stock of global postwar conditions. U.S. State Department discussions surrounding aid to poor countries carried on throughout 1945-1946 in the Truman administration, with the notion of American security always in a preeminent place. Truman's cabinet and advisory group included legal, business, and political experts like James Byrnes, W. Averell Harriman, and even former U.S. Ambassador to Ankara, Joseph Grew, who attempted to grasp this new large-scale of American foreign policy interests.[47] Their wide-ranging experiences abroad collectively informed Truman of the general scope of the postwar world's problems. Further, they happened to have worked in an era of relative agreement over the issue of Soviet power, and they seemed to share a belief that America's interests did indeed stretch around the globe.

Truman's relevant addresses and the policy discussions that followed did not primarily reflect a tendency to seek directly to manipulate the affairs of foreign countries through market control as revisionist historians argue. Truman and other high ranking Americans legitimately sensed a Soviet expansionist threat was imminent, and large scale programs to ward that threat off were seen as necessary. Dean Acheson, James Byrnes, and later Robert Patterson all expressed serious reservations about Turkey and Greece's resistance to Soviet influence, and backed the president in his proposals to move toward sending aid. It was not all in their heads,

47 Harriman's own private equity firm, W. A. Harriman & Company incidentally purchased Marion, Ohio's Marion Steam Shovel company in the 1920s, and oversaw its growth over the following decades.

either. Turkey had been a region Stalin wanted political control over since before the war, and the Republic provided fodder for the Molotov-Ribbentrop discussions in 1939.[48] The old Russian pressure to amend the Montreux conventions for access to the straits connecting the Mediterranean and Black Seas never fully went away, and Turkey consistently had to seek outside help warding off Soviet advances[49].

Turkey's economy, infrastructure, and proximity to Russian power were elaborated upon at length in State Department discussions in 1945-46. For centuries, Russia attempted to gain control of the Straits both as a security measure and a means of easy trade with Southern Europe. Like after the Balkan Wars of 1912-1913, access to the Straits weighed heavy on Russian leaders' minds after World War II. At Yalta, the Soviets angled for a revision of the Montreux Convention of 1936 that gave Turkey full control over the Straits. The Soviets mainly sought the right to establish bases near the Straits as a security buffer, a request the Allies largely agreed with at the time. After the war, Americans gave closer attention to the issue, especially as Turkish policymakers interpreted later Soviet revision requests as aggression. Turkey desired to remain in the non-communist "free world," and any Soviet entreaties heightened Turkish sensitivity to Soviet requests. The Straits became a rallying point for American engagement with Turkey, especially as Turkish officials presented Americans with their concerns as leverage for American assistance.[50]

Although the Straits issue remained a main focus of the department, there were inklings of American assistance plans as well. Turkey was open and clear about its receptiveness toward

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[48] George Kennan, *Russian and the West under Lenin and Stalin* (Boston: Little Brown, 1960*)*, 351.
[49] It should be noted that George Kennan promoted a more scaled-back set of US foreign policies, mainly focused on Western Europe. It did seem that he was less interested in Turkey than other Truman advisors, but saw value in Turkish aid in the end.
[50] Howard Adelbert Munson IV, "The Joint Military Mission to Aid Turkey: Implementing the Truman Doctrine and Transforming U.S. Foreign Policy, 1947 – 1954," (Ph.D. diss., Washington State University, 2012), 44-46.

receiving aid on a number of occasions for various purposes. Infrastructure concerns occupied a significant place in policy discussions between Ankara and Washington. A cable in 1946 noted that "Economic life of [Turkey] depends on motor and rail transport systems which are heavily overburdened at present and any breakdown or reduction in service will have serious consequences."[51] The Turkish Government warned in 1946 that they possessed an "urgent" need for thousands of trucks, cars, and rubber tires through the country. Partly a result of economic weakness and wartime embargoes, the Turkish road system stood in a bad spot, possessing less than 500 miles of asphalt roads in 1946. The country had few modern automobiles, and freight often moved on the backs of livestock. For those vehicles that did exist, a necessary consequence of badly or unpaved roads was increased tire wear, which brought its own set of demands.[52] Discussions about potentially aiding Turkey regularly started with the military and geopolitical implications of such aid. For instance, James Byrnes suggested that the U.S. could offer the Turks Lend-Lease program automobiles housed in Basra, Iraq, but the idea was summarily quashed because of the potential tensions the move could cause in a region close to the USSR.[53]

In the midst of these discussions, American policymakers developed a plan to intervene in the case of a Soviet invasion of Turkey in 1946. In that plan, (codenamed: GRIDDLE) American personnel would form a Romanian rebel group to interrupt supply and communication lines from Russia. American aircraft would stand at the ready to mobilize against further Russian aggression from the sky.[54] The war plan went as far as identifying strategic targets for American air raids in the event of Soviet mobilization.

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[51] *FRUS 1946, The Near East and Africa,* Vol. II (1969), 900.
[52] Max Weston Thornburg, Graham Spry, and George Henry Soule, *Turkey: An Economic Appraisal* (Greenwood Press, 1968), 81.; Steve Theodorides, "Highway Construction and Maintenance Equipment" (M.S. thesis, Missouri School of Mines and Metallurgy, 1951), 1.
[53] *FRUS*, 1946, The Near East and Africa, Vol. II, 910.
[54] Eduard Mark, "The Turkish War Scare of 1946," in Melvyn Leffler, *Origins of the Cold War: An International History*, ed. Melvyn P. Leffler and David S. Painter, 2nd edition (New York: Routledge, 2005), 119-122 .

The American military, sensing the real possibility of Russian aggression to Turkey, sought to find ways to aid Turkey as a means of readying the Turks for a possible attack. Loaning American money to Turkey and other poor countries for economic uses had been in practice as recently as 1945. Turkey, for one, was granted a loan of $3 million in 1945 for building an airport.[55] Seeking greater allotments, Truman's advisors began forming aid strategy through utilizing the International Monetary Fund and World Bank as sources of assistance.[56] But, those measures were not wide-ranging enough to match the challenge of steeling Turkey fully, and most doubted the ability of Turkey or Greece to repay loans in the end.[57]

The discussions that followed through fall 1946 covered the feasibility of other means of aid to buttress Turkey in case of entanglement with the USSR. Through Word War II, the British provided financial aid to both Greek and Turkish militaries, maintaining their strength even as European economic conditions deteriorated after the war. As a result, American policymakers discussed more unilateral programming to relieve the British while keeping Greece and Turkey's forces strong.[58] Truman's advisors suggested that a direct military aid program would provide arms and funding for military projects in Turkey quickly, and relatively efficiently. Turkey's standing army needed training and tools for defense, and, given the unclear Soviet designs on the region, American policymakers pursued this course as a necessary and expedient preemptive measure.

The U.S. had already dispatched some naval vessels to Turkey in the first half of 1946, a move whose significance a number of historians have detailed. The events of April 1946 brought

[55] "Statement of the Foreign Loan Policy of the United States Government" by the National Advisory Council (Doc # 70-A), March 1, 1946, Truman Library, Official File 212, Box 942.
[56] Leffler, *A Preponderance of Power*.36.
[57] "Executive Session – US Committee on Foreign Relations," March 13, 1947, Truman Library, Papers of Paul A Porter, Economic Mission to Greece, Box 2.
[58] The UK had been sending aid to Turkey for maintaining its rather large army, but the British became overstretched financially after the war, and could no longer support the Turkish expenditure by 1947.

the deceased body of Turkish ambassador to the U.S., Mehmet Ertegün, to Istanbul on the USS Missouri, a moment that later historians have argued embodied "gunboat diplomacy" as a show of deterrence toward the Soviet Union. That argument has since been challenged by Gül İnanç and Şuhnaz Yilmaz, who argue that the Missouri simply represented a "courtesy" at the time, and only took on Cold War overtones after the fact.[59] But, by the second half of 1946, those Cold War overtones became undebatable and more prominent. American officials contended with what seemed to be a growing communist threat to a region losing the ability to maintain its military strength. In late 1946, the Soviet threat to Turkey was seemingly growing by the day. The more American policymakers thought about Soviet mobilization, specifically in the Straits, the more they looked for a longer term solution to fading British power in the region. As a memorandum from Truman stated in August 1946, the president and his staff came to believe, unequivocally, that "the primary objective of the Soviet Union is to obtain control of Turkey." [60]

In response, Truman began to form a proposal to ask Congress for aid money for Greece and Turkey in early 1947. The threat of communist rule in Greece reached critical mass by February, and Turkish balance sheets drained as the Republic attempted to maintain its standing army in the face of British financial withdrawal. On March 12, Truman gave a speech in front of joint session of Congress asking for a total of $400 million in aid, $100 million of which was to go to Turkey. In addition to funding a full standing army, the money's purposes included building communication and transit infrastructure as a part of the Turkish defense apparatus.[61] In doing so, strengthening Turkey as a critical buffer against Soviet influence became a hallmark of American containment during the Cold War.

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[59] Gül İnanç and Şuhnaz Yilmaz, "Gunboat Diplomacy: Turkey, USA and the Advent of the Cold War," *Middle Eastern Studies* 48, no. 3 (May 1, 2012): 401–11.
[60] *FRUS* 1946, The Near East and Africa, Vol. II pg. 840.
[61] VanderLippe, *The Politics of Turkish Democracy: İsmet İnönü and the Formation of the Multi-Party System, 1938 – 1950* (Albany, NY: SUNY Press, 2005), 156.

Truman couched his congressional address in what would become the language of the Cold War. Although the issue at hand concerned specifically aid to Greece and Turkey, Truman's speech repeatedly mentioned the wariness of "coercion," in poor parts of the world. Without saying it, Soviet incursion became synonymous with that coercion, and limiting opportunities for incursion meant snuffing out points of perceived instability. Truman emphatically declared, "I believe that we must assist free peoples to work out their own destinies in their own way. I believe that our help should be primarily through economic and financial aid which is essential to economic stability and orderly political processes."[62] In using such language in reference to Turkey and Greece, Truman opened a door for eventual widespread interventions wherever the notion of "stability" was at stake.

Discussions on the Greek-Turkish aid topic dominated Congress just after the Truman speech, and supporters and opponents to the bill hardly fell along party lines. Although Republican congressmen like Lawrence Smith of Wisconsin and Robert Twyman of Illinois consistently questioned the wisdom of the aid package, other Republicans like Vermont's Ralph Flanders (an engineer and former president of the ASCE) advocated the aid package as an expedient answer to the crisis in the Mediterranean. Supporters of the bill articulated the benefits of the program through the language of national security. Representative Chester Merrow, a New Hampshire Republican, argued that, "By giving aid to Greece and Turkey, we will help guarantee the security of the United States…There must be no diplomatic appeasement [with the communists]."[63] Ralph Flanders echoed Merrow in a radio interview on March 17. Flanders stated that the aid to Greece and Turkey was analogous to "maintaining our internal strength."[64]

[62] United States, *Department of State Bulletin*, (Washington, D.C.: Government Printing Office, March 23, 1947), 534.
[63] "Remarks of Rep. Chester Merrow," *Congressional Record* 80, (10 March 1947), 1869.
[64] "Remarks of Sen. Ralph Flanders," *Congressional Record* 80, (17 March 1947), A1035.

For the bill's supporters, America's national security blanket clearly covered the non-Western world, suggesting that U.S. foreign policy had a duty to stabilize the globe, or suffer indeterminate consequences at home.

Like many supporters of postwar aid, Texas Senator Tom Connally invoked the notion of collective security that tied American interests to the undeveloped world. Connally remarked in April 1950, that "As the United States has assumed new and greater responsibilities, we have learned that the progress of mankind in general and the well-being of our own country in particular are directly bound up with the conditions under which people live in other lands."[65] Such sentiment became increasingly popular in Congress, and contributed to the support of later aid bills as well.

Opponents of the aid program typically resided in the "isolationist" camp, a wing of the Republican Party led by Ohio Senator Robert Taft. The isolationists desired for America to look harder at its internal problems rather than extend itself into relationships with foreign counties of indeterminate length. Despite their strong leadership, isolationist sentiment was subsumed by internationalists in the Truman Doctrine debate's critical moments. Even with significant pushback from domestically-minded Congress members, Congress passed the Greek-Turkish Aid Act, with Truman signing it into law on May 22, 1947. Even after the Act's passage, the ideological lines drawn during the debates over the Truman legislation remained relatively consistent in the later debates over the Marshall Plan and Point Four programs.

With the tone set by the Truman Doctrine, Turkey and Greece were no longer peripheral to U.S. interests. The legislation defined Turkey as vitally important to American strategic interests and national security, but did so under the overarching framework of communist fear. In

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[65] "Remarks of Sen. Tom Connally," *Congressional Record* 81, (20 April 1950), 5418.

other words, Turkey would benefit from Truman Doctrine aid and later assistance efforts for the primary purpose of containing communism, and not for any notion of a modern humanitarian developmental enterprise. Policymakers knew that the Truman Doctrine was the beginning of a new era for U.S. foreign relations. Policymakers understood the moment as a launching pad for later aid efforts in more places, which would spread American power across the globe, with policy architects like Joseph M. Jones penning entire books chronicling the outward pivot.[66]

Greek and Turkish officials responded positively to the bill's passage, especially given that the aid came in the form of grants, not loans. Prime Minister of Greece, Dimitrios Maximos wrote as much in a letter to Truman in March 1947. "The Greek people; we are well aware of the importance of your assistance under the present circumstances…[we are] confident that the policy outlined by your address will soon bring peace and happiness to this part of the world…"[67] Truman received positive feedback also from the Greek Orthodox Church in America, and other Greeks living in the United States.[68]

Although sitting Turkish President Inönü and his countrymen expressed gratitude for military support, the Truman Doctrine did not adequately address broader Turkish domestic economic problems. "By earmarking most funds for security purposes, Washington thwarted Ankara's plans to use some of the funds for Turkey's economic development," writes historian Michael Carver.[69] Now that the Turkish military had the support it needed, Turkish leaders hoped for additional assistance to get the unstable Turkish economy off the ground. Their economy had not seen consecutive years of positive GDP growth since 1938-39, and had not experienced a

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[66] Leffler, *A Preponderance of Power, 147*.; Joseph M. Jones, *The Fifteen Weeks,* (New York : The Viking Press, 1955).
[67] "Statement by the President," March 15, 1947, Truman Library., Official File, Box 426
[68] Peter Vochi to Truman," April 4, 1947, Truman Library, Official File, Box 426.
[69] Michael Carver, "A Correct and Progressive Road: US –Turkish Relations, 1945-1964," *(*PhD Diss., Bowling Green State University, 2011), 51-52.

five-year span of positive growth in the entirety of its history.[70] Turkish leaders, including İnönü, moved to encourage privatization domestically to show U.S. policymakers that Turkey was willing to liberalize its economy, which would bode well for future aid packages. Their reforms would serve their purposes perhaps too well, for, over the next three years, such aid would become a regular occurrence in Turkey.

As will be shown, the Truman Doctrine provided the seed capital to start a number of assistance programs in Turkey. In addition to military programs, development projects like the roads program came out of the initial allotment from the Truman Doctrine. Later aid legislations provided much longer-run sources of funds as the programs progressed over the following decade and beyond.

The Marshall Plan

In the midst of the implementation of the Truman Doctrine aid program, American foreign policy incorporated a second large foreign assistance project, the Marshall Plan. This program concerned European economic reconstruction, not military aid as in the Truman Doctrine. Later that summer of 1947, Turkey joined other European nations as prospective American economic aid recipients. But as non-combatants in the war, Turkey was not in need of "reconstruction" as other European states were, and was denied aid initially.[71] American officials maintained that the primary interest of the U.S. in Turkey was to "deny certain portions of

[70] Yüksel Görmez and Serkan Yiğit, "The Economic and Financial Stability in Turkey: A Historical Perspective,", *Fourth Conference of Southeast Europe Monetary History Network (SEEMHN)* (March 27, 2009): 28.
[71] Senem Üstün, "Turkey and the Marshall Plan: Strive For Aid," (MA Thesis: University College of London, 1997), 33.

Turkey to the USSR." For the time being, this meant restricting assistance to the military through the Truman Doctrine.[72]

In early 1948, delays in the delivery of Truman Doctrine supplies concerned Turkish leaders. Although inconvenient, this moment proved pivotal for convincing Americans of the need to provide more help for the Turkish economy. During a February 1948 meeting, Turkish Ambassador to the U.S., Huseyin Ragip Baydur, hinted to American officials that without more expedient delivery of defense material, Turkey could fall prey to intimidating Soviet pressures. The delays exerted "an adverse effect" on the Turkish people who wanted to maintain their freedom from the Soviets.[73] Baydur's appeal put American leaders on notice that the situation in Turkey called for more than just promises of aid. Either because of Soviet concerns or Turkish salesmanship, American supplies began to roll in the following spring, along with a review of Turkey's application for Marshall Plan economic aid.[74]

In a 1948 interview, President İnönü stated that he felt that Turkey served as a "high return" for American investment aid. Further, he acknowledged that Turkey and the U.S. had "common interests, the principal of which is to defend ourselves against threatened Soviet aggression." For, "Turkey is like an oasis in the desert. We have no reliable friendly forces on any side-north, west, south or west." In an apparent plea for further American help, he closed by stating that a stronger Turkey would lead to a less aggressive Soviet Union, and American presence there provided a key to that strength.[75] The interview showed both a desperation for American help, but also an alignment between U.S. and Turkish ideas about Soviet strength.

[72] *FRUS*, 1949, Vol. VI: The Near East, S. Asia, and Africa (1977), 1638.
[73] *FRUS* 1948, Vol. IV Eastern Europe: Soviet Union (1974), 20-21.
[74] VanderLippe, *The Politics of Turkish Democracy*, 170, 178.
[75] "Memorandum of interview with President İnönü of Turkey," exact date unknown, Truman library, President's Secretary's Files, Box 166. It should be noted that İnönü often communicated in French through diplomatic channels as president. French was the language of the old Turkish elite since well into the Ottoman period. İnönü was a product of that age, and educated at that time. İnönü was himself trained as a military engineer at the Imperial School for Military Engineering.

İnönü had attempted to draw down Turkish state trade protections and encourage American private investment, another symbol of Turkish willingness to deal with American terms of aid.

In Congress, the Marshall Plan's proponents invoked not only the urgent need to assist an ailing Europe, but also the overt desires of the countries of Europe themselves. Senator H. Alexander Smith of New Jersey noted just months before the Marshall Plan was approved that "Secretary Marshall tells me that applications from all over the world…to help them with some of their jobs, and especially to give them the benefit of American techniques."[76] Requests were not isolated to Europe, but included countries from South America, and of course, the Republic of Turkey. In the minds of Marshall Plan supporters, non-interventionists simply obstructed the deployment of aid to a desperate people.

Debates surrounding the Marshall Plan ended in April 1948, when Congress approved the Economic Cooperation Act (ECA). The text of the Marshall Plan, and the reports that led to its approval said little about Turkey. In fact, the legislation said little about any one country being the target for American aid. Rather, the bill allowed the ECA latitude in deciding where aid should be best allocated. What the Marshall Plan *did* enunciate was that aid to Europe served as a vital move to ward off communism to recipients.[77] Even though Turkey received significant military aid from the U.S. in the Truman Doctrine, its economic situation had implications for American security interests, especially since Soviet pressure to open the Straits continued.[78] And just as in the Truman Doctrine discussions, the notion of stabilizing poor countries like Turkey led Americans to increase their financial commitment to the republic.

Additionally, Turkish development increasingly stood as a means to assist Europe's reconstruction struggles. An economically stronger Turkey could both steel itself against

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76 "Remarks of Senator Smith," *Congressional Record* 80, (16 January 1948), 248.
77 Ibid, B5.
78 Vanderlippe, *The Politics of Turkish Democracy*, 44.

communism and help Europe with its more robust crop exports. Acknowledging the dual potential purposes of strictly economic aid to Turkey, Turkey officially became a part of the Marshall Plan through Truman's July 4, 1948 signing of a Treaty of Economic Assistance. After ratification from the Turkish Grand National Assembly, the treaty came into force later that month. The Marshall Plan and its successor agencies would prove to be the Turkish roads program's greatest financial source. As the Truman Doctrine spending limit expired, the Marshall Plan's Economic Cooperation Administration (ECA) took on the bulk of Turkish aid work, a great deal of which was dedicated to providing grants and loans for building the road network.

The next year, Moscow responded in kind with an economic aid program of its own, the Council for Mutual Economic Assistance (Comecon). As John Michael Monti as writes, the Comecon overtly worked to establish greater trade relationships between the USSR and satellite states. Established in 1949, this program had the dual purposes of helping communist states cut off from the economy of Western Europe while simultaneously bringing them closer to the Soviet orbit.[79] The Soviets also extended aid to these countries as a way to link them closer to the Soviet Bloc, but with varying degrees of success.[80]

Turkey became one such target for Soviet economic engagement, which added pressure to the relationship between Ankara and Washington. Given the continual Turkish need for outside economic aid, the Soviets offered Turkey aid money on considerably smaller levels than the U.S. But, any aid came with the understanding that Turkey would remain in the Western camp. In the end, Soviet economic engagement with the Turks softened the diplomacy between

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[79] James F. Brown, *Eastern Europe and Communist Rule* (Durham, NC: Duke University Press, 1988), 151-153.
[80] Enrico Fardella, "The Sino-American Normalization: A Reassessment," *Diplomatic History* 33 no.4 (2009): 33, 545-578.;; John Michael Montias, "Background and Origins of the Rumanian dispute with comecon," *Soviet Studies*, Vol. 16 ,no. 2 (October 1964): 130.

the two countries over the next decade. Over the course of the 1950s, trade with the Soviet Bloc increased significantly, signaling that at least some moderating did occur long term between the two countries.[81]

Given the presence of Soviet aid to the American-Turkish diplomatic equation, American policymakers' pursuit of further development policies seems at least somewhat pragmatic. American suspicions of Soviet incursion may not yet have been realized, but the USSR's advance in Eastern Europe through Comecon along with aid and trade relations with Turkey presented Washington with fuel to stoke its developmental fire.

On a larger scale, the Soviets embarked on their own large scale development work at this time. Like in the U.S., Paul Jopsephson writes that the Soviets carried a "fascination" with technology that could solve problems with proper expertise. Stalin's postwar attempts to extend his power into the rest of the bloc included massive hydroelectric plants and canal systems reaching into Turkmenistan and other outlying regions. As these projects were completed, they stood as Moscow's evidence that the Soviet system worked to the betterment of all the Soviet people.[82]

Point Four

In the tradition of great power technological experimentation during the Cold War, American officials put forth another aid program in the 1940s. The third and final significant source of American Aid to Turkey in the postwar period came in the form of President Truman's

[81] Mutual Security Program, Near East: Turkey, 1958, Eisenhower Library.; A. Suat Bilge, "An Analysis of Turkish- Russian Relations," *Center For Strategic Research* (1997): 5.
[82] Paul R. Josephson, "'Projects of the Century' in Soviet History: Large-Scale Technologies from Lenin to Gorbachev," *Technology and Culture* 36, no. 3 (1995): 519, 534-535.

Point Four Program for Technical Assistance. During his inaugural address in January 1949, President Truman espoused four policy aims to promote global "peace and freedom."[83]

The fourth aim pertained to technical assistance to the undeveloped world. "More than half the people of the world are living in conditions approaching misery. Their food is inadequate. They are victims of disease. Their economic life is primitive and stagnant. Their poverty is a handicap and a threat both to them and to more prosperous areas." Since the United States was "preeminent" in the development of useful technology, Truman believed that the US "should make available to peace loving peoples the benefits of our store of technical knowledge."[84] In other words, Truman declared for the first time that technology itself now held a central role in American foreign policy. The projects Truman envisioned through Point Four did not include new missile silos or advanced air bases. Instead, Point Four projects were meant to help the undeveloped world find its way out of destitution, and that meant homegrown economic production. Under the Point Four Program, building transportation infrastructure, clean water systems, and teaching modern farming techniques would become an arm of American influence abroad.

Rhetorically, Truman's Point Four speech called for much of the same aid-based foreign policy already outlined by the Truman Doctrine and Marshall Plan. In practice, however, it sought a different means of assisting foreign nations. Unlike the earlier aid programs, Point Four was a specific effort to use American knowledge to help the underdeveloped world's uplift while still furthering older Cold War stability aims. Financially, it earmarked $35 million for the

[83] The first three points related to acknowledging the importance of the U.N., European recovery through the Marshall Plan, and NATO in sequence.
[84] "President Harry Truman Inaugural Address," *Congressional Record* 81, (20 January 1949), 478.

program, an even smaller sum than was allotted to Turkey alone through the Truman Doctrine.[85] Where it lacked in initial financial strength, Point Four carried strategic power in spades. Point Four symbolized a move to develop other nations without the large capital investments seen in other programs, but still continued to further the Truman administration's Cold War aims. Human capital would serve as a ready substitute for simple dollars and cents.

At times during the succeeding months, Congress debated Point Four on similar grounds as it did the Truman Doctrine and Marshall Plan. Supporters emphasized the upcoming expiration of the Marshall Plan in 1952 as a potential global crisis that Point Four could alleviate. In this way, Point Four was described as an extension to Marshall Plan spending, not an expense to be laid on top of existing bills. Even with the added urgency of expiring Marshall Plan aid, the final congressional vote on the bill was tight. The Senate passed the measure by one vote, and the House only approved it after paring down the amount of the bill from $45 million to $35 million. On June 5, 1950, Truman officially signed the "Act for International Development" bill into law.[86] Without clear geographic boundaries, the Point Four Program seemed to many a mysterious effort to involve the U.S. in other nations' affairs. That view proved prescient. Indeed, by the mid-1950s, Americans had been dispatched by Point Four to every continent but Antarctica.

Turkey would receive Point Four aid intermittently over the next decade, with a portion of that going toward the road program. At the confluence of Turkish economic strife and domestic political divisions, the rise of American assistance programs provided an opportunity for Turkey to jump start their economy at the risk of undue American influence. Turkish leaders who strongly desired American aid made policy changes to show Turkey was already willing to

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[85] Amanda Kay McVety, *Enlightened Aid: U.S. Development as Foreign Policy in Ethiopia* (New York: Oxford University Press, 2012), 97.
[86] Ibid., 109.

reform its economy on the American model. But with more open trade policies and American aid money, Turkey increasingly accepted American influence as a way to steel itself against Soviet pressure.

Some commentators within Turkey were not as enthusiastic about accepting more American help. Fears arose especially over the possibility of Turkey becoming a "satellite of America."[87] This was, in fact, part of the U.S. plan. The American aid programs for Turkey certainly were intended to cure many of Turkey's domestic woes, but the Americans wished to achieve other ends through aid programs as well. Strengthening the economy and decreasing poverty would be a secondary to the U.S. goal of steeling the Republic against communism, and using Turkish agricultural exports to continue to feed Europe.[88]

Still, the U.S. priority with regard to Turkey was its military condition in case of Soviet incursion. U.S. Ambassador to Turkey, George McGhee, noted in an January 1951 State Department memo, "We must not lose sight of the fact that our objective will probably be to build up Turkey's military capability, and that in the final analysis we will probably be willing to pay the cost of such a build-up, if that is the only way to get it."[89] In the short-term, this would mean continuing to assist Turkey's military through various grants and loans. If the three postwar aid programs were any indication, such continual assistance would meet with congressional approval as long as it was couched in the name of anti-communism.

Under these aid programs, development projects began on highways, dams, and other large–scale projects in Turkey. Engineers became central to these projects' operations by providing needed expertise for their implementation. The projects' operations will be detailed in

[87] VanderLippe, *The Politics of Turkish Democracy*, 179.
[88] Senem Üstün, "Turkey and the Marshall Plan: Strive for Aid," (M.A. thesis, University College London, 1997): 35.
[89] *FRUS* 1951, Vol V, The Near East and Africa (1982) , 1110.

full in later sections, but the very presence of aid programming brought out certain dynamics in the diplomatic relationship between the U.S. and Turkey. Those dynamics became emblematic of wider trends in American diplomacy with poor nations.

High Foreign Policy in the Early 1950s

The institution of the aid programs of the late 1940s seemed to only heighten American sensitivity toward Soviet pressures in the Third World. Those pressures still dominated the diplomatic discussions with Turkey in the early 1950s. Both sides continued to monitor the costs of maintaining the Turkish military with those pressures present, and sought solutions to increase capital flows into Turkey to decrease the burden of those expenditures.[90] In negotiating the path American aid would take in Turkey, the relationship took on a tone of dependence. Given that two separate treaties of economic and technical assistance were in action when the calendar turned to 1950, Turkey had become reliant on American aid to maintain its military.

The economics of Turkish defense still relied on fears of Soviet incursion which hung over the minds of Turkish diplomats. For this reason, they openly began discussing the potential of Turkey joining NATO with the American counterparts. Turkish security needed to remain a central focus of American foreign policy, and as 1950 wore on, Turkish policymakers sensed that the U.S. was beginning to get more distracted by developments in Korea. In Turkish (and some American) eyes, the Middle East and Europe still represented ground zero in the Cold War, and they hoped Americans would cement that reality in policy through NATO membership.[91] Turks also framed their participation in Truman's containment policy as one of active partnership, and

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[90] *FRUS*, 1950, Vol V, The Near East, South Asia, and Africa, 1227.
[91] Ibid, 1232.

sought to hold that position as long as tension with the USSR remained. Turkey could, and did, continually leverage that pressure to gain benefits out of its relationship with the U.S.

But in the midst of continuing to build closer relations, Turkish politics threw a new wrinkle into the equation. In May 1950, the party of Ataturk, the CHP (Republican People's Party), was unseated by the newly formed Democratic Party led by Celâl Bayar. İnönü and his Turkish officers had long been at the head of the Turkish side of the U.S.-Turkish relationship in the Truman era. İnönü was a known quantity to American policymakers, a secularist in the Kemalist tradition, but not an internationalist in trade. İnönü was credited for moving Turkey into a new stage of its development as a part of the Truman development programming, but time would tell whether his slow acceptance of freer markets and American foreign aid would help or hurt his republic.

With real political competition for the first time, Turkey poised itself to take a more democratic path under Bayar domestically. In foreign policy, both Turkish and American officials hoped the changing of the guard would not mean a change in the Turkish relationship that had been growing closer. Over the next two years, Turkish and American relations would be greatly defined by the broader developments in NATO and the Korean crisis. As talk of involving Turkey into a security "pact" of some sort drifted closer to concerted NATO negotiations in 1950, policymakers also investigated the possibility of Turkish forces being used in Korea. Turkish desire to enter NATO had taken on the look of a sales pitch by Turkish officials, arguing that their inclusion only would bring greater stability and warding off Soviet aggression for fear of broader retaliation by allies. Further, the morale of the pact nations would be further reinforced with Turkish inclusion, and its proximity to the USSR would allow NATO

a closer position to the enemy.[92] Steps toward a mutual defense agreement between the U.S. and Turkey were taken with NSC 73/4 in August 1950, which stipulated that if the USSR would invade Turkey under the pressures of American action in Korea, the U.S. would come to the aid of the Turks or other named countries.[93]

In September 1950, The Joint Chiefs of Staff officially suggested that Turkey and Greece be admitted to NATO only as associate members.[94] This came partly as a result of the Turkish contribution of nearly 5,000 soldiers to the Korean War effort, but still fell short of the desired outcome of full membership. Through 1951, Turkish development programming was still in full swing, but Bayar insisted more firmly that Turkey ought to be admitted to NATO or risk Turkish neutrality in the case of the Cold War turning hot in the Middle East.[95]

NATO and Eisenhower

The year 1952 brought major events in the story of U.S. development policy and Turkish relations. The first event was the official inclusion of Turkey into NATO in February, a final contentious decision made largely to keep Turkey oriented towards the U.S. For President Celâl Bayar, the acceptance marked his largest foreign policy win since taking office in 1950, and potentially the biggest of his administration. If Turkey's participation in the Korean conflict was not evidence enough, Turkey's long fought-for membership into NATO became the longest-lasting proof that Truman's efforts to keep Turkey oriented away from the USSR had worked.

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[92] Ibid, 1298-1299.

[93] *FRUS*, 1950, Vol. I, International Security Affairs; Foreign Economic Policy (1977), 380.

[94] Ibid, 1309.

[95] Leffler, *A Preponderance of Power*, 420.

The second big event of 1952 came in the election of Dwight Eisenhower to succeed Truman as President of the United States. Eisenhower became the first Republican since Herbert Hoover to occupy the White House. Truman, it has been said, privately disclosed that he did not believe in Eisenhower's political acumen. And yet the transition ultimately seemed to be a civil one, at least publically. John Steelman, Truman's close advisor, stayed on in DC after Truman left the White House to help Eisenhower get acquainted in his new role.[96] Before leaving office officially, Truman met with Eisenhower to brief him in matters relating to foreign policy.[97]

Although personal differences existed between the two presidents, their approaches to foreign policy shared more similarities than variances. Like Truman, Eisenhower campaigned on a staunch internationalist platform. With a still-existent isolationist cadre in Congress, Eisenhower pushed back against the inward impulse loudly and authoritatively even before taking office. In a June 1952 campaign radio broadcast given from downtown Denver's Brown Palace Hotel, Eisenhower stated that anti-globalization advocates like his rival for the Republican nomination, Senator Robert Taft, undertook a "counsel of eventual self-destruction," as the greater globe still facing threats from Soviet power. To Eisenhower, those institutions in place to unite the greater globe, such as the U.N., deserved American dedication and aid.[98]

Eisenhower conveyed a universalism that undergirded development policy, which posited that what was good for the United States was naturally good for the rest of the world under Cold War conditions. Development policy had attempted to share or replicate American style ideas and constructs in poor countries, and the Turkish highway program stood as just one clear

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[96] Nick Ravo, "John Steelman, 99; From Riding the Rails to Top Truman Aide," *The New York Times*, July 22, 1999.
[97] Douglas Brinkley " Tea and Transition," *The New York Times*, December 21, 2000
[98] JOHNSON KANADY, "Ike Blasts Global Policy Foes; Tells 4 Point Peace Plan: ALL DELEGATES AT LARGE BACK OHIO SENATOR Party Rally Sees 1952 Victory," *Chicago Daily Tribune*, June 24, 1952, 1.

example. Eisenhower's dialogue reflected much the same spirit of interdependence that Truman expressed in his own inaugural speech a few years earlier.

While the Eisenhower presidency progressed, it continually moved American development reach outward into new endeavors that reinforced his notion that America in the world was an America for the good. Eisenhower believed in NATOs power to leverage the power of the West against communism, and drove to remove barriers to global trade over his tenure. In his "Cross of Iron" speech to the American Society of Newspaper Editors in April 1953, Eisenhower noted that greater international integration embodied America's response to the Soviet vision of the future, which marked itself in sharp contrast with "huge armies, subversion, [and] rule of neighbor nations." He proclaimed that "every gun that is made, every warship launched, every rocket fired, signifies, in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed." That is, Eisenhower equated quantity of armaments produced by the Soviets directly to the developmental projects that the U.S. undertook around the world: "The cost of one heavy bomber is this: a modern brick school in more than 30 cities. It is two electric power plants, each serving a town of 60,000 population. It is two fine, fully equipped hospitals. It is some fifty miles of concrete highway."[99]

As with Truman, development programming would continue to be a hallmark of Eisenhower's Cold War foreign policy. Eisenhower legitimized Truman's Point Four plans by increasing private investment into the Third World on a more regular basis in his administration. Eisenhower's support of state protections to allow U.S. companies to do business in poor countries more deeply ingrained Truman's internationalism into the American foreign policy.[100]

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[99] Speech to the American Society of Newspaper Editors, April 16, 1953, Eisenhower Library, AW Speech Series, Box 3.
[100] Michael T Hayes, "The Republican Road not Taken: the Foreign-Policy Vision of Robert A Taft," *The Independent Review,* vol. VIII, no 4, (Spring 2004): 518.

His continuing to fund development programming serves as one example of Eisenhower's support for engineering in foreign policy. Of course, the Cold War still motivated that decision. Roughly coinciding with Josef Stalin's death in March 1953, the Soviets ramped up attempts to lend aid to the Third World for development and technical assistance. The nearly $2 billion Soviet investment into the Third World from 1954-1958 ensured that Washington would not only stay the course regarding development programs, but increase their scope and financial support to negate any effects of Soviet aid.[101]

In general, the Eisenhower administration's approach to economic engagement with the world has been described by historians as generally more free-market driven than Truman's policy. In a Third World foreign policy called "trade and aid," Truman-era aid programming worked alongside greater trade and market exposure to as a mode of improving poor economies.[102] Along with trade increases, Eisenhower sought to leverage the resources of the World Bank and Export-Import Bank to shoulder more of the development load. The President wanted to extend aid through credit rather than freely given grants, which would theoretically keep American costs down. Over the course of his tenure, Eisenhower vacillated between eliminating aid and replacing it with only low-interest loans, a challenge that in the end became incongruent with American foreign policy goals. Although he attempted to drop aid grants completely, confronting communism in the Third World militarily required the more expedient grants-in-aid, rather the loans that would usually require internal adjustments before releasing. In the realm of strictly development assistance (for dedicated long-term economic programs),

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[101] Michael Adamson, "The Eisenhower Administration, Foreign Aid and the Third World," in eds. Kathryn C. Statler and Andrew L. Johns, *The Eisenhower Administration, the Third World, and the Globalization of the Cold War* (Lanham, Md: Rowman & Littlefield Publishers, 2006). 56.
[102]See Burton Ira Kaufman, *Trade and Aid: Eisenhower's Foreign Economic Policy, 1953-1961* (Johns Hopkins University Press, 1982) and. Statler and Johns, *The Eisenhower Administration, the Third World, and the Globalization of the Cold War*.

Eisenhower was successful in moving more toward a loan-heavy program. But, this shift occurred without any visible change to on the ground operations of development projects like the Turkish roads program.

As a reflection of Eisenhower's initial aim to decrease development spending, budgets dedicated for foreign aid declined once Eisenhower took office, but not permanently. The budget for the Mutual Security Program (the agency that succeeded the ECA in administering military and development aid programs) between Eisenhower's first three full years as president (1954-1956), dropped from $4.5 billion to $2.7 billion, with military expenditures making up the bulk of each year's budget. As the decade closed, the MSA's budget increased again to at least $3.3 billion every year until 1960. The fluctuation related to bigger global events of the Cold War. With the threat of Soviet expansionism growing in the latter half of the decade, the President moved away from his initial goal of replacing aid with trade, to combining the two, while pushing for greater expenditures across the broad. Between 1954 and 1960, non-military technical assistance and development budgets increased markedly. Congress allocated approximately $181 million for technical assistance for 1960, the highest in the Eisenhower administration's tenure. That amount stood in stark contrast to the $35 million Congress initially approved for the Point Four Program for technical assistance way back in 1950.

When taken as a whole, the changes made to development programming under Eisenhower's administration ended up making more, not less, development aid available. After Eisenhower's tenure, policymakers could increasingly seek help from a number of credit sources, including the World Bank and Eisenhower's $550 million Development Loan Fund created in

1958. Combined with what grants-in-aid that still existed, Eisenhower's administration made clear that development spending was here to stay.[103]

The Soviet expansionist threat that motivated the re-emphasis on aid came tied to the trends of post-colonialism. As more colonial nations moved to independence, their newfound freedom was met with the realities of status as Third World countries. These nations became part of the lists of targets for American assistance due to their perceived instability and weakness. The more young countries that emerged out of colonial states, the more frequently problems had to be identified and addressed with new American allocations and programming. When American angst toward Soviet interest in the newly independent parts of the Third World increased, Americans pacified themselves with more designs on finding and fixing internal Third World problems. Repackaging where development funding came from did not change the emphasis Eisenhower put on development, but only underlined the reality that once started, ending development was nigh-impossible without losing the geo-strategic benefits that came with it.

Just because Eisenhower remained committed to development did not mean that he did not reform its function. For starters, Eisenhower and John Foster Dulles increased cooperation between the State Department and aid agencies. In 1953, Dulles and Stassen traveled to the Middle East to understand shortcomings in the region's Middle Eastern Defense Organization first-hand. The mission came as a result of the increasing pressures military and development aid had applied to American resources in the preceding two years. Dulles intended to inform personally foreign leaders of that pressure to American budgets, and as a warning that cuts to aid may follow.[104] Potential aid cuts were routinely received badly by Turkish leaders across the

[103] Reports to Congress on the Mutual Security Program, 1952-1960.
[104] *FRUS* 1952-1954, Vol IX, part 1, The Near and Middle East (1986), 158-167.

decade. In a 1957 memorandum, undersecretary of State Christian A. Herter, noted that the Turkish Finance Minister threatened to shop “attractive” Soviet aid offers in the event American cuts, a moment that echoed Bayar’s threat to do the same in 1953.[105] Turks would continually leverage threats of taking greater Soviet aid against American threats of aid cuts remained a normal part of Turkish-American diplomacy throughout the 1950s.

The bureaucracy of aid presented its own headaches for the administration. Even before Eisenhower took office, the Truman Doctrine, Marshall Plan, and Point Four programs experienced reorganization multiple times. Upon taking office, Eisenhower inherited Point Four’s Technical Cooperation Administration (TCA) and the Marshall Plan’s Mutual Security Agency (MSA). Shortly after his inauguration, the administration consolidated all aid programs under the Foreign Operation Administration (FOA) in 1953, then created a nonmilitary-specific agency in 1955, the International Cooperation Administration (ICA).

The shift from the FOA to the ICA came as a result of congressional pressure to release military aid administration to the Department of Defense, along with Eisenhower’s internal struggle to control his own administration.[106] The head of the FOA, perennial GOP presidential candidate and Eisenhower ally, Harold Stassen, presented headaches to the administration’s management of aid. Costs in Stassen’s head office at the FOA had ballooned to almost $500,000 annually by 1954, an easy target for spending cuts. Additionally, Stassen began to voice concern with nuclear testing out of turn in the eyes of Dulles and Eisenhower, who preferred for him to publically stick to aid –related issues. Stassen’s hunger for more influence in the administration worked against him ultimately, and both Dulles and Eisenhower viewed his meddling in affairs,

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[105] Herter to Dulles, October 14, 1957, Eisenhower Library, John Foster Dulles Papers (JFD), White House Memoranda, Box 5.

[106] Memorandum of Conversation with Mr. Humphrey, December 6, 1954, Eisenhower Library, JFD Papers, White House memoranda, Box 5.

like campaigning for a nuclear test ban, grounds for removal. In the words of Dulles, "I did not feel that he could be loyal or effective as regards out policies." Eisenhower had reportedly come to the same conclusion about his longtime ally "rather reluctantly" Dulles intended to offer Stassen the Greek Embassy as a soft landing spot away from Washington, but he ultimately took up private law practice in Philadelphia, while the chairmanship for the ICA went to the much older (and quieter) John B. Hollister.[107]

Technology for Defense

Development represented only one of a wide variety of foreign policy-related programs that incorporated engineers. As the following sections will show, both presidents brought engineers into foreign policy through a number of other means that had little to do with instituting change in poor countries to orient them away from the Soviets. Truman and Eisenhower implemented research and development programs for ballistic missile technology, surveillance, and, eventually, a space exploration program, all of which brought engineers along as necessary contributors. These programs brought the talents of engineers into places of importance in the execution of American foreign policy.

In many cases, their implementation came about after consultation with engineers themselves. Truman, and Eisenhower more prominently after him, assembled and consulted with councils and committees populated by engineers on issues relating to security. These councils produced recommendations that led to real policy changes on a number of levels, but always to the benefit of the field of engineering. Taken together, the results of the Cold War policy

[107] Memorandum of conversation with the president, October 1, 1957, Eisenhower Library, JFD Papers, White House memoranda, Box 5; Memorandum of conversation with the president, October 18, 1957, Eisenhower Library, JFD, White House Memoranda, Box 5; Albin Krebs, "Harold E. Stassen, Who Sought G.O.P. Nomination for President 9 Times, Dies at 93," *The New York Times*, March 5, 2001.

decisions elevated engineering to new levels of importance and visibility in American society. Their contributions to defense related innovations had important implications for the directions of American policy, driving new discussions related to nuclear testing, deterrence, defense measures, and the strategic deployment of missiles, most notably in Turkey itself.

Against this Cold War context influenced by Truman and Eisenhower, the stage had been readied for engineering to play a significant role in the direction American engagement with the rest of the world. Both presidents found new places for engineers in foreign policy during their administrations. Engineers would find themselves leading large-scale design projects in Turkey and elsewhere that incorporated their skills to further American security aims, while also increasingly becoming a part of defense and surveillance projects. Their contributions to foreign policy brought engineers great status in society, while allowing American policymakers to continue advancing a complicated foreign policy agenda at home and abroad. In the process, the positive feedback loop involving the American government and engineers slowly gained momentum beginning under Truman, and continually built strength under Eisenhower. Both presidents thus contributed to a seismic change in American engineering culture, a change that remains a central component of American engineering experience to this day.

The following sections will detail the experience of the first wave of engineers involved in these projects, and the specific work they did as a part of foreign policy. At the front of the shift that took engineering from the margins of foreign policy to a central component of it stood the engineering generation. These individuals' backgrounds positioned them well to take leadership roles in the function of Cold War engineering programs, sharing common traits and tendencies that the government readily incorporated into its policy plans. To adequately understand their place in Cold War American policy requires an investigation into the context in

which they grew up. From birth, this generation was conditioned to innovate based on the world around them. Turn-of-the-century America presented all types of engineering feats that influenced young men to pursue the field themselves. Without knowing it, their interests put them on the slow track to Cold War government service decades later.

Pat Gifford represented his peer group well. As a young man, Gifford exhibited tendencies that many of his future colleagues shared, which contributed to their rise in the Cold War era. Their personalities, then, become important features for explaining what motivates the "technical expert," and why American foreign policymakers became so enamored with their skills.

Chapter Two: The Engineer at the Center

At age 24, Pat Gifford received notification that the U.S. Patent Office approved his first invention for an improved radiator cap. Gifford's cap addressed two simple problems. First, radiator caps on cars at the time were clumsy-looking and unappealing. Radiators were not typically located under an automobile's hood, so drivers were forced to watch the road with a cap in view. The aptly-named "Gifford" cap was meant to beautify the automobile radiator, and thus the driving experience, by adding a polished brass finish and two symmetrical atom-like arms extending from the base of the cap. The second problem Gifford hoped to fix was that the exposed radiators of early automobiles were often difficult to fill. Especially on warm days in which a radiator may have run dry, opening a red-hot radiator cap meant prolonged hand-to-metal contact in order to unscrew it. The Gifford eliminated such fumbling with its simple hinge construction. With it, filling a hot radiator was as simple as flipping a lock. Due to a rise in motomoeter (a device used to read engine temperatures) thievery, the cap was also tamper-resistant thanks to an included locking mechanism. The Gifford lock was advertised as the "most convenient" on the market at the time.[108]

The invention of the radiator cap followed a lengthy research and development process. Gifford investigated his competition, reading up on radiator cap manufacturers as far as Great Britain. He sketched his design hundreds of times, first on standard newsprint, then with full blueprints. He shopped metal casting companies, marketed the cap, and wrote pamphlets highlighting the features of his invention. He then sought precedent for his product with legal counsel from Washington D.C. patent lawyer George P. Kimmel, who confirmed in April 1920 that indeed Pat was the first to make this specific type of hinge-action cap in the U.S. And after

[108] Gifford Hinge Radiator Caps advertisement, 1925, Gifford Personal Papers.

filing the requisite paperwork, just over a year later Gifford was the owner of patent number 1382499.[109]

By the end of his career, Gifford would patent ten inventions in all, most of which would be under the employ of the Huber Manufacturing Company. But, as his first foray into inventing, the radiator cap marked a significant point in Gifford's engineering career that would ultimately take him around the globe. His labors in designing the radiator cap were emblematic of a generation of engineers who would eventually help remake the Third World as an extension of U.S. foreign policy.

The notion of a "Lost Generation" of Americans born during the last decades of the 19th century obscures a less-noticed subset of people just as important for explaining the 20th century American experience as F. Scott Fitzgerald and Ernest Hemmingway. Like the Lost Generation of artists, American engineers born right before the turn of the twentieth century would come of age during World War I, weather the storm of the Great Depression, and find themselves in various positions of authority by World War II. By the time the Cold War emerged, engineers of this generation would hold premier positions in a number of enterprises useful for a postwar American government in a bipolar geopolitical world. Some more academically-inclined (and administratively ambitious) engineers wound up heading U.S. technology projects such as the Office of Scientific Research and Development and the Manhattan Project. Others like Gifford took positions on the other end of the Cold War engineering spectrum; designing the very tools the U.S. government would need for executing grand development projects abroad. These twentieth century engineers often shared a similar socioeconomic background and a hobbyist's inclination toward solving problems through innovation.

[109] Letter, George P. Kimmel to John H. Clark, April 17, 1920, Gifford Personal Papers.

It is important to acknowledge, then, who these engineers were, where they came from, what motivated them, and what they brought to the postwar development endeavor, and general American technology. To do this means delving into the mind of engineers and the field itself to investigate how they thought about and viewed the wider world.

What Is Engineering?

The practice of engineering may seem like a straightforward occupation. Engineers are educated in mathematical and scientific methods needed to execute designs. Despite their ubiquity in modern society, people in the engineering world have never seemed to agree on what engineers do. After surveying histories and studies of the field, it becomes clear that there is no consensus definition of engineering, only a set of diverse ideas about where the heart of engineering truly lies.

Some argue that engineering is not science, marked by a distinction between the material uses of engineering versus science. Those opposed to treating engineering as science do so on the grounds that scientists work in the theoretical, while engineers work in the practical. Walter Vincenti commented on the uses of science to the engineers in his excellent volume, *What Engineers Know and How they Know It*. Vincenti posits that engineers differ from scientists in that engineers ultimately seek to produce “artifacts” in their work: “Engineering science in general is both similar to and different from science itself…engineering science and science both conform to natural laws, although one deals ostensibly with artifacts (engineering) and the other with nature (science).”[110] In contrast, scientists articulate their efforts through theories or

[110] Walter Vincenti, *What Engineers Know and How They Know It: Analytical Studies from Aeronautical History* (Baltimore: Johns Hopkins University Press, 1993). Vincenti describes engineering science here as a specific set of mathematical and scientific principles tailored for engineering uses. Engineers in this sense use engineering science in their work, but this does not make them scientists in a formal sense.

calculations, which technicians look down on as being only of limited practical use. In some cases, scientists openly admit their indifference to the practical applications of their work. When asked if he ever thought about “technological applications” of the subjects of his many published scientific papers, chemist Paul Harteck, (one of the minds behind the Nazi nuclear program), plainly stated, “Not too much.”[111] The true mark of an engineer, it seems, is that the engineer will ultimately make something tangible and in some way useful. Where physicists may be interested in fluid dynamics, for instance, an engineer would seek to use laws of fluid dynamics to make an airplane wing more aerodynamic.

While some engineers accept their field as effectively “applied science,” others shudder at the term when describing the work they do. In this view, the engineer takes science further than simply “applying” it, since designing and constructing things with mathematical and scientific principles requires “creativity” on levels far beyond what scientists have.[112] Those opposed to the notion of engineering as applied science argue that engineers possess a *tacit* knowledge of the world that lends them a certain level of know-how in their plans and designs that classically trained scientists do not.[113]

On a similar note, some engineers have taken to articulating engineers more as “artists” than scientists. The mere production of engineering drawings, a hallmark of the profession, reflects an artistic tendency only utilized by “creatives,” not mechanical thinkers. According to one author, those drawings contain “an air of great authority and definitive completeness…The conversion of an idea to an artifact (which is what the drawing is) …is a complex and subtle process that will always be far closer to an art than a science.”[114] Additionally, great inventors of

[111] Ibid., 92-93
[112] Edwin T. Layton, “Technology as Knowledge,” *Technology and Culture* 15, (1974): 31–41.
[113] Vincenti, *What Engineers Know and How They Know It*.
[114] Ferguson, *Engineering and the Mind’s Eye*, 2-3.

the nineteenth century in many cases worked as artists before they turned to technology, which only strengthens the link between art and engineering.[115] Some have stated that more artistic-leaning engineering concepts have not been as emphasized in university engineering programs since the middle of the twentieth century, but their importance is evident in the processes used by engineers of Gifford's generation.[116]

Perhaps the most ambitious of the interpretations comes articulated by Michael Davis in his book, *Thinking Like an Engineer*. Davis writes that engineering is "the practical study of how to make people and things work together better - an undertaking as creative as art, as political as law, and no more a mere application of science than art or law is."[117] In this sense, engineering should be visible in practically every human endeavor, and be able to explain fields that it typically has nothing to do with.

Despite the lack of consensus surrounding precisely what engineers do, two themes remained constant across studies of the field. First, all suggested at some level an interest in "solving practical problems," presumably with the aid of some kind of specialized knowledge. Hans Straub's *A History of Civil Engineering* notes that engineers have limited use for scientific theories, specifically because they have little practical application, a reality only reinforced by real-life examples across time[118] The practice of designing practical and technical tools stems from the earliest of Italian Renaissance engineers. As Eugene Ferguson states in his telling book *Engineering and the Mind's Eye*, sixteenth-century engineer Agostino Ramelli's portfolio was

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[115] Ferguson profiles institutional reviews of engineering departments in the postwar era that confronted the skewing away from design in engineering education. This sort of review was meant to reemphasize the importance of design and critical thinking rather than more systemic scientific modes of education. He focuses heavily on the loss of ability to consider ambiguity in engineering in favor of certainty arrived at via calculation and quantification.
[116] Samuel C. Florman, *The Existential Pleasures of Engineering* (New York: St. Martin's Griffin, 1996), xiv.
[117] Michael Davis, *Thinking Like an Engineer: Studies in the Ethics of a Profession* (New York: Oxford University Press, 1998), ix.
[118] Hans Straub, *A History of Civil Engineering: An Outline from Ancient to Modern Times* (Cambridge, Mass.: MIT Press, 1964), 238.

made up of a number of engineering drawings "derived from experience in workshop and field."[119] In other words, the drawings came from actual tangible *use*.

A preoccupation with practicality has further support in the standing interests of budding engineers attempting to fix problems on usually smaller scales. Engineering innovations often start with the identification of a material problem of practical consequence. Gifford's interest in mechanics and solving problems had long drawn him toward tinkering and inventing, work that consistently exhibited a concern for fixing things that everyday people used. Besides his aforementioned work with automobile radiator caps, he also designed an improved metal milk bottle cap, the "Elwyn Sanitary Milk Bottle Lid." This design responded to the common issue of protecting milk from dirt and dust after the paper stopper the milk came with was disposed of. Made of a reusable nickel alloy, this cap protected half-empty milk bottles from being contaminated for future use.[120] Although Gifford did not put the cap in full production, the milk bottle lid signifies that, like most engineers, he occupied himself by solving practical issues of normal people. Throughout his life, Gifford continued tinkering in his basement workshop, out of pure enjoyment, if nothing else.

Other engineers of this generation expressed their preoccupation with practicality through publishing practical engineering reference books. With titles like *Calculus for Practical Engineers*, these authors strove to adapt more strictly mathematical or scientific information for the engineering mind, by cutting through some of the less relevant theoretical principles of mathematics, and emphasizing engineering applications.[121]

A second theme in engineering literature is that engineers seem to be concerned with technology, broadly defined. The deeply technical skills these people possess to solve practical

[119] Ferguson, *Engineering and the Mind's Eye*.
[120] Clayton Gifford, Elwyn Sanitary Milk Bottle Lid Advertisement, undated, personal papers.
[121] Alois Cibulka, *All This Could Happen Only to an Engineer*, 1950.

problems define the profession at nearly every level. As described by Edwin Layton in his 1974 article "Technology as Knowledge," technology is a unique and independent process that combines technique with special knowledge: "At the outset, design is an adaptation of means to some preconceived end," effectively arguing that technologists seek to solve problems with a combination of their designs and special knowledge.[122] Engineers may know a lot of technical information, but they also choose to use it to produce some *thing* novel to serve a practical need. As a result, most scholars seem comfortable using "technician" or "technologist" as a substitute for "engineer." Many engineering histories draw contrasts between the status of technology and science as different entities, and that engineers were trained in "technology" as such.[123] For this reason, the terms "technologist" and "engineer" may be read as synonymous in this thesis.

With their position on the cutting edge of technology, engineers have consequently been associated with modernity across eras. As environmental historians have pointed out, modernity can be marked by a strong inclination to master or harness the laws of nature for human use. Ruth Schwartz Cowen explains in *A Social History of American Technology* that the term "technology" itself suggests a certain synonymy with modernity: "We use the word technology to dente those things that people have created so that they can exploit or manipulate the natural environment in which they are living."[124] Going back as far as the Enlightenment, engineers held the staff of modernity in their quest to build dams, water-powered mills, and roads in natural settings all to serve human need. Even in internal discussions among engineers in the twentieth century, the idea of harnessing nature for human use continually emerged as a consistent motivation for their endeavors. Consequently, the engineering profession always stood at the

[122] Layton, "Technology as Knowledge," 37. Layton also argues that not all technologists are engineers and vice versa, but his opinion reflects just another of the varied interpretations of who engineers actually are.
[123] Florman, *The Existential Pleasures of Engineering*, 16.
[124] Cowan, *A Social History of American Technology*, 2.

forefront of the modern, since they were the very ones building the markers of modernity through technology.

All of this is to say that engineers constituted a cohesive body of professionals. Regardless of their specialties, engineers shared commonalities that propelled them into technical careers. The similarities among engineers of different specializations have been proven by outside research. In a 1929 study funded by the Engineering Foundation, 3000 Stanford University students were polled about their general interests. Based on their general likes and dislikes, the results showed that engineering students in the four major engineering specialties, Electrical, Civil, Mechanical, and Mining and Metallurgical, "cannot be separated to any appreciable degree in terms of their interests."[125] Such a claim further supports the notion that engineers of every denomination think relatively alike.

Technology in Nineteenth-Century America

In America, preoccupation with technology paired well with nineteenth-century U.S. visions of itself and its modern progressive mission in the world. While spreading its reach into the North American West, the American government sought to provide modern conveniences and ideas to "uncivilized" lands unsettled by whites. Technology like railways and telegraphs (not to mention democratic governance) would bring civilization to the interior, thereby claiming the frontier for a triumphant American modernity. As the famous image of John Gast's *American Progress* exhibited, bringing technology to the West provided the ultimate marker of a land conquered by the United States.[126]

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[125] Lance E. Metz and Ivan M. Viest, *The First 75 Years: A History of the Engineering Foundation* (New York: Engineering Foundation, 1991), 52-53.
[126] Frederick Jackson Turner, "The Significance of the Frontier in American History," *Report of the American Historical Association* (1893): 199-227.

Other technologies that took the young nation by storm portended big things for the American economy. In the 1810s and 1820s, new canal constriction connected previously-dislocated portions of the U.S. using horse-powered cranes and hydraulic cement to prevent seepage. Thanks to canal construction, and the technology applied therein, interior towns and hamlets in the Midwestern states experienced new commercial activity, a development that would eventually facilitate heavy manufacturing. Technology was thus credited for the American aspiration to, as John Kasson writes, centralize a country that feared "regional fragmentation."[127] Such technological victories proved American mastery over its previously untamed and unproductive domains.

The early United States government overtly supported technology through one specific and important institution: patent protections. In 1790, the Patent Act provided a 14-year patent protection for inventors as a way to promote innovation in the young republic. Indeed, Congress aimed to make such protections a central aspect of American statecraft. According to historian Kenneth Dobyns, Congress ensured that "the promotion of science and literature would contribute to the security of a free government…"[128] That process included stimulating economic activity through selling a patented item with the safety of government copy protection. Historian Adrian Johns accounted for the connection between science and intellectual property, noting that the patent process provided incentive to technically oriented individuals to produce original innovations. At the same time, the "ownership" of science that patents reinforced was a "corrupting" process that undermined open scientific culture.[129] Especially compared to Great Britain, the relatively cheap patent process in the U.S. has been cited as a reason for America's

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[127] Kasson, *Civilizing the Machine*.
[128] Kenneth W. Dobyns, *The Patent Office Pony: A History of the Early Patent Office* (Fredericksburg, Va.: Sergeant Kirkland's Museum and Historical Society, 1994), 21-23.
[129] Adrian Johns, *Piracy*, (Chicago, Ill: University of Chicago Press, 2009), *p401-401*

innovative and productive economy.[130] Over the course of the 1800s, the terms of the patent protections changed multiple times, but still served as an impetus for Americans to innovate, market, and sell their findings.

Technology itself became a sort of public sensation in the 1800s as American engineers achieved bigger and better mechanisms for public display. Observers fawned over the effects of technology on humanity through literature and public addresses. During a speech at the New Hampshire State Agricultural Society in October, 1858, Edward Everett cited American character and commercial might as the first explanations for American dominance over the Eastern region of the United States. This mastery could only be finished through implementation of "labor-saving machinery" and the locomotive.[131] Ralph Waldo Emerson noted that such technology added enormous aesthetic stimuli to the American landscape, adding that railway bridges and explosions to make way for new roads "keep the senses alive and imagination active."[132]

And yet, questions about technology's supremacy slowly gained steam to counter claims that technology always brought good into the world. Although technology provided increased levels of leisure in labor-saving innovations, there also existed pushback. Industrialized America experienced economic crises at a higher rate, and the working conditions for those involved in industry were dangerous. What is more, critics argued that technology also brought increased stress and strain into daily life.

Literature reflected suspicion of technology. A key example is Mark Twain's 1889 *A Connecticut Yankee in King Arthur's Court.* The story centers on the exploits of a 19th century

[130] Robert J. Gordon, "Perspectives on *The Rise and Fall of American Growth,*" *American Economic Review: Papers and Proceeding Proceedings 2016,* vol . 106, no. 5 (2016): 75.
[131] Edward Everett, *Orations and Speeches on Various Occasions* (New York: Little, Brown, 1870), 248.
[132] John F. Kasson, *Civilizing the Machine: Technology and Republican Values in America, 1776-1900* (New York: Hill and Wang, 1999), 121.

engineer knocked out in a fight so hard that he woke up in Arthurian England. The engineer proceeds to introduce modern technology into the medieval town, going as far as manufacturing Gatling guns for military use. While teaching his medieval friends the merits of new 19th century technology, suspicion gave way to outright revolt. The Catholic Church, especially sensitive to change in this era, put together a campaign to eliminate the technologist and his modern tricks. Armed with his anachronistic weaponry, the engineer proceeded to kill "all of England" who attempted to seize him.

The true lesson of technology's pitfalls can be seen in the book's climax. With the carnage that the modern weapons caused, the engineer now sat trapped behind a wall of dead bodies, essentially blocked in by his innovations. Without any way to escape the wall, the engineer was stabbed by one of his own victims. The walls built by modern weapons had very literally led to his downfall.[133]

The story reflected tension between society and technology. Twain exposed the progressive belief that technology *always* brought good as a fallacy- or, at least challenged the notion. Rather than eliminating problems, technology only seemed to bring with it new problems, much like the industrialized world Twain actually lived in. The idea that the world was better with modern technology had a ripe proving ground in the Middle Ages, but left behind a lot of carnage rather than happiness and prosperity. Utopia proved elusive, and technology sometimes made it seem ever-further away.

Professional Organization

Public criticism of technology still became overshadowed by a sense of exhilaration that it could bring. To believers, the fruits of technology were visible to all who were willing to see.

[133] Mark Twain, *A Connecticut Yankee in King Arthur's Court* (New York: Harper and Brothers, 1889).

The pitfalls of technology just served as natural speed bumps that engineers could iron out. Just because engineers had not yet eliminated strife from modern American life was no reason to believe that they would not do so in the future. Engineers saw little decrease in interest and public need for their skills. As a result, they consolidated their interests into a number of professional organizations in the latter half of the 1800s. The second half of the 19th century saw the incorporation of the American Society for Civil Engineers (ASCE), American Society of Mechanical Engineers (ASME), the American Institute for Electrical Engineers (AIEE), and American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME). These groups all organized themselves into unique professional organizations, with steadily increasing membership every year after their founding. At their founding, these organizations emphasized less stringently "professional" issues, instead focusing on fostering fraternal relationships among members. In the twentieth century, that changed as these societies started emphasizing new standards of engineering practice and codes of conduct among trained engineers.[134] Professional societies then served as fraternal groups and career guides, keeping engineers up to date on the latest innovations in their respective engineering areas, while forming relationships that would support individuals in their careers. Annual meetings provided open discussions on all matters of engineering, collectively reinforcing the notion that engineers were of a certain shared mind when it came to technology. They outlined their concerns while perpetuating a specific ideal of engineering vision for the world.

As historian Robert Wiebe writes, developments in engineering's professionalization in the nineteenth century came as a part of a larger trend toward professionalization of many Progressive Era industries. Individuals in fields like law founded their own professional associations to raise standards and barriers to entry, increasingly closing the field off to people

[134] Zussman, *Mechanics of the Middle Class*., 6.

without requisite expertise or backgrounds. Just as teachers and lawyers adjusted their standards for entry, engineers viewed their profession as something more esoteric than simple tinkering could account for (although tinkering remained a lifelong habit for most). Along with setting standards, engineering associations found ways to foster their own discrete cultures and worldviews.[135]

The American Society of Mechanical Engineers (ASME) serves as one example of the sort of image these professional organizations fostered internally. The ASME organization's insignia itself communicated a great deal about the way the group viewed its greater purposes. The ASME logo featured an image of the globe set atop a lever in the sky. With a cloud as its fulcrum, the lever's work appeared to be exerted by a muscular human arm. The symbolism was rich; the organization was comprised of men who were deeply interested in leveraging the laws of nature for some greater human ends. That arm of human effort was, of course, the input into the efficiency equation, and the output would be whatever came of the melding of the human effort with natural laws.[136]

The turn of the century presented a chance to take stock of where American modernity lay on its progress spectrum, and engineers provided an accurate gauge of that status. Although anti-technology gained some traction in the 1800s, the masses still seemed to put faith in technology rather than buy dystopian theories wholesale. In this climate, engineers like Gifford would absorb the notion of engineering as a viable career as they pursued their life's work. The world of engineering became more and more visible and accessible for young men growing up at this time. That visibility helped direct people like Pat Gifford toward the field.

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[135] Robert H. Wiebe, *The Search for Order, 1877-1920* (New York: MacMillan, 1967), 117-119.
[136] "Transactions of the American Society of Mechanical Engineers," *Transactions of the American Society of Mechanical Engineers* 38 (1917).

A New Engineering Generation

Pat Gifford showed a long-run fascination with technology. Besides his independent innovations like the Elwyn bottle cap, he worked and lived knee-deep in technology during his career at Huber. There, Gifford built on existing heavy machine technology to receive patents that would alter the functionality of implements like road rollers. Doing so demanded intimate knowledge of that existing technology, and a command of the principles that made them run.

From youth, Gifford exhibited a deep interest in anything and everything related to mechanics. He was born an only child in November 1895 to a farming family in Pittstown, New York, a rural hamlet between Troy and the Vermont state line. His family's farm provided an ideal setting for exposure to steam and coal fired motion. Gifford readily studied any farm implements he could get his hands on, fostering an appreciation for tinkering and working with his hands. He studied new internal combustion engines as they grew more prevalent in his adolescence, even teaching his own father to drive a neighbor's Ford at age 15.

This trait of tinkering with technology put Gifford in league with other boys of his generation. Like eighteenth-century middle-class Britons before them, middle-class Americans at the turn of the twentieth century saw technology as an exciting avenue for professional advancement.[137] Developments in areas like electricity opened new horizons for boys like Gifford, transfixing them on the possibilities that technology held for society.[138] Other American notables of Gifford's generation, like the flying ace Eddie Rickenbacker and industrialist Leroy Grumman (of today's Northrop-Grumman), found that their interests in tinkering and mechanics were also satisfied by at least some formal engineering training. This trait of tinkering is one shared by engineers across eras. Engineering biographies, regardless of the time period written,

[137] Ferguson, *Engineering and the Mind's Eye*, 142.
[138] G. Pascal Zachary, *Endless Frontier: Vannevar Bush, Engineer of the American Century* (New York: Free Press, 1997), 21-22.

often mention early fascination with tinkering with simple and not-so-simple mechanisms. Those biographies make clear mention of the emerging engineer's ability at a young age to take apart mechanisms (like doorknobs and engines), and the satisfaction that came along with it, as a motivation for pursuing a career centered on designing such implements.[139]

One more well-known American engineer of this generation shared similarities with Gifford's life and career arc: Vannevar Bush. Born five years before Gifford in 1890, Bush shared with Pat an appreciation for manual work and bigger dreams to design new gadgets and devices. Similar to Gifford, Bush came from rather humble beginnings as the son of a pastor, and learned to appreciate the way things worked by tinkering in a workshop in his house. Bush, like Gifford, made a habit of imagining new products to solve various practical problems. As biographer G. Pascal Zachary notes, Bush's tinkering resulted in a number of varied inventions even as a young man, such as a land surveying machine contrived with two bicycle-scale tires on either side of a wooden box. Although such inventions did not provide Bush any widespread notoriety, habits of budding engineers of this generation would pay off a great deal in their careers.[140]

Another of Gifford's and Bush's engineering generation colleagues came from the West Coast. Born in San Francisco, California in 1899, Jack Adalbert Killalee served as a Bureau of Public Roads field engineer in same Turkish roads program Gifford assisted in the early 1950s. Killalee grew up in a geographic environment quite different from Gifford and Bush, but one filled with tinkering and innovation just the same. Well before the days of "Silicon Valley," San Francisco became home to enterprising waves of Americans in the middle of the 1800s, seeking explore the natural resources of the state. Closely behind came those wanting to provide new

[139] Richard L. Meehan, *Getting Sued and Other Tales of the Engineering Life* (Cambridge: The MIT Press, 1983), 1-2.
[140] Zachary, *Endless Frontier*.

services to those adventurous figures. If innovation is the child of necessity, San Francisco served as a perfect proving ground for new ideas and products of all types. California inventions began rolling into the U.S. Patent Office in the 1870s, a trend that never truly died.[141] These patents had largely come from those living in the San Francisco area, which had become the tenth largest city in the country by then.[142]

But it was not just Killalee's location that inspired his engineering tendencies. Killalee's father, John Joseph Killalee, the son of Irish immigrants, worked as an engineer in San Francisco's Buck-Hecht brand shoe factory. Although he submitted no patent application for it, family legend recalls that John Killalee invented a machine to construct moccasin toes on hiking shoes.[143] Surrounded by a father who encouraged creative problem-solving and a city with a culture of innovation, Killalee's environs heavily influenced his future career path.

Thus, this thesis details the careers of three different, but related engineers for explaining postwar engineering in foreign policy. Gifford's profile serves as a window into the world of the private engineering contractor. Bush's profile reveals the experience of more elite engineers involved in policymaking at the highest levels of American government. Killalee mostly worked as a middle manager in the Bureau, whose experience straddled the line between the elites of the field and more workaday engineering practice. Despite their varied future positions within the field, these engineers shared traits and experiences as young men in turn-of-the-century America. There existed broader trends in American culture at this time that further supported engineering as an attractive occupation.

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[141] Searches for patents from California in the U.S. Patent Office yield plenty of results each year from the 1870s-onward. Such a measure does not consider inventions for which patents were not filed, which at the time happened due to cost and time concerns, given California's remoteness from Washington.
[142] Kevin Starr, *California: A History* (New York: Modern Library, 2007), 121.
[143] Killalee to Deacon Edwin Owen, June 24, 1967, Jack Killalee Personal Papers, Burlingame Historical Society, Burlingame, California.

The Heroic Engineer

Engineering appealed to boys of this generation on multiple levels. For one, they grew up during the era of the “heroic engineer.” Engineers served as the force behind modern convenience, and garnered praise for their work. The unprecedented scale upon which engineering feats were featured in large projects at the time, like the Panama Canal and New York’s Manhattan Bridge (1909), put skills of trained engineers in public view like never before. With their prominently visible work on large-scale projects like bridges, dams, and the like, engineering became deeply revered as a career field on the forefront of human advancement, marking what has been noted by some as a “golden age” in engineering history from 1850 to 1950.[144]

The engineering generation grew up during a high tide of scientific prestige in American society. From the hand-wringing that followed industrialization’s advancements in the 1800s, American Progressive Era reformers turned to engineers as the counterweight to the negative effects of that industrialization, building reputations as reformers for the betterment of society along the way. Science’s “disinterested” principles could be employed to fix industrialized society’s problems though expert management practices. Ruth Schwartz Cowan categorizes those problems by noting that industrialization’s effects were decidedly uneven: “For some people, work became less physically burdensome; for others, more so. Some people prospered, others were reduced to penury. Some people worked longer hours for less pay; others, shorter hours for more.”[145] But remedying the uneven benefits of industrialization often became subsumed by pursuing a bigger and better form of industrialization. In this, Michael Adas writes

[144] Florman, *The Existential Pleasures of Engineering*, 6.
[145] Cowan, A Social History of American Technology, 198.

that Americans saw themselves as second to no nation; the U.S. had the gumption to develop bigger and better machines than any other people on the planet. Technology would become a hallmark of a uniquely American civilization.[146]

Their skills lent engineers credit for modern conveniences, and were the gatekeepers of such modernity in many ways. As a result, engineers who could employ science to solve practical issues were deified in popular press as rescuers for a society in need. [147] The steam engine, harnessing of electricity, and the new combustion engine of the late 1800s were all testaments to the power of individuals with technical knowledge to turn nature's laws into something useful. The Engineering Foundation acknowledged as much when it published a chronicle of its first three-quarter century anniversary: "Steam engines, electric light and power, farm machinery that allowed significantly greater productivity, industrial machinery used to manufacture a myriad of products and textiles, telephones, automobiles, electric street cars-these and other inventions radically changed society in just a few decades. There was little the engineer, possessed of imagination and skills that had so benefitted society, could not do."[148] Thus, the public saw engineers as the people best-suited to take humanity to its next levels of development, and were revered as such.

The achievements of engineers garnered praise from the areas of literature and poetry as well. Regarding his overseeing of the building of the Panama Canal, American poet Percy MacKaye cited U.S. Army engineer George Washington Goethals as a hero in his poem "Goethals":

Where Balboa bend his gaze

[146] Michael Adas, "Modernization Theory and the American Revival of the Scientific and Technological Standards of Social Achievement and Human Worth," in *Staging Growth: Modernization, Development, and the Global Cold War,* ed. David C. Engerman (Amherst: University of Massachusetts Press, 2003), 8.
[147] Ibid, 156.
[148] Metz and Viest, *The First 75 Years,* 115.

He leads the liners through

And the Horn that tossed Magellan

Bellows a far halloo

For where the navies never sailed

Steamed Goethals and his crew;

So nevermore the tropic routes

Need poleward warp and veer,

But on through the Gates of Goethals

The steady keels shall steer,

Where the tribes of man are led toward peace

By the prophet-engineer[149]

In this case, the engineer was a leader who held keys to progress for backward people. Figures like Goethals literally moved mountains in their efforts, work that only modern expertise could make possible. Such examples of lyrical reverence for engineers signaled that much of society was enamored with engineering's charms.

Further evidence of heroic engineering's hold on society at large during the upbringing of the engineering generation is seen in the popularity of world exhibitions. Started in part to showcase the newest technological innovations, world exhibitions built up greater public reverence for engineers' work. Expositions throughout the 1800s profiled such innovations, celebrating the aesthetic wonder modern technology could bring. These events highlighted a sort of exceptionalist view of American-made machinery. Kasson notes that European observers of American machinery at these expositions "were generally offended" by the often-ostentatious

[149] MacKaye Percy, *The Present Hour: A Book of Poems* (BiblioBazaar, 2009), 68.

American displays of brightly colored and resplendent mechanisms. Machines of great mass in these exhibitions stood not only as examples of technological wonder, but also to inspire republican achievement in its observers. These expositions clearly displayed the power of marrying patriotism and technology. The 39-foot tall Corliss Engine displayed at the 1876 Philadelphia Centennial Exposition embodied those very traits, which were not accidentally reinforced by the sitting head of state himself, Ulysses S. Grant, who launched the machine to the awe of fairgoers.[150]

The 1876 Philadelphia Centennial Exhibition highlighted by President Grant's activation of the Corliss Steam Engine stood as only one early example of public engineering exhibitions. Before and after the turn of the twentieth century, exhibitions like this regularly captured the attention of Americans and the world at large. The 1893 World's Columbian Exposition in Chicago and the 1904 Louisiana Purchase Exposition in St. Louis both featured significantly more visitors than the 1876 event, and their share of engineering feats. Both the 1893 and 1904 events included "machinery buildings" dedicated to the man-made engines, tools, and vehicles powering the nation. The Chicago machinery building captivated fairgoers with "automatically working displays" of "labor saving" contraptions. One reportedly entrancing machine automatically spooled cotton into thread of eighty different shades.[151] In St. Louis, the machinery building alone took up twelve acres of the city's Forest Park, and housed an 8000-horsepower Curtis steam turbine. As a foreshadowing of things to come in transportation technology, the

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[150] John F. Kasson, *Civilizing the Machine: Technology and Republican Values in America, 1776-1900* (New York: Hill and Wang, 1999), 162-163.
[151] "THE EXPOSITION.: An Exhibit Thats Is Interesting and Instructive.," *Chicago Daily Tribune (1872-1922)*, June 11, 1893.

building also housed the "world's-largest" 3000-horsepower *gasoline* engine.[152] Observers consistently held these machinery attractions up as crown jewels of their respective events. Even well into the twentieth century, such fairs carried heavily technologically-focused themes. And, as will be elaborated on later, the Huber Manufacturing Company participated in, and won distinction through, demonstrations of their own machinery at both expositions.

As noted above, the notion of a heroic change-agent engineer only fed the desire for future engineers to pursue the field. Yet, there is still another side to the engineer's heroism which posits that the engineer was also a *servant*. Engineering work served important and meaningful purposes, as technicians used their knowledge to serve others and solve problems that affected a lot of people. Engineering historian Eugene Ferguson points out that even in state advisory capacities, some engineers believe that they merely serve others and "deny their influence" in making government policy.[153] As such, their motives in designing bridges and dams were not self-serving in any way, but rather meant to help people who cannot help themselves, logic that American postwar policymakers used in spades to describe development projects abroad. In reality, in the context of postwar development policy, Ferguson rightly points out that engineers are the ones who construct the policymaker's shopping list in order to fix whatever problem was identified.[154] Given that engineers have carried significant weight in making policy decisions since World War II, their perceived detachment from policy is striking, but instructive to understanding the engineering mind.

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[152] "GIANT POWER PLANT.: Colossal Engines That Furnish Powe for the Louisiana Purchase Exposition.," *Los Angeles Times (1886-1922)*, May 29, 1904; Rand McNally and Company, *Advance Guide to the World's Columbian Exposition*, 1893.
[153] Ferguson, *Engineering and the Mind's Eye*, 2.
[154] Ibid.

Another facet of engineering heroicism is that engineering thinking is closely tied to its potential pitfalls, which heightens the risk and thrill involved in engineering practice. The designing of bridges, buildings, and motor vehicles symbolized achievements that engineers at once take credit for, while also being to blame for their failings. Furthermore, the fact that lives were often at risk in engineering projects imbued the profession with a greater consciousness of the responsibility engineers hold to the general public. Engineers across time have acknowledged this responsibility to humanity, including perhaps the most famous American engineer of all, Herbert Hoover, who once quipped "If his works do not work, then the engineer be dammed."[155] Today's engineers have developed a collective awareness that what they do affects the masses for generations to come. Inherent risk in the field has given rise to more contemporary engineers who specialize in confronting those risks. Henry Petroski's work *To Engineer is Human* outlined the inherent risk in the profession. In the accompanying film to the book, Petroski noted "without engineers…there would be no disasters, but also no achievement."[156] Engineers' acute consciousness of a responsibility to protect the wider public is part and parcel to the field as a whole, both in Gifford's era and today.

Engineering Literature

Another inspiration for the engineering generation can be seen in young adult literature. In the early 1900s, young men had their choice of book series covering engineering and science, romanticizing and instructing them in the ways of engineers. One hugely popular example was the young adult novel series, *Tom Swift*. First published in 1910 by Stratemeyer Press, these novels followed the title character as a young man occupying his time inventing. Tom's

[155] "To Engineer Is Human - by Henry Petroski." Accessed October 2015. http://0-search.alexanderstreet.com.libraries.colorado.edu/view/work/1796482.
[156] Ibid.

technological know-how and interest in mechanics allowed him to travel to exotic locales, all while teaching the reader some lessons about technology in the modern world.

Just like Gifford, Tom Swift lived in upstate New York, and was awarded patents at a young age. Tom's own father worked as an inventor with a great reputation the world over. Running through many of the early Tom Swift novels was the notion that technology was a powerful force, one that benefitted those with the proper expertise to understand it. This obviously worked as a large draw for young men of similar social status who may have already identified an interest in technology. Tinkering with machines had special importance to the *Tom Swift* stories. Throughout the series, Tom routinely tinkers with and adjusts the machines he owns (motorboats, motorcycles, and the like) to make them run faster, farther, or more efficiently than originally intended. His knowledge of technology granted Tom advantage over his neighborhood rivals who had it in for him for various plot-driven reasons. Tom's passion was engineering, and each story in the series had its own way of rewarding that zeal.

The second book in the series, *Tom Swift and His Motor-boat*, follows a plot driven by the main character's mechanical impulses. After winning an old boat in an auction, Tom encounters challenges in refurbishing the machine to its previous glory. This meant making mechanical adjustments to the engine, changes closely listed in the text to engage budding engineers who may be reading. In one case, Tom knew that the "magneto was out of order and the batteries needed renewing, while the spark coil had short-circuited and took considerable time to adjust." Not only did the pseudonymous author, Victor Appleton, describe the adjustments needed, but he made a concerted effort to explain what each component of the engine actually did. While attempting to fix that same boat engine, Appleton writes, "After a few turns of the fly-wheel there were no explosions. Finally, after the carburetor (which is the device

where gasoline is mixed with air to produce and explosive mixture) had been adjusted, the motor started off as if it only had intended to do so all the while…"[157] This sort of technical description was just the thing to grab the attention of young men heading for engineering careers.

More importantly, technical know-how and tinkering proved over and over again to be a decisive advantage in Tom Swift's various adventures. In 1911's *Tom Swift and His Sky Racer*, Tom found himself in the middle of an air race, the winner of which would receive $10,000. While most of the other competitors had conventional stock aircraft, Tom's skills tinkering with his plane produced additional thrust that could push his "little monoplane" over one hundred miles per hour. Thanks to his skills, Tom won the race against much more expensive planes. As a bonus, Tom's modified plane caught the attention of a U.S. government official, who inquired about an exclusive right to purchase his special plane, making Tom Swift an early beneficiary of lucrative military aircraft contracts.[158] Due to Tom's deft understanding of the patent process, he was able to protect his invention and safely distribute his innovation to an Uncle Sam wary of militarizing European copycats in the dawn before the Great War.

Another series published by Stratemeyer played on the excitement of accessible mechanization and its potential to inspire young men. *The Motor Boys*, initially published in 1906, profiled three young men in the early days of automobile culture. While the exhilaration of machines drove each book's plotline, the lessons of mechanization in the modern world were also plainly discussed. Regularly, the boys frightened unsuspecting passersby and horses in the road with their automobiles. In one scene, the boys unpack "new-fangled bicycles" (motorcycles) to the chagrin of an old man nearby. While the boys explained their excitement over their new

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[157] Victor Appleton, *Tom Swift and His Motor Boat: Or, The Rivals of Lake Carlopa* (Stratemeyer Press, 1910), 53-54.
[158] Victor Appleton, *Tom Swift and His Sky Racer: Or, The Quickest Flight on Record* (New York: Grosset & Dunlap, 1911), 195.

purchase, the old man quipped "I knowed there'd some trouble come of that machine…It all comes of man trying to improve on nature."[159] Modernity's gifts, it turns out, rarely come without suspicion, especially from the older generations. Mastering such technology made these young men radicals in their own way.

Lest they be completely excluded from the excitement of mechanization, Stratemeyer also published a female version of the series, *The Motor Maids.* Perhaps as a commentary on the social roles of young American women in the early 1900s, the *Motor Maids* stories exhibited markedly less danger and fascination with engines and technology themselves, but rather had more developed subplots involving romance and friendship.[160]

Author Harry Irving Hancock captivated young turn of the century audiences with his depictions of engineers conquering vast natural challenges to meet human needs. His *Young Engineers* series, first published in 1912, profiled a youthful professional engineer duo that he first introduced to readers in his earlier *Grammar School Boys* series. The two engineers, Harry Hazelton and Tom Reade, found themselves all across North America solving problems other more experienced engineers could not. In *The Young Engineers in Arizona,* the two protagonists received a commission to solve a problem that stumped even giant railroad magnates: building a rail line across a large span of Arizona "Man-killer" quicksand. Despite repeated failures by other engineers, Hazelton and Reade showed determination, cunning, creativity, and virtue in solving the conundrum.

These engineers were meant to embody the skills good modern engineers needed, especially clever problem solving. Instead of simply laying a bed of concrete and inserting steel poles into it to support the railroad, Reade and Hazelton opted to use hollow steel pillars filled

[159] Clarence Young, *The Motor Boys: Or, Chums Through Thick and Thin* (New York; Cupples & Leon, 1906), 84.
[160] Katherine Stokes, *The Motor Maids Across the Continent* (London: Hurst, 1911).

with concrete, which would eliminate the lateral forces of quicksand from affecting the railway above. Their solution, it was importantly noted, was largely "original", and they saw past doubting looks that came from the public to execute their plan successfully.

The books also emphasize the importance of level-headed engineering. Reade and Hazelton possessed a supervisor's penchant for overseeing a mass of workers, and motivating them to finish the job right. When their workingmen displayed disturbing tendencies to overindulge in alcohol after work, the engineers were able to pep-talk the men into using more discretion outside of the workplace. The railroad's general manager noticed their leadership: "I haven't your gift with the tongue, Mr. Reade, and I've never been able to lead men into the right path as you did…"[161] To be a good engineer, the story teaches that engineers were leaders and holders of a special place in the social order.

Another trait the Young Engineers possessed was a keen awareness of their responsibility to the greater good. An engineering failure could lead to catastrophic loss of human life, and the railway quicksand dilemma was no different. If an improperly secured railway was laid across the quicksand, and entire train full of people could be lost for good. The railroad manager realized this reality in the Arizona desert, and quipped to Reade: "I'm glad I'm not an engineer…The responsibility for safety of life at this point is all yours Reade." To this, Reade emphatically replied, "I'm willing enough to take it sir."[162] The Young Engineers instructed young men what it took to be good and decent engineers. Engineers had to accept that the reality of their profession demanded maturity and a certain determination to ensure the safety of the

[161] Harrie Irving Hancock, *The Young Engineers in Arizona: Or, Laying Tracks on the Man-Killer Quicksand* (Philadelphia: Henry Altemus Company, 1912), 53-54. It should be noted that the books were geared toward young, white, middle-class males. Coming out of the Progressive Movement, Hancock liberally peppered his work with middle-class suggestions about the virtue of temperance, hard-work, and financial frugality. In one episode of this book, secondary characters argue that saving money was more important than drinking, and putting cash away in a "savings bank" was a safe venture because they "don't fail nowadays" (56).
[162] Ibid, 85.

general public. These themes run throughout the Young Engineers series, regardless of where Reade and Hazelton's adventures took them.

Budding engineers could also learn about engineering in this era via popular magazines like *Popular Mechanics*. First published in 1902, *Popular Mechanics* dedicated itself to exploring new technology with the tagline "Written So You Can Understand It." By pushing cutting edge technology into public orbit, publishers consequently grabbed future technologists, like Gifford who were enchanted by accounts of innovations like long-distance experimental train travel without steam power.[163] For a mere $1 a year, future engineers were exposed to the possibilities, however far-fetched they may have been, of a world dominated by new useful technology.

Retrospectively, those of the engineering generation professed early interest in the aforementioned books and magazines, notably the inventor of the U-2 spy plane [164] The literature revealed a world that mechanical skill could unlock, and the many uses those skills could find in everyday life. Unlike their forerunners who more often learned engineering through on-the-job training, the engineering generation increasingly had to gain those technical skills through formal education at institutions that carry a whole history unto themselves.

Engineering Education

Engineering education had its own turn of the century champions, most notably from the presidency. Theodore Roosevelt boldly promoted it in his 1906 Annual Address before a joint session of Congress:

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[163] "Locomotive without Fire or Water," *Popular Mechanics* (Hearst Magazines, January 1905 vol. 7 no. 1), 101.
[164] In one particular engineering memoir, the writer states that he "devoured" *Tom Swift* books as a young man, encouraging his future career path; Clarence L. "Kelly" Johnson and Maggie Smith, *Kelly: More Than My Share of It All* (Washington, D.C.: Smithsonian Books, 1989). In one particular engineering memoir, the writer states that he "devoured" *Tom Swift* books as a young man, encouraging his future career path; Ibid.

Our industrial development depends largely upon technical education, including in this term all industrial education, from that which fits a man to be a good mechanic, a good carpenter, or blacksmith, to that which fits a man to do the greatest engineering feat. The skilled mechanic, the skilled workman, can best become such by technical industrial education. The far-reaching usefulness of institutes of technology and schools of mines or of engineering is now universally acknowledged, and no less far--reaching is the effect of a good building or mechanical trades school, a textile, or watch-making, or engraving school. All such training must develop not only manual dexterity but industrial intelligence. In international rivalry this country does not have to fear the competition of pauper labor as much as it has to fear the educated labor of specially trained competitors; and we should have the education of the hand, eye, and brain which will fit us to meet such competition.[165]

For a president in the process of spearheading the Panama Canal project, Roosevelt spent time observing the engineering profession's largest effort first hand. And his words about engineering education signified some of the first vestiges of support for technicians from a modern president. With an almost-prescient eye toward a future of big-power status for the United States, Roosevelt noted that to be outpaced by international rivals in technical education would put America at a distinct disadvantage in world affairs. He acknowledged that training engineers had more importance for the future of the country than other subjects, defining a connection between the government and technicians that later presidents not only acknowledged, but institutionalized in state policy.

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[165] "Sixth Annual Message," December 3, 1906, The Miller Center, University of Virginia, http://millercenter.org/president/roosevelt/speeches/speech-3778.

The first decades of the twentieth century were an exceptional time to train as an engineer. The reputation and demand for engineers experienced an upswing, a trend that continued for decades after Gifford, Bush, Killalee, and their cohorts left their respective higher learning institutions. Engineering colleges trained young minds in techniques meant to harness nature and its laws and put it to beneficial human use. As such, engineers came to embody the best of modernity, who could unlock technology's possibilities for rural and far flung places untouched by those advances.

Nineteenth-century inventors and technologists only sometimes used formal education to learn principles needed for their innovations. Thomas Edison received only limited formal education, yet his work inspired later American engineers like no one before him. By the second decade of the twentieth century, colleges became more numerous and accessible for non-elites like Gifford. Between 1899 and 1910, college enrollments increased 50 percent nationally, and a number of colleges appeared in and around Gifford's region of upstate New York in that period.[166] As a result, this new generation of budding engineers viewed formal schooling at engineering colleges as a more natural first step in their professional aspirations. Even so, many engineers of the generation still learned from apprenticeships or simple field experience.

Located in Pittstown, New York, the Gifford family farm conveniently laid a short train ride from the Rensselaer Polytechnic Institute (RPI) in Troy, NY, likely the premier engineering-specific college in the nation. Going to RPI became a sort of destination for Gifford as a youngster. By the time he entered RPI in 1914, Pittstown and the surrounding towns had sent a consistent stream of students to Troy for decades. Perhaps relatedly, the region itself had its own small culture of innovation. Throughout the 1800s, inventors residing in Pittstown, Johnsonville,

[166] Thomas D. Snyder, editor, *120 Years of American Education: A Statistical Portrait* (Washington, D.C.: U.S. Department of Education, January 1993), 65.

and nearby Hoosick Falls regularly applied for, and were awarded, patents for items as diverse as bottle-stoppers and harvesting machines.[167] Notably, Hoosick Falls resident Walter Wood patented a variety of reaping devices in the 1850s and 60s. Wood's inventions gave rise to one of Hoosick Falls' most important industries, the Walter A. Wood Mowing and Reaping Machine Company, which operated until the 1920s.[168] The steam shovel itself had been patented by Albany resident William Otis, whose descendants, oddly enough, later opened a shovel factory in Marion, Ohio.[169]

RPI had been founded in 1824, making it the oldest engineering college and science school in continual existence in the United States.[170] It first served as a regional school for young men in New York state. Most of the early graduating classes were made up of students from upstate New York, with occasional entrants from western New Hampshire, Vermont, or New York City. RPI brought together like-minded people, usually from middle class backgrounds into a place that provided the grounds for indulging the curiosity so many of them had fostered at home growing up. The Institute largely collected its faculty from the East, carrying degrees from the usual eastern elite institutions like Princeton and Harvard.

Its founders appropriately envisioned RPI as a school that existed to teach the "application of science to the common purposes of life."[171] As noted in the founding documents, practicality was at the forefront of RPIs mission, one that pervaded the institutional pamphlets and course catalogs that the Institute published:

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[167] Connelly, Eighaed S., Improvement in bottle-stoppers, U.S. Patent 52269 A, issued January 30, 1866.; Locke, Sylvanus D. Improvement in harvesters, U.S. Patent 214929 A, filed February 19, 1879, and issued April 29, 1879,.
[168] Wood, Walter A, Improvement in Harvesters, U.S. Patent 110713, issued January 3, 1871.
[169] "Tells Lions History of Osgood Co.." *The Marion Star,* July 3, 1961, 2.
[170] Palmer Chamberlain Ricketts, *History of Rensselaer Polytechnic Institute, 1824-1914* (New York: J. Wiley and Sons, 1914).
[171] Ibid, 7.

In every branch of learning the student begins with its practical application… By this method a strong desire to study an elementary principle is excited by bringing his labors to a point where he perceives the necessity of it and its direct application to a useful purpose.[172]

The process of observation and replication of scientific action stood as one of the main modes of education at RPI. Formal engineering training has always been geared toward practicality in this sense. Besides requiring engineers to learn scientific principles, engineers needed ways to ground those principles in real-life scenarios. For example, knowing the theoretical equations of gravity, velocity and the like only mattered to engineers when they could put them to use in a physical, tangible way.[173] Even mathematics, a mainstay for any engineering student, is only helpful in the ways engineers themselves can apply things like analytical geometry and calculus to practical problems.[174]

After the Civil War, RPI's reputation was such that the Institute increasingly attracted students from further afield. For the first time, students consistently flocked to RPI from outside the northeast from places like Indiana and Louisiana. There also existed an increasing contingent of international students, mainly from Brazil and Cuba. The 36-person class of 1888 alone contained three graduates from Havana, and one each from Peru, Brazil and Tokyo.[175]

The major concentrations at RPI tracked closely along the changing labor market of the time of the Institute's founding, specifically the need for civil engineers. Although engineers had long been a staple of the military corps, the specialization in "civil" engineering came to denote a departure for engineers who were meant to work outside the service. New technologies, like iron

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172 Ibid, 45.
173 Vincenti, *What Engineers Know and How They Know It*.
174 Ibid, 30.
175 Henry Bradford Nason, *Biographical Record of the Officers and Graduates of the Rensselaer Polytechnic Institute, 1824-1886* (Troy, NY: W.H. Young, 1887).

bridge making, steam power, and mountain tunneling demanded that more people trained in these technologies be prepared for non-military careers. With the expanding population of the U.S., these technologies saw increased need, especially in formerly isolated rural areas. RPI served its region by filling this burgeoning civilian demand.[176] At the time of the civil engineering degree's first offering, the Institute stated it could be obtained in one year by a "well prepared" entering student.[177]

In the early part of the 20th century, RPIs engineering curriculum followed what course bulletins described in terms of "efficiency": "The mode of instruction adopted by the Institute has been carefully perfected…It is believed to be well adapted to secure, with the least expenditure of time and work, that high grade of scholarship which is justly esteemed indispensable to the successful engineer and the technical manager."[178] In this sense, RPI and other engineering colleges served as vocational institutions. While other colleges incorporated engineering into its major offerings as a small part of a broader academic community, RPI maintained a focus on career training as central to the institute's mission.

By 1914, the Institute offered engineering degrees in civil, mechanical, electrical, and chemical specialties, along with degrees in general science. With the expansion of degree offerings into more specializations, RPI also enjoyed state of the art facilities. In 1907, a new laboratory was erected that included a 300-ton construction materials testing machine, and an entire 2,800 square-foot laboratory dedicated to steam turbines and technology. Students owned the privilege to have access to various smaller-scale materials testing machines, along with

[176] Ricketts, *History of Rensselaer Polytechnic Institute*. Although the institute did not cite "engineering" as its main purpose at its founding (preferring "scientific application" as its mission), the curriculum quickly transitioned into an engineering-heavy one because of the aforementioned reasons.
[177] United States Bureau of Education, *Monthly Record of Current Educational Publications* (Washington, D.C.: U.S. Government Printing Office, 1913), 109. Other engineering colleges emerged around the beginning of the Civil War, including New York City's Cooper Institute and Massachusetts Institute of Technology.
[178] Rensselaer Polytechnic Institute Bulletin (March 1916, Vol 15 no 1), 57.

torsion and in-house blue printing facilities. RPI buildings also provided ample space and tools for various forms of electrical and light measurement - key skills for budding engineers to master.

The RPI faculty and curriculum retained a complete engineering focus, even during Gifford's tenure. At the time of his enrollment, there were no courses offered in humanities, except for English (which Gifford struggled with frequently), and French. All graduates carried a written thesis requirement, which may have been one reason English had at least some emphasis at the Institute. Beyond that, all work had a singular practical engineering theme, without the distracting lure of non-technical subjects.[179]

RPI's undergraduate degree tracks incorporated the practical and theoretical most visibly in the first two years of instruction, but did so with the intention of leading engineering students to the final year of almost completely practical coursework. Students investigated mathematics and chemistry in their first years, but by year four, courses like that were completely absent from students' schedules. The variation came in the final year; students took courses studying the tangible concepts specific to those the students would see in the field. What took the place of chemistry and physics were courses in "steam engine design", "ventilation, heating and refrigerating", "naval design" and "automobile design".[180] What matters here is the gradual transition from the classroom to tangible field work. It is further important to note that engineering curricula across major concentrations varied little. At RPI, mechanical engineering students like Gifford were exposed to civil, chemical, and electrical engineering covered the "fundamental subjects" of every other branch.

[179] Ibid., 8-13, 78-84.
[180] Ibid., 61-84.

As engineers, their education became only as good as its applicability to the real tangible world. And as such, RPI proudly advertised its graduate's placements in various offices and engineering firms around the world as proof that its curriculum was "practically efficient"[181] To inforce further the notion of a practical engineering education, RPI graduates commonly ended their degree programs giving lectures on the application of science to daily life.[182] Graduates of RPI before Gifford went on to complete big engineering feats. George Washington Gale Ferris Jr., the inventor of the Ferris Wheel, graduated in 1881. The head engineer of the Brooklyn Bridge, Washington Roebling, graduated in 1857, and Frederick Grinnell, the inventor of the automatic fire sprinkler, graduated in 1855.

At other engineering-specific schools, fieldwork and practical observation were central to undergraduate education. Course catalogs from other engineering colleges highlighted men studying practical, tangible implements that reinforced their positions at the forefront of modernity. The Colorado School of Mines in Golden, Colorado required all entering students to take courses in mine surveying, which meant moving students into the field both to observe and to practice the skills they would be expected to use in the job market.[183] Massachusetts Institute of Technology catalogs from the early 20th century images showed students tinkering with engines, with the subtext that man had an inherent impulse to "design and build, and to participate in man's efforts to harness the forces of nature to his benefit."[184] Such a modernist claim reinforced the notion that engineers stood on the forefront of modern thinking in America.

Gifford's work at RPI embedded him in a community of like-minded young men with aspirations to do technical and practical work. The collective student body connected to one

[181] Ibid., 58.
[182] Ibid., 50.
[183] Quarterly of the Colorado School of Mines (Vol IX No. 1, 1914-1916), 48-49.
[184] Meehan, *Getting Sued and Other Tales of the Engineering Life* (Cambridge, Mass.: The MIT Press, 1983), 34.

another in many ways, with strong membership numbers in various fraternal and professional associations. Gifford himself participated on less-than-stellar track and football teams at RPI, but nevertheless gained a reputation as a jock at the Institute. As an entering mechanical engineering student, Gifford's academic performance at RPI was anything but exceptional. He consistently earned more passing grades than not, but had his share of "conditional" marks throughout his career in subjects like analytical geometry. His strengths lay in those subjects directly applicable to the practice of engineering: mechanical drawing, steam engineering, electricity, and the like. The skills learned in these courses were right in line with his preoccupation with design. His interests would later manifest themselves in his patent applications and a lifelong hobby of designing and producing projects for his personal household use. More important, his aptitude in areas like engineering drawing paid off as he asserted himself in the post-college engineering labor pool.

The educations of Vannevar Bush and Jack Killalee took place at other institutions, but with much of the same emphasis on practical work. Bush pursued his studies at Tufts University, then MIT for graduate work in electrical engineering. Like at RPI, MIT's engineering programs occupied the heart of the institution. At the time of Bush's enrollment at MIT in 1915, undergraduate degrees were awarded in civil, mechanical, mining, electrical, chemical engineering, and general science. But MIT's degree offerings went well beyond these specializations, and included geology, biology and public health, along with a hyper-specialized program in electrochemistry, among others. Students at MIT also had a longer list of courses to supplement their engineering educations, including history, political science, and economics.

The principles behind Bush's engineering doctoral program at MIT retained a strong practical and problem solving aims. The Institute stated that "[Doctoral degrees] will be

conferred only upon candidates who have not only breadth of scientific attainment, but have also shown the power of dealing with new problems in an independent and efficient manner." Upon completion of a thesis based on "scientific research," doctor of engineering degree candidates were expected to form two additional minor subject concentrations in other branches of the field than one's major subject. More centrally for Bush, MIT stipulated that doctoral degrees would only be conferred "as a rule" after three years of faculty tutelage.[185]

Bush's path to the Eng. D., however, took a slightly different route. Thanks to the advocacy of his adviser and his own stubbornness, Bush pushed through the program within a year, submitting his thesis entitled "Oscillating-current circuits: an extension of the theory of generalized angular velocities, with applications to the coupled circuit and the artificial transmission line," in the spring of 1916.[186] The anti-dogmatic Bush, who seemed driven like few engineers of his generation, sought to ultimately enter the workforce in academia as a researcher. To that end, with the Eng. D. in hand, his greatest academic hurdle had been overcome.

Although his college education would occur after the disruption of World War I, Jack Killalee's formal engineering training took place at the University of California-Berkeley. As a civil engineering major, Killalee enjoyed coursework in a college dedicated to that specialization. Even as late as 1925, Berkeley's College of Civil Engineering served as a training ground for mostly California students, attracting future engineers from all parts of the Golden State.[187]At the time of his attendance between 1921 and 1925, the College of Civil Engineering contained a group of twelve faculty members teaching mostly a variety of courses in infrastructure building. The college offered a number of railroad courses, and a highway

[185] Bulletin of the Massachusetts Institute of Technology Catalogue (Vol 51, No. 1, December 1915), 43, 161-162.
[186] Vannevar Bush, "Oscillating-Current Circuits; An Extension of the Theory of Generalized Angular Velocities, with Applications to the Coupled Circuit and the Artificial Transmission Line" (Eng.D. diss., Massachusetts Institute of Technology, 1916).
[187] *Register - University of California* (Berkley: University of California Press, 1923 - 1924), 16.

engineering course for upper-level undergraduates. Undergraduates had the option to complete a senior thesis, but it was not required for graduation. Killalee opted out of the thesis option, choosing instead to get his war-delayed career started as fast as possible.[188]

These programs served as settings for burgeoning engineers to take in and practice skills they would use for the remainder of their careers. And in these environments technicians cemented in their minds one of the profession's most basic and important skills: problem solving. Within the courses in engineering programs, problem solving represented a basic building block for all material. Homework, lab work, quizzes, and examinations based themselves on the concept of solving problems, thereby building in students a certain systematic way to view the world at large. In electricity, physics, chemistry, and most obviously, mathematics courses, work depended on properly and accurately evaluating problems. In fact, students of the engineering generation typically owned multiple notebooks dedicated solely to working out problems.

RPI student records provide plenty of models of problems encountered by those in the engineering generation. In physics courses, students were expected to determine horsepower levels of a river of a given size or discharge rate. Mechanics lab experiments asked students to determine error rates of measurement tools, or the power output of a fly wheel design of a certain weight. Electricity courses revolved around a student's ability to solve problems like determining the electrical forces between two differently charged bodies.[189] Students learned processes to tackle these problems, including formulaic application of rules and steps known to help reach often singular outcomes. Mechanics, math, and physics courses required previously memorized

[188] Ibid., 75-81.
[189] Physics problems, Notes And Notebooks 1908, , Rensselaer Polytechnic Institute Archives (RPI), Ralph L. Angell Papers, Box 1; Mechanics notebook, 1910; "Problems in electricity," RPI, Ralph L. Angell Papers, Box 1,;; Drawing, design of a fly wheel, April 22, 1913, box 1RPI, Christian J. Herzog Papers, Box 1.

formulas and equations with set variables and unknowns. Balancing equations for chemistry courses required identifying the natural products of a given chemical reaction. But, regardless of the subject, students typically worked toward a single, correct answer. Chemical reactions were balanced into a single reduced product, while physics and mechanics problems used formulas to produce a one correct answer.

Regardless of the subject, conceptualizing engineering work through "the problem" came with certain implications. In presenting all work in terms of problems, engineers implicitly learned that all problems have a solution. Those solutions were best reached through standardized means, using equations, laws, and scientifically tested methods. As a result, in the field these individuals adhered to a belief in engineering's ability to overcome obstacles; just as in the classroom, professional engineers viewed problems big and small as conquerable through the gifts of engineering. Ultimately, throughout the twentieth century, engineers met challenges in the profession and within individual engineering projects, with the triumphant attitude of technicians trained to view the world as a reducible and beatable problem.[190]

But, before these engineers could fully use their skills in the field, war disrupted their career paths. Indeed, World War I served to delay the career progress of many members of the engineering generation, but they often absorbed important lessons about their field in the process. Not all went overseas to serve in the military, but even in home-bound service, this group of engineers experienced the war in their own individual ways.

Facing War

[190] Engineering colleges fostered problem solving skills to reducible singularities, and were evaluated on their ability to reach those singularities efficiently in coursework.

The United States had distantly observed storm clouds forming over Europe in the years leading up to the outbreak of World War I in 1914. Despite his Allied leanings, at first President Woodrow Wilson navigated the nation away from the war to great electoral acclaim. America's conscious avoidance of embroilment in the conflict played well at home, launching Wilson to his second term as president in 1916 on the now infamous promise that "He kept us out of war." Little did his constituents know that American neutrality would soon to come to an end.

After the January 1917 Zimmerman Telegram left Wilson with no choice but to stand up to an increasingly threatening and aggressive German Empire, the U.S. shifted its foreign policy from preparedness to one of active engagement with Europe. Wilson asked for, and received a congressional declaration of War in April, 1917, sending the United States headlong into a total war effort. This foreign policy pivot changed the career timelines of Gifford's engineering generation, pulling young men his age out of their personal pursuits to confront the urgent crisis.

Finished with his junior year when the U.S. entered the war, Gifford left Troy and joined the Army in June 1917 in the medical draft at Fort Ethan Allen, Vermont. [191] Along with the rest of the 76th Artillery Regiment he was assigned to, Gifford received basic training at Camp Shelby, Mississippi. The automobile fanatic first hoped to be assigned an ambulance to drive. When that did not work out, he angled for a pilot position in the Army Aviation branch, but was turned down due to an eyesight issue. However, Army administration found out about his RPI education, and they referred Gifford to Officers Candidate School, where he became a "90-day wonder" in the artillery corps. Gifford graduated from the Field Artillery Central Officers' Training School at Camp Taylor on August 31, 1918 around the time the novelist F. Scott Fitzgerald attended the same camp. The decision to join the artillery corps likely came tied to his

[191] "U.S. Department of Veterans Affairs BIRLS Death File, 1850 – 2010," 2011, Ancestry.com, [database on-line].

knowledge in the mechanics of heavy weaponry, something he knew a lot about given his training at RPI.

After spending some time back home in Pittstown after graduation, he reported to Camp McClellan, Alabama. At Camp McClellan, Gifford's first post required him to train artillerymen, in groups of seventy at a time. His performance appears to have been exemplary in that task, due to his promotion to First Lieutenant in October 1918. Shortly thereafter, the camp caught wind of the news from the front; an armistice had been signed November 11, marking the end of the war. Gifford would never use his training in battle, and, in fact, was never shipped overseas. Instead, he and the rest of Camp McClellan's personnel were ordered to Camp Upton on Long Island for discharge. First Lieutenant Gifford remained stationed at Camp Upton until his honorable discharge in February 1919.[192]

A number of other RPI students and recent alumni joined the fight as well, disrupting their academic timelines, and in some cases, their entire lives. Eighteen RPI students and graduates lost their lives while fighting in Europe, while twelve actually died during training at various camps at home. Clearly, training possessed its own formidable dangers, even to those who never left the United States.[193]

For Bush and Killalee, the war opened up different spaces for involvement. Fresh out of high school when Congress declared war, Killalee enlisted in the Ambulance Corps, and lived Gifford's dream as an ambulance driver in Europe. Shipped to France, Killalee not only drove an ambulance, but served in a field hospital's contagious ward- delicate environs in a war so ravaged by fatal disease.194 His observations from the front reflected the often-cited horrors of the conflict. Besides the gruesome sites in "no man's land" between trenches, as an ambulance

[192] Military discharge document for Clayton E Gifford, February 5, 1919, Gifford Family Files.
[193] Rensselaer Polytechnic Institute, *Men Killed 1914-1918*.
[194] Letter, Jack Killalee to Deacon Edwin Owen, June 24, 1967, Jack Killalee Papers, Burlingame Historical Society.

driver he faced the prospect of personally digging graves if he missed an assignment. The weather conditions in France did not help his impression of war, writing “It has drizzled steadily for a long while now and I think the sun has gone to another world.”

On a lighter note, Killalee’s experience driving his ambulance on European roads left a deeply negative impression of the problems bad infrastructure caused. The would-be highway engineer wrote to his future wife, Gladys from Toul, France regarding a trip from Revigny-sur-Ornain: “[I]t took us nine hours to go about fifty miles…It surely got tiresome and gave us an opinion worse than ever of the French and their systems. They have some fast expresses however.”[195] Like Gifford’s stint in the Artillery Corps, these young engineers often found opportunities to use and grow their knowledge of how engineering affected war operations.

Bush’s war experience dramatically differed from those of Gifford and Killalee. Already graduated from MIT when the U.S. declared war, Bush contributed to the war effort stateside, engaged in active research for naval purposes. The electrical expert conceived of a device to detect submarine movements with audible signals. With financial backing of the J.P. Morgan Bank, he tested and developed his device satisfactorily, at least to Bush. The Navy seemed unenthused, however, and the device was ultimately used on British ships to little acclaim.196 Nevertheless, Bush’s wartime activities pointed to the increasing importance engineering research of different types would hold in war-making. More broadly than the experiences of these three engineers, for those who survived the conflict, the schism that engineers experienced as a result of the war gave rise to an increase dialogue regarding engineering’s role in executing and recovering from the Great War.

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[195] Letter, Jack Killalee to Gladys Killalee, December 12, 1918, Jack Killalee Papers, Burlingame Historical Society.
[196] Zachary, *Endless Frontier*, 36-38.

Before America's involvement in the war, engineers collectively confronted the rising military challenge by discussing the issues of potential American militarization. In an April 1916 roundtable entitled "Organizing for Industrial Preparedness", members of the ASME discussed the role engineers could play in the event of war. Echoing Wilson's own words, the ASME commentators noted that engineers at large were in favor of "peace with honor" and would "make personal the process to insure it" through "preparedness" measures.[197] Engineers were in fact a central part of Wilson's preparedness plans, which included ensuring that adequate levels of liquid fuels remained on hand for military vehicles. But preparedness discussions often descended into self-important or technical observations. Some engineers stated that they felt that an engineering board should be established in the service of the U.S. government to focus on the "big things," while the "little things" should be left to somebody else. These engineers exhibited sensitivity to the typical concerns of the field, like "efficient" preparedness in the event of a national emergency (presumably surprise attack). But, engineers viewed the war, like most events, as a collective issue that they had a greater-than-average stake in. Engineering journal authors wrote freely in phrases like "What May We Do to Serve Our Country?" framing the national crisis as an issue that the whole of engineering had to address.[198]

These engineers proceeded to outline in great detail every step of the preparedness process, going as far as discussing how to mobilize the "workingman." One suggested that the board of engineers should work to find agreement between the ASME and the National Tool Builders' Association regarding the details of producing machine tools for "rapid and economical production of American munitions." This sort of dialogue revealed that engineers had a shared awareness of their place in American society. Patriotism was celebrated, and duty to

[197] Spencer Miller, "Organizing for Industrial Preparedness," *Transactions of the Society of Mechanical Engineers*, Vol 38, (1916):) P. 47.
[198] Ibid, 437.

the nation was held in high regard. In the words of engineer Spencer Miller, technicians who willingly served their country without compensation for military purposes would "set an example of patriotism which is bound to be felt. This spirit of patriotism will be transmitted to the workingman producing war supplies."[199] Individual engineers saw the defense of the state as a process that engineers had a specific and important role to play in, but in the service of technology.[200]

After Congress' declaration of war, American engineers' discussions turned to contributions to an active war effort. Indeed, they would play a significant role in the war's execution. The Society of Automotive Engineers (SAE) President George W. Dunham proclaimed that "The members of the Society, three thousand strong, and comprising practically all the leading automotive engineers of this country…are experts in the design, building, operation, and maintenance of all forms of automotive apparatus. Their experience therefore is such as to make them invaluable in virtually every activity connected with the prosecution of the war in which the country is at present engaged."[201] The ways engineers viewed the conflict reflected their vision more broadly. Duty to country was certainly a part of the story, but more important was their collective awareness of their usefulness to the cause.

In reality, the machines of modern war-making *were* products of engineering, and their skills in the way of planning and efficiency made engineers important for government positions in the war. Their skills were in high demand during the war, as seen in swelling numbers of Army Engineer Corps members -from 3000 to about 250,000 during the course of the war (most of which were of non-military backgrounds). The government called upon these men to design

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[199] "Advertising Section," *Journal of the American Society of Mechanical Engineers* 38 (1916): 54-57. Ibid, 1916, 54-57.
[200] Ibid.,, 47-66.
[201] George Dunham, "Presidential Address," *The Journal of the Society of Automotive Engineers* 1 (1917): 2-3.

and construct transport lines that brought supplies to the front, and keep troops on the move by building new bridges and ports at places like Brest, France, and directly engaging in dangerous, fatality-ridden defensive battles against Germans at Amiens .[202]

The war's end brought new questions about science and progressive thought which contributed to a certain level of suspicion toward the engineer especially in European circles. As much as engineers were revered for their knowledge at the turn of the century, the disruption of war served as an indictment of engineering on two fronts. The first was a clear signal that a rapidly modernizing world did not move society further from barbaric, deadly conflict. Modern civilization's faith in science-based progress had not advanced the world beyond a primitive and violent past. The second cause for wavering faith in engineering was the sheer quantity of death and destruction wrought by modern weaponry during the war. If nothing else, World War I shocked modern societies into a sort of numbing state that the unprecedented death from the conflict had been directly tied to advancements in modern weaponry designed by engineers.[203]

And yet, American engineers were largely spared from that suspicion. While Europeans looked inward to reconcile the mass suffering with technology, historian Michael Adas points out that Americans reveled in their technological might- and celebrated technology after the conflict. Europeans questioned it. "In the decades after World War I, applied science and technology pervaded American life to a degree that greatly exceeded that experienced by any other society throughout history." [204] Technology brought optimism along with it, spurring American production through the 1920s at similarly unprecedented rates.

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[202] US Army Corps of Engineers, *The History of the US Army Corps of Engineers* (Alexandria, Va., 1998), 79-81.
[203] Paul Fussell, *The Great War and Modern Memory* (Oxford: Oxford University Press, 2013).
[204] Michael Adas, "Modernization Theory and the American Revival of the Scientific and Technological Standards of Social Achievement and Human Worth" in *Staging Growth: Modernization, Development, and the Cold War,* ed. David C. Engerman (Amherst, Mass.: University of Massachusetts Press, 2003), 25 – 46.

American engineers wasted no time in claiming the war recovery effort for their kind. President of the ASCE Fayette Curtis said as much in his address to the organization in June 1919: "The armistice having been signed, it is incumbent on us, as founders of prosperity, with the sciences and the arts, to become one of the greatest upbuilding factors in the future, to help reconstruct that which has been torn down and destroyed by the ravages of war, and to promote new ideas for the world's future prosperity."[205]

Furthermore, engineering's professional ranks expanded to new heights after the war, and large-scale construction and engineering efforts proliferated. Membership in the ASME exploded from just under 4,000 to more than 17,000 between 1909 and 1922, while membership in the American Society of Civil Engineers jumped from 7255 in 1913 to 10,509 in 1922.[206] The general trend continued in newer, smaller specializations as well, like the SAE (of which Gifford was a decades-long member), whose ranks grew from 1,911 to 5,246 between the years 1911 to 1922.[207]

Engineers also sought to consolidate their efforts in the hopes of expanding their influence over public issues, like national security. Organizing together as a bigger coalition of engineers was key to furthering the vision of engineers across subfields. Civil engineer Arthur Davis said as much in an address to the Federated Engineering Societies of America (a conglomerate of engineering trade societies) dated August 10, 1920. For the good of the United States at large, it was imperative that engineers come together for, "the unified efforts of all the organized engineers of the country, and all the prestige that that the greatest, the oldest , and the

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[205] Address of President Fayette S. Curtis, "Address at the Annual Convention in St. Paul and Minneapolis, Minn., June 17th, 1919," *Transactions of the American Society of Civil Engineers* vol 83 (, 1919-1920):20 pg. 783.
[206] "Proceedings of the American Society of Civil Engineers," *The Society* 39 (1913): 799; "Proceedings of the American Society of Civil Engineers," *The Society* 48 (1922): 632; "Transactions of the American Society of Mechanical Engineers," *The Society* 32 (1910): xiii; "Proceedings of the American Society of Mechanical Engineers," *The Society* 44 (1922): xiv.
[207] "December Council Meeting,", *The Journal of the Society of Automotive Engineers* 10, vol. x (January 1922): 11.

most eminent societies can offer. Among these measures are the unification of the engineering work of the Government under one department with a technical head." Davis continued, "this will promote efficiency and eliminate waste, and what is more important, will serve as a precedent for the reorganization of other departments along similar lines of homogeneity, efficiency, and economy."[208] He added later that, "the demand for active participation of all engineers in civic and other work for the general benefit of mankind and the advancement of the Engineering Profession has been growing for many years…" Davis noted that the field should strive to envelope all the professional groups in existence, while citing a constitution the group adopted earlier in 1920.[209]

These internal discussions among engineers reveal a close identification with the nation in crisis. Big problems like war mobilization and recovery seemingly required big engineering thinkers, and their ideas made clear that engineers felt strongly that there was a place for engineering at the high levels of American policymaking. From the ASME's wartime call for engineers to have an advisory office in the U.S. government, to the establishment of cooperative engineering associations, engineers established a trend of clamoring for more voice in the federal government that would not soon go away. Throughout the twentieth century, engineers attempted (and often failed) to produce a cohesive and influential voice through cooperative associations. The Federation of Associated Engineering Societies, American Engineering Council, and Engineers Joint Council were just a few twentieth-century examples of the engineering field's attempts to bring technicians from different specializations into a cohesive public policy voice. Engineers' proposals for government influence did not always get traction with the federal

[208] Charles L. Lawrence, "Air-Cooled Engine Development," *The Journal of the Society of Automotive Engineers* 10 vol. x (February 1922): 138.
[209] Arthur P Davis, "Address at the Annual Convention in Portland, Oregon*,"*, *Transactions of the American Society of Civil Engineers*, vol 84:136.

government at this time, but that would change in World War II, when engineering took its biggest steps toward melding its visions to that of the state.

On an individual level, the end of the war left young engineers at a crossroads. Given his limited service, and desire to return to engineering, Pat Gifford went home to Pittstown in order to plan his first post-military move. He had not yet finished his mechanical engineering degree at RPI, and debated whether returning for a final year was necessary. Engineers at this time were more valued for their knowledge than for the formal credential of a degree. Plenty of engineers received incomplete college educations, but still got remarkably good jobs. RPI would still require a written thesis from him for graduation, and given his discomfort with his English courses, that thesis became a mark against returning.

During his break at home, Gifford took some small jobs like working at a local garage and doing drafting for a company in Albany.[210] In the process, he planned his next steps. Despite his remaining year of school, Gifford decided against finishing his degree at RPI. His experiences and education thus far, not to mention his personal drive, led him to move directly from the military to the civilian workforce. Gifford planned to take a train trip across the Midwest, a region bustling with industrial activity. One of Pat's stops was Marion, Ohio, home of the Huber Manufacturing Company. A small town with under 30,000 residents, Marion lay just fifty miles due north of Columbus.[211] The town remained notable for its agricultural community, but also for its status as the home of a rising political star, Senator (and future President) Warren Harding.

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[210] Summary of the life of Clayton Elwyn Gifford, undated, Gifford Papers.

[211] "Census of Population and Housing," US Census Bureau, retrieved November 3, 2012, http://www.census.gov/prod/www/decennial.html. .

Gifford's path to Marion came about because of his Captain in the Army, an Indiana native who had connections in the Midwestern agricultural manufacturing sector. He offered to introduce Gifford to some of these companies after the war, laying the ground work for Gifford's train trip. During his stop in Marion, Gifford was offered, and accepted, a position as a drill press operator in the Huber machine shop in 1919. Shortly thereafter, he transferred to the Huber drafting room. His quick promotion had much to with his education at RPI, as most Americans still did not attend college for any length of time. Along with his education, Gifford possessed an almost-singular focus on new ideas, which remained a driving force behind his ambition to work at Huber.

Gifford would not leave that drafting room for almost forty years. He built a life in Marion, marrying a local girl, Florence Elizabeth Lister, in August 1919. He earned a promotion to design engineer at Huber in 1922 and bought a house in town in 1927. He raised five children in that house, living the quintessential Midwestern life of productivity, ambition (and Republican political affiliation).

Engineers and Midwestern Manufacturing

Wilbur Wright once offered choice advice for young men seeking to get ahead in the world: "Pick out a good father and mother, and begin life in Ohio."[212] For would-be engineers, Wright's words could not have been more appropriate. In that vein, Gifford's decision to look for work in the Buckeye State was altogether unsurprising. The state filled with heavy manufacturing during the latter parts of the 1800s and early 1900s, in remarkable numbers. In the 1880s and 1890s, new firms sprung up across the region making parts and machines designed by

[212] David McCullough, *The Wright Brothers* (New York: Simon and Schuster,: 2016), 12.

technologists to serve the needs of farmers most of all. By 1919, Ohio owned the third largest value-added manufacturing base in the country, outpacing every other state in the Midwest.[213]

A part of that productivity had to do with the engineers that flocked to the region. Engineers sought the Midwest as a space of great professional possibility- each of the manufacturing firms needed engineers on staff, which consequently grew the region's technology population. To be employed as an engineer by one of these firms meant becoming a part of a wider regional ecosystem that sustained itself with engineers.

So often, the Midwest in the twentieth century is remembered for its robust automobile industry. The industry's decline changed the region in a number of usually-negative ways, especially in cities like Cleveland and Detroit. The reality is that Midwestern manufacturing was made up of an equally robust non-automobile industry that developed products like road rollers and tractors, big-ticket items involving expensive and complicated engineering feats. Ohio specifically contained a significant number of heavy manufacturing firms. Its fortunate position between Lake Erie and the Ohio River provided easy mobility, raw materials, and market access for finished goods for firms in the state. These companies flourished in the twentieth century just like the auto companies, but in smaller hamlets and towns. They did not carry the recognizable labels of Detroit, but rather obscure names out of Marion, Lima, and Galion. Unlike the stories of Detroit or Cleveland, the production and innovations of companies like Huber had small regional population bases, light infrastructure, and comparatively light financial backing. In spite of these obstacles, Midwestern firms came to dominate heavy construction and agricultural manufacturing, their machines finding homes across the globe in often very visible and important

[213] Marina Adshade and Ian Keay, "Technological and Organizational Change and the Employment of Women: Early Twentieth-Century Evidence from the Ohio Manufacturing Sector," *Feminist Economics,* vol 16 (January 2010): 153.

projects. Furthermore, these companies built excellent reputations from consumers, good enough later to become a part of government projects in World War II and after.

The Midwest's innovation culture began decades before Gifford made his way to the region. The fertile soil of the American Midwest made for an equally fertile ground for entrepreneurs interested in farm mechanization. As the nation recovered from the Civil War, Northern industry once again focused on civilian production. Entrepreneurs found agricultural production lacking in technological innovation, spurring a flood of new innovations meant to improve farm operations. The self-propelled tractor and the humble steel plow attracted numbers of farmers who sought more efficient ways to make their living. At the heart of these developments at the turn of the twentieth century laid a turn toward mechanization of farm work, simultaneously cutting work time and prices for agricultural goods.

Indiana-born engineer Edward Huber emerged as one entrepreneur interested in farm mechanization. Raised in the 1840s, Huber brought a vision to harness the steam engine for agricultural use. In Indiana, Huber formed an interest in agriculture through his father's work as a farm wagon maker.[214] He found himself tinkering with metal as a blacksmith's apprentice, and he would ultimately design and fashion his first patented invention, the "improved hay-rake" in 1865 at age 27.[215] Huber's penchant for invention continued throughout his, often with successful commercial acclaim.

His reputation as an agricultural innovator spread throughout the Midwest. In 1874 financiers from Marion, Ohio lured Huber to their town by agreeing to invest in a Huber manufacturing plant to be built there. What was ultimately incorporated as the Huber Manufacturing Company began steam engine production (a version of which Huber himself had

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[214] "History," The Huber Manufacturing Company, undated, Gifford Papers.

[215] Huber, Edward. Horse Rake. U.S. Patent 46001, issued January 24, 1865. This patent has been cited elsewhere as being granted in 1863, but the official approval date is 1865.

a different patent on) to serve farmers. The development of the Huber threshing machine in 1880 marked a turning point in the company's direction. With the threshing machine, Huber became a full supplier of threshing supplies, with the ability to outfit the Midwest's important threshermen. In doing so, the Huber Manufacturing Company ingrained itself as an almost indispensable resource for Marion-area farmers and beyond. By 1899, Huber established satellite offices as far west as Nebraska as its reputation for quality farm implements widely spread.

That reputation spread because of the close association with area farmers. Huber's machines received high praise and emerged as favorites for Midwestern farmers due to their reliability. The *Thresherman's Review*, a farming periodical, regularly profiled Huber products. Readers who wrote into the magazine spoke with frequency about the merits of the Huber machines. Happy customers noted that the Huber threshing machines performed with "great satisfaction," and stood "among the best" machines these farmers owned. The positive reviews so flooded each issue that some editions of the magazine's letters to the editor contained only a few non-Huber related submissions.[216] Such a reputation became a positive feedback loop for Huber specifically, and technology in agriculture more generally. The more benefits farmers saw in using modern tools, the more they wanted to invest in them, and so they became staple of the agricultural scene and their relative communities.

Huber's reputation continued to ripen at the Chicago World's Columbian Exhibition in 1893. Like usual, ground-breaking inventions took center stage in the event's exhibits. The massive Worthington Vertical Pumping Engine took fairgoers' breath away, and new household and consumer goods held their attention during the fair's duration. For Huber, the fair presented an opportunity to show off its most cutting edge product, the 30 horsepower Huber traction engine (essentially a self-powered tractor). The "engine," as it was called, resembled a small

[216] "Live Letters from Live Threshermen," *The Threshermen's Review* 14 (March 1905): 25 - 28.

train steam locomotive, with a boiler in front, and large all-metal cleated wheels near the back. Huber won an award at the Exposition for its engine's unique attachment for burning straw.[217] Huber repeated the feat in winning win a gold medal for its engine at the 1904 Louisiana Purchase Exposition in St. Louis.[218] Huber's participation in these fairs proved that Huber undoubtedly stood in the vanguard for the entire equipment manufacturing industry.

Huber's own in-house literature suggests that the company did more than believe in progressive technological ideals. Putting the company in line with engineering at large, from its catalogs in the late 1800s to its postwar literature, Huber's corporate culture reflected a preoccupation with making progress happen through its "spirit" and innovation. Thanks to those guiding principles, Huber's engineers spearheaded constant tweaks to its machines that expanded the reach of modern road building and farming practices. A 1948 company publication stated that the company's Maintainer Tractor came as a "product of Huber advanced engineering and design. Today's Maintainer moved on rubber tires and bears only the slightest resemblance to the machine in 1920."[219] The company boasted that its design, manufacturing methods, logistical expertise, and even its "industrial safety record" put Huber "in the vanguard of the industry."[220] The notion that Huber constantly progressed in its product designs by replacing the "old" with the "new" complimented the company's wider technological ethos, an ethos that would carry it to all corners of the globe.

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[217] Calvin Young, "Farming Tools, Implements, and Machinery," in *Report of the Committee on Awards of the World's Columbian Commission: Special Reports upon Special Subjects or Groups* (Washington, D.C.: Government Printing Office, 1901), 470.
[218] Huber was also a pioneer in the gasoline traction engine- as opposed to the steam variety- but did not put the engine in full production when developed in 1894, believing that the machine was ahead of its time, and it would not take off in the general marketplace for a while down the road. As spark plugs and carburetors were invented later, these machines became smaller and more manageable, and most importantly appealing for the typical farmer.
[219] Advertisement for the Huber Maintainer, 1948, Gifford Papers.
[220] Pamphlet entitled *The Huber Story 1863-1948,* Gifford Papers.

Marion's influence in the world of machinery extended far beyond Huber's operations. Marion earned the nickname "Shovel City" in the first half of the twentieth century because of the emergence of three separate steam shovel manufacturers. Marion Steam Shovel, the Osgood Shovel Company (a descendant brand of the steam shovel patent holder, William Otis), and Fairbanks Steam Shovel all became recognizable labels in the shovel industry. Combined with Huber's manufacturing operations, Marion's industry sat poised to contribute to a wide variety of domestic and international building projects over the following decades.[221]

Industrial Innovation

Huber's position on the cutting edge of machinery design contributed to Ohio's culture of as a center for engineering innovation. A consequence of heavy manufacturing taking hold on the region was that a wave of engineers populated these smaller towns to work for firms needing their skills. Ohio became home to an engineering class that quietly underwrote the machines that transformed the modern world, most visibly after World War II. The rise of heavy manufacturing in Ohio would have been impossible if not for engineers and their designs, and their machinations formed a unique climate. Ohio remained home to the nation's third-largest population of engineers through the middle of the 1940s, outpacing even California as a center of engineering. By that measure, the Midwest as a whole attracted the second highest number of engineers, behind the Mid-Atlantic states.[222] Consequently, Ohio laid claim to a new sort of think tank, where engineering knowledge was being put to work in small towns across the state, innovating both in big and small-scale ways at a suffocating pace. But before it became a bastion

[221] Stuart J. Koblentz, *Marion County* (Chicago, IL: Arcadia Publishing, 2007), 119.
[222] U.S. Department of Labor, "Employment Outlook for Engineers," *Bureau of Labor Statistics*, *Bulletin* 968 (1949): 78.

of engineering, these small-town brands provided a powerful local source of goods needed by farmers in the area.

The notion of Ohio as a heavy machinery pioneer is supported by two main characteristics of the region. Central to the manufacturing firms' operations were engineers employed to design machinery and tweaks to those machines to improve performance and utility. As a result, the rate of innovation in the state's firms was remarkably high. The patents that emerged out of Ohio manufacturing firms in the 1920s-1950s ran the gamut of purposes, but prove that the region possessed an extraordinary juxtaposition between high-powered innovation and small-town settings. Thanks to the close proximity to their consumers, Ohio manufacturing firms constantly innovated and changed their products at a swift pace, making the region a unique hub of engineering activity.

The second way Ohio stood at the front of industrial innovation came in the talent swapping that sometimes made it difficult to keep track of which engineers worked for who at any given time. The patents owned by these engineers were often signed over to the engineer's employer because the employer usually provided the materials and space needed for the inventions to be developed. This tight association with manufacturing firms and engineering innovations is much like the association between software engineers and Silicon Valley firms; their reputations for tweaking machines preceded them, bringing new talent to the area in the hopes of becoming a part of the region's engineering fabric.

The intense demand for engineering talent at Ohio firms bred a competitive atmosphere among firms to attract and retain their best. The best engineers were sometimes the most mobile and in demand. This sort of talent swapping reached its height between the 1920s and the 1950s. More striking is the small geographic radius that these engineers moved within. For instance,

Raymond Keeler began his career in the late 1910s as a draftsman at Kelly Springfield in Springfield, Ohio, but later patented a number of inventions while at Galion Manufacturing in Galion, Ohio during the 1940s. By 1952, he was inventing for Huber, just twenty-five miles down the road from Galion.[223] John Harrison innovated for Huber in the 1930s, but by the mid-1940s he started doing the same for Buffalo-Springfield Roller Company out of Springfield. Despite their mobility across manufacturing firms, these engineers remained in this relatively small region for the majority of their careers.

Competitiveness among Ohio manufacturers made it important for firms not only to lock down their talent, but to stay abreast of competitors' creations. Pat Gifford became notorious in his family for collecting and studying product literature of his Ohio counterparts, partly to see how Huber differed from the field at large, but also to keep tabs on the innovations coming from other engineers like him. Area firms also had to deal with corporate espionage. Marion firms like the Marion Steam Shovel and Huber employed secret codes meant to obscure details about their machinery designs from competitors interested in getting a marketplace advantage. When sending messages by way of telegraph, these companies used code names for the projects in development, and code words for communication between staff members, all of which resided in secret corporate books to keep them out of the hands of competitors. If a remote salesman needed help with a new machine, Marion Power Shovel might receive a cable like this: "Elderberry (Marion) cherish (send representative) to Elating (Cleveland) for Conops (Model 36)." These sorts of communication modifications reflected a reality that the intense competitiveness in the Ohio engineering crucible required sometimes-elaborate measures.[224]

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[223] *The Journal of the Society of Automotive Engineers* 15 no 5-6 (1919): 383.
[224] Marion County Historical Society, "Shovel Secrecy a Serious Game in Early Years," *Newsletter* (, Marion County Historical Society, 2005).

Firms greatly valued engineers' ability to tweak their designs in ways that adjusted to the demands of their farming clients. Although Ohio firms patented few wholesale vehicle designs, those companies constantly drew up smaller alterations to improve the function of those equipment pieces. For example, Ohio engineers did not invent the threshing machine, but they found ways to make it more efficient. They may not have invented the farm tractor, but they found ways to make its tires turn more easily in muddy fields to avoid getting stuck (a farmer's most inconvenient delay).

In sum, Ohio became a crucible of engineering in the first half of the twentieth century as a result of the entrepreneurial spirit of inventors like Edward Huber. Their firms attracted engineers in droves, building a climate of competition in the region, while providing needed tools for locals. The innovation and talent swapping that became commonplace in the region came as a direct result of the high demand for their goods by farmers that desperately sought after the latest and greatest in agricultural technology. But more than that, out of this crucible came cutting-edge heavy building equipment, a vital resource for postwar American foreign policy.

Transitioning after War

When World War I ended, engineers at large turned to face new challenges that had nothing to do with war mobilization or submarine tracking. The United States would encounter a unique age in the 1920s that provided new opportunities for technicians at all levels. Gifford had found his niche in Marion, and stood poised to contribute to, and capitalize on, this new and exciting age. While Gifford remained hard at work at Huber, Killalee finally enrolled at Berkeley upon returning to the United States to pursue his engineering degree. Bush abandoned his

submarine-detection project and moved back to full-time academic work, this time at his alma mater, MIT.

In their own ways, each of these engineers could apply something from their wartime experiences to their professional lives. Gifford saw that his engineering training had direct military application in artillery design and function, and put him in an almost unquestioned position of authority among his perceived peers in the workplace. As an ambulance driver in war-torn provincial France, Killalee learned that roads could enable or inhibit the connections both between nearby communities and across entire countries. Although he likely felt strongly about technology's role in modern warfare before the conflict, the brash Vannevar Bush's wartime research taught him first-hand about the importance of building relationships between engineers and American military planners.

Thanks to a slowly converging relationship between the U.S. government and engineers over the next decades, each individual would find that their chosen career paths could take them much further than any of them dreamed as youngsters. As the United States encountered different economic and geopolitical situations, engineers stood at the ready both to comment on the global state of affairs, and to act as the nation's problem solvers. That impulse proved useful for policymakers in Washington as new challenges to American power emerged. The next decades would prove that the engineering mentality, though useful, responded to changes in American society in sometimes-unexpected ways.

Chapter Three: Learning to Deal with Crisis

When Pat Gifford joined the Huber Manufacturing Company in 1919, he entrenched himself in the world of heavy machinery out of pure necessity. Gifford had little background in heavy machinery production, and even less in working for a large company. Tinkering with farm machinery was one thing, but drawing blueprints for complicated equipment was something very different. For the first time in his engineering career, he had to collaborate on real products intended for mass production. Surviving in this world meant studying up on the company he worked for, and the machines in the field that his designs would be competing against.

Gifford went back in time to understand how far farm machinery had come over the preceding decades. As a part of this effort, Gifford amassed a collection of literature covering Huber, its products, and its competition. As noted in the previous chapter, Huber manufactured farm machinery going back well into the 1800s. In his research Gifford learned that his new employer's reputation in the field was high, especially in the Midwest where new vendors and satellite offices opened as far west as Nebraska and Fargo, North Dakota. Huber's star piece of equipment was the award winning Huber Traction Engine, which was produced in a number of sizes, the largest being a 16 horsepower machine in 1891. Huber also pioneered threshing machines. By 1901, Huber's product line included a 25-horsepower engine, a small-scale threshing machine, along with a bevy of new attachments for its equipment.[225] Reflecting its belief in itself as a contributor to the greater good, Huber's turn-of-the-century product line was touted as "The 19th Century's Best Gift to the 20th Century."[226] Thanks to Huber's performances

[225] Product Catalog forThe Huber Threshing Machinery Catalog, 1901, 49, Gifford Papers.
[226] Product Catalog, The Huber Manufacturing Company, 1900, cover, Gifford Papers.

at the Chicago and St. Louis World's Fairs, Huber gained great notoriety, and the company's reputation for innovation pushed their status in the field ever-higher.

To maintain this status, Huber engineers needed to be good, preferably better than those employed by rival Midwestern firms. The company did not take hiring lightly, seeking formally-educated talent from far afield in the early decades of the twentieth century. Gifford's migration to Ohio from prestigious RPI was one example of the formally educated talent Huber began to attract during its boom times.

As he gained expertise in farm machines, Gifford moved up the ranks during the interwar years. Kick-starting his success in this era was what can safely be described as Gifford's first "big break" as an engineer. In August 1921, Huber's president, Shanck Barlow, approached young Gifford about designing a new piece of equipment, a gasoline powered road roller for paving work. As Gifford himself stated, Barlow "told me to design a gasoline driven roller 6 feet rolling width, 69" rolls, to weigh 10 ton, not a pound more or less..." Barlow granted Gifford no more than one calendar year to deliver the drawings, a furious challenge for a green draftsman. But, as he would so often do over the course of his career, he delivered in spades. In August 1922, Gifford submitted the completed roller's drawings "in ink" to Barlow, for which he was paid a handsome $100 bonus.[227] As a late 1920s corporate catalogue expressed, Gifford's gas roller, "was along step toward the ideal- a roller combining the convenience and economy of gas with the reliability and power of steam."[228] Thanks to his design, Huber entered the would-be lucrative gasoline road rolling market. The new roller proved so significant for the company and the field at large, that a later report stated that "Huber caught the whole industry sleeping," when it was released.

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[227] Advertisement for "The First Huber Gas Roller," 1923, Gifford Papers.
[228] Huber Manufacturing Company Four Cylinder Motor Rollers Product Catalog, c. 1929, 3, Gifford Papers.

The machine mattered for the field because of what it replaced. Before Gifford's roller, road rolling machines ran on steam power. These rollers produced so much heat that operators could not run them for much longer than an hour at a time before needing to cool off. The Huber "Automotive Type Roller" changed the productivity rate of road building efforts. By keeping the heat contained in the internal gas combustion engine, operators could work as long as they needed, resulting in faster build times for America's infrastructure projects.[229]

Gifford's 10-ton roller served as the firm's very first dedicated road machine, and launched the company into the burgeoning road building industry. For decades after the 10 ton roller was first sold in 1923, Huber stood as a mainstay in the road building industry, selling its machines to clients across the United States. Much as the company had ingrained itself among local farmers in its early days as a farm machinery company, the gas roller opened new doors for the firm, and expanded its reach far beyond rolling Midwestern fields.

Modern road building just took hold in the U.S. with gusto a few years earlier. Between 1920 and 1923 alone, over 100,000 miles of new roads were constructed or inventoried by the federal government. Most new road construction at the time utilized gravel, not concrete or bituminous materials. But, bituminous material and concrete would see greater use in the following years, and as Huber joined the road building trend, it unwittingly put the company on a slow but gradual track to engaging in postwar global development projects in Turkey and elsewhere. In the meantime, American municipalities and construction firms bought Huber machines to build modern roads in both rural and urban settings.[230] As a testament to its

[229] Mary Lawrence, *The Marion Star*, November 20, 1994.
[230] Annual Reports of Department of Agriculture, *Annual Report*: Bureau of Public Roads (Washington, D.C.: Government Printing Office, 1920 - 1923),, 4-5.

durability, postwar Huber literature noted that the first-ever Huber gas roller was still operating in 1948, paving roads in Cuba.[231]

Following his design, Gifford earned a promotion to design engineer, a move that propelled him to two even higher promotions over the next decade. By 1928, Gifford became chief development engineer at Huber, his final promotion until becoming Huber's general chief engineer in 1933.[232] His quick advance up the Huber ladder served as a testament to his skill; Gifford had proven himself as a hard-working, creative, and dependable engineer. Given the competitiveness of the manufacturing sector, Huber aimed to lock Gifford down as a leading mind in the field. In this final position as general chief engineer, Gifford would prove most productive. The bulk of his patents came during the interwar era, and those innovations became central to improvements in Huber equipment that was increasingly sent to new markets. The Maryland State Roads Commission and the City of Miami, Florida stood among the company's interwar clientele for the new roller, proving that the road machine had national appeal. Huber became a national name in road building, and the quality of its engineers served as a key to growth.

Engineering's Place in the 1920s

The events pushing Gifford and Huber's advancement took place in an interwar economic context that rewarded innovative engineering. The end of World War I saw a number of changes in the U.S. domestically. With the relaxing of government wartime controls on the economy and public life, pro-business economic policies took their place. While Marion's own Warren Harding slid into the presidency in 1920 on a promise to "return to normalcy," the

[231] The Huber Manufacturing Company, *The Huber Story 1863-1948,* 3, Gifford Papers.
[232] "Gifford C.E.," *Who's Who in the Midwest,* 1954, 287.

American economy reached unprecedented levels of productivity in the 1920s, with New York Stock Exchange listings returning more than 400% between 1924 and 1929.[233] Robert Gordon's *The Rise and Fall of American Growth* identifies the 1920s as a decade contributing to the height of labor productivity in American history. Not only that, the decade revealed a sort of convergence of innovations that had made high American standard of living dreams possible: frozen food, interconnected urban and rural infrastructure, and modern indoor plumbing, (masterminded by sanitation engineers), brought up the standard of living in the U.S. to new levels.[234]

The decade portended big things for heavy manufacturing, specifically. Motoring culture had become a fact of life in America by this time, and automakers reaped large returns off of record sales volumes. Enabled by a growing consumer credit culture, Americans purchased cars in greater quantities, contributing to a trend of exponential automobile registration growth in the 1920s. Between 1920 and 1929, American automobile registrations increased from 9.3 million to over 26 million.[235] Additionally, American car manufacturers increasingly penetrated foreign markets after the war, and set records for car exports beginning in calendar year 1920.[236] To serve motorists, ever-larger infrastructure projects demanded new machines from equipment makers in the 1920s. Huber became only one of the major brands to experience higher sales in the decade as the rush to build more roads grew. Tractor and earthmoving equipment makers like Caterpillar reached high profitability in especially the latter half of the decade. Caterpillar's pre-

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233 James L Roark, et al, *The American Promise: A History of the United States, Volume II (*Boston/New York:, Bedford St. Martens, 2012), 705.

234 Gordon, "Perspectives on *The Rise and Fall of American Growth*," 73-75: Gordon, *The Rise and Fall of American Growth*., 4-6.

235 Federal Highway Administration, " State Motor Vehicle Registrations by Years, 1900-1995," April 1997, https://www.fhwa.dot.gov/ohim/summary95/mv200.pdf.

236 "AUTOMOBILE EXPORTS IN 1920 EXCEEDED $350,000,000 100% GAIN: Sales Covered 88 Countries Gains by Markets Outnumbering Declines 8 to 1 United Kingdom Took 20Times More Than in Year 1918.," *Wall Street Journal (1889-1922)*, February 28, 1921.

Depression sales peak in 1929 came in at nearly $52 million, setting a record and reflecting a common trend at a number of other equipment makers.[237]

Besides the growth of car and road equipment sales, the 1920s demanded engineers for a number of other technologically oriented projects. Managing the complicated networks of road, train, and streetcar infrastructure gave transportation engineers plenty of work in the decade, especially as the nation's urban-dwellers reached their height of public transit usage in 1925.[238] Skyscrapers, consumer goods, and advances in airplane travel in America required new technology like never before from road, electrical, and civil engineers. Consequently, the nation's engineering manpower exploded. In 1920, engineers' ranks swelled to over 130,000, more than eighteen times the amount of technicians in 1870.[239] Across the decade of the 1920s, American colleges collectively graduated an average of 7,000 engineers per year with B.S. degrees, a number that would jump to 10,000 a year in the 1930s, despite economic challenges.[240] Even with the healthy graduation rates of engineers in the 1920s at home, major engineering states added to their ranks by becoming home to immigrant engineers as well. Ohio took in 59 professional immigrant engineers in 1920 alone, while New York set the pace with an astounding 699.[241] Altogether, the engineering profession boomed right along with the nation as a whole.

As recent professionals, those of the engineering generation found themselves contributing to the productivity of the 1920s by leading new design projects at firms like Huber

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[237] William Haycraft, *Yellow Steel: The Story of the Earthmoving Equipment Industry* (Champaign: University of Illinois Press, 2000), 66; high and often record-breaking returns occurred in the 1920s at International Harvester, Allis-Chalmers, and Massey-Harris, among others.
[238] Gordon, *The Rise and Fall of American Growth*., 149.
[239] Robert Zussman, *Mechanics of the Middle Class: Work and Politics Among American Engineers* (Berkeley: University of California Press, 1985), 5.
[240] U.S. Department of Labor, " Employment Outlook for Engineers," 78.
[241] U.S. Department of Labor, " Report of the Commissioner General of Immigration," (1920): 426; New York consistently led the nation in housing the most engineers in the country all the way through the 1940s.

and General Electric. This generation of engineers maintained their positions at the forefront of the production boom by innovating and expanding their firms' product lines. If the 1910s were the decade of Ford's ubiquitous black Model T, the 1920s were the decade of engineered choice. Thanks to the pace of innovation and competition, manufacturers offered more options and variations of products than ever before. Heavy manufacturers continued to find new tweaks to meet the demands of motorists, construction workers, and farming consumers. Huber's product line exploded in this decade. Not only did the company enter the construction industry with Gifford's revolutionary road roller, but it introduced its versatile maintainer tractor and combine machines as well. Other firms grew their product lines in the 1920s, and created massive competition in the road rolling sector, especially. In each of these endeavors, engineers stood to inherit an endless supply of work that only they could complete.

Also in the 1920s, a quiet but profound change in the engineering profession occurred. Amongst all the changes in manufacturing and productivity, agricultural innovation increasingly became the domain of trained engineers rather than the hobbyist tinkerers like Edward Huber generations before. As R. Douglas Hurt writes, "The technical requirements had become greater than one individual could afford- either in time and money or in expertise." Companies like Huber and their engineering staffs of trained engineers began to preside over more of the innovations in agriculture from the 1920s-on due to the high levels of complicated, and sometimes esoteric, knowledge needed to master the machinery involved in American fields.[242]

In this fast paced environment, allegations of intellectual piracy ran rampant across industries. Huber competitors emulated or baldly copied Gifford's design for the gas road roller, causing him to later deride his company's weakness in filing and protecting patents. Huber did not patent the roller design quickly enough, and a number of copycat rollers emerged from other

[242] R. Douglas Hurt, "Dream Reaper (Book Review), *Isis* 92 no.1 (March 2001): 225-226.

builders. Even to the naked eye, these road rollers from other companies looked no different than the Huber machine, and found commercial success just the same.

Pirates recognized that engineering's fruits were profitable in their utility, and therefore ripe for copying. Pursuing piracy in court was a costly endeavor, and a burden of proof was often hard to satisfy in a field with complex machines like heavy manufacturing. Plus, with the common talent-swapping in the industry, cross-pollination in machine design at different firms was somewhat expected. At least at Huber, suspicions of piracy like Gifford's rarely, if ever, went to court. Such lawsuits took up valuable financial resources and time, and Huber management seemed content to push forward with new innovations rather than worry excessively about old ones.

Just because Huber rarely pursued piracy claims in court did not mean that other firms did the same. In likely the most well-known piracy charge in the machinery industry, the Best Manufacturing Company of California accused Stockton, California's Holt Manufacturing Company of patent infringement. The 1905 lawsuit pertained to the "power take off" implement on the Holt-branded tractor.[243] After almost three years of legal disputes, the two companies decided to settle out of court, and merge in the process. The new and bigger Holt Company then decided to centralize their operations and accessibility to eastern steel mills by moving the company to the Midwest. In 1910, the new company incorporated in Peoria, Illinois. In the 1920s, the son of the Best Manufacturing Company's deceased owner, C.L., had built a new company under the Best name building track-based "crawler" farm tractors in California. At the same time, the owner of the larger Holt company died in 1920, and Holt board members feared for the future of the company. To strengthen Holt's position, board members sought a merger

[243] A power take off is a tractor's attaching mechanism for auxiliary implements that allows them to operate off of the power produced by the tractor's engine. An example would be a mowing attachment towed by a tractor whose blades spun through the power take off link.

with a robust smaller rival. They targeted the second incarnation of Best Company now run by son C.L., whose equipment designs seemed to be a step ahead of Holt's. After a meeting of the two companies' heads in 1924, the second Holt-Best merger officially took effect in May, 1925. The company's center of operations remained in Peoria, under a new corporate label: Caterpillar.[244] As such, the frantic competitiveness of the heavy manufacturing sector in the 1920s produced one of the most recognizable and enduring equipment brands in the world.

Engineers Respond to Prosperity

The prosperity and demands of the 1920s were not lost on engineers more generally. The American Society of Mechanical Engineers (ASME) expressed as much as it addressed the need for new engineers in a January 1922 issue of *Mechanical Engineering.* Noting the high demand for engineers during this time at major firms, vice-president at General Electric, Francis Pratt, wrote that in 1920 alone the company hired 360 new engineers.[245] For a company on the forefront of the consumer goods boom of the 1920s, the marked increase in its engineering ranks is instructive for understanding just how necessary new technicians were becoming.

ASME President Edwin Carman interpreted the 1920s as a new epoch in world history, and said that engineers would, unsurprisingly, have a role. The first epoch was marked by "scientific advancement of material things" while the second was predicated on rising to the challenge of "human relationships." Without world war to rally engineers to bring their power to bear on the battlefield, engineers needed to look at serving the greater good more generally. Given a great but vague "opportunity for service" in the 1920s, engineers needed to take up "the

[244] Eric C. Orlemann, *Caterpillar Chronicle: History of the Greatest Earthmovers* (Osceola, WI: MBI, 2000)., 14-15.
[245] Francis Pratt, "Professional Engineering Education for the Industries," *Mechanical Engineering* 44, no 1 (1922):), 1.

forces and materials of nature and human efforts into a composite, yet unified and synchronized unit of production, operating with satisfaction to the worker, to the capitalist, and for the benefit of all mankind."[246] Given the widespread growth of engineered goods in the 1920s, the perceived need for engineering was at least partly a reality. Thanks to voices like Edwin Carman's, it became clear that in the 1920s engineers often sought to be all things to all people by finding ways to maximize the way of life for all Americans.

The American Society of Automotive Engineers contributed perhaps the most appropriate response to economic boom times by identifying how engineers might increase the efficiency of the nation's unprecedented production. In a March 1922 issue of the *SAE Journal*, engineer R.H. Grant declared that engineers can help businesses work more efficiently in filling high quantity orders. With too little cooperation, factories ran the risk of getting swamped and not meeting demand. Grant stated that engineers could become the cohesive glue a company needed to take the next steps in its growth: "We need cooperation badly. If the man at the head of the engineering department has the right attitude, he will transmit it to every member of his force." Cohesive glue was not the only role engineers stood to play in 1920s commerce. Grant further stated that "the engineer can help very materially by studying every known method of producing at the lowest possible cost just as good an article as has been produced," and "engineers should be in touch with the selling end of the business…getting out and seeing the product in use is the thing that counts."[247]

According to Grant, engineers once again saw themselves inhabiting every space in boom time American industry. He saw engineers playing roles in company management, but they also

[246] The American Society of Mechanical Engineers, "President Carman's Address, Annual meeting 1912," *Mechanical Engineering*, 44, no. 1 (1922):*)*, 8, 74.
[247] RH Grant, : "How the Engineer can Help Business," *SAE Journal* (Society of Automotive Engineers., 1922) vol 10, no 3, 152.

could spread positive vibes and a certain contagious attitude about cooperation in the workplace. Not only that, Grant believed that engineers could work more closely with salesmen in seeing the product off to market. These claims reflect a certain self-important notion engineers carried with them. These examples serve as evidence that even when the nation was not in crisis, as it was in World War I, engineers still rushed to find their place in the order, identifying new or novel ways they could assist in progress, wherever it was needed. There may not have been a war on, but even in times of plenty, engineers saw ways to solve problems that only they could see.

Engineers' collaborative efforts manifested themselves in new coalitions to voice their ideas more loudly. In 1920, the Federated American Engineering Societies (FAES) formed with just that purpose. Serving as a successor of sorts to the World War I-era- and largely invisible- Engineering Council, the FAES attempted to meld the interests of the ASCE, ASME, AIME, and AIEE in order to fulfill a central characteristic of engineers at large. Headed by a Herbert Hoover fresh from his relief work for war-torn Belgium, the FAES brought service as a more visible part of the engineering profession. In a profile in *Industrial Management* in July 1920, L.P. Alford wrote plainly of the organization; "A great engineering dream has come true. The earnest wish of many engineers to participate in public affairs, to make their education, training and experience serve society at large, is on the road to realization…"[248] That dream contained elements of a progressive impulse in engineers to reform the industrialization process for the better, something engineering commentators had taken umbrage with since the turn of the century.

With service at their engine, the group focused its efforts on a variety of industries to reduce waste and increase safety in industry, while attempting greater collaboration with government. By the FAES's count, 90% of federal, state, and municipal government money was

[248] L.P. Alford, "Federated Engineering Societies: the birth of a Super-engineering organization," *Industrial Management* 60 no.1 (July, 1920): 53.

spent on engineering work in some form already; meaning engineers were at the very least, obligated to share its knowledge with its big benefactor. And this concern for engineering in public life extended to maintaining peace in interwar America. In the words of one engineer commentator, "Statesmen and military men alike were helpless without the aid of the engineer to furnish the means wherewith the war could be prosecuted; but the services of the engineer in time of peace can be made even more important that in time of war."[249] The FAES believed that engineering could make industry, and public life in general, better without the distractions of war.

The FAES ultimately struggled to achieve its aims. Financial constraints and issues collaborating with certain industries on their studies meant that the group's reach and influence was limited. The rising star power of Herbert Hoover aside, the FAES's efforts to force engineering in to wider public policy discussions fell short of its intentions. The group remained active, but less ambitious through 1941, when it dissolved under the name American Engineering Council.[250] Although the FAES failed to make grand changes in American society by itself, its organization symbolized an important trend of engineers attempting to make their collective voice heard among the political discourse of the day. Making the government and industry work better required the skills of engineers, at least in their minds. Executing that vision alone proved difficult, but their persistence (technicians would continually attempt these collaborative groups many times over the course of the twentieth century) proved that engineers were motivated at a fundamental level by a notion of service that could benefit all of those around them.

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[249] "Federated American Engineering Societies,", *Machinery: Engineering Edition*, October ,1920.
[250] Marc Rothenberg, *History of Science in United States: An Encyclopedia* (Routledge, 2012)., 28.

Also key to understanding the collective identity of engineers is the continued use of "we" as a self-referential pronoun.[251] Throughout engineering publications in this era, the plural "we" was used to reflect a collective awareness that engineers are a unique body of skilled technicians. Just as in World War I and before, the consolidation and professional organization of engineering specializations resonated through a collective consciousness which signified that engineers had aligned their interests broadly, rather than positing a set of diverse beliefs about how the world should work. Engineering, simply put, brought betterment to any problem in society when properly applied, a reality that became clear in both times of war and peace.

Interwar Road Building

American road building in the interwar era satisfied and reinforced notions of a self-important engineering group. Bruce Seely's *Building the American Highway System* investigated how vital engineers became in the construction of early American highways through their lobbying and positions as authorities in the ways of road building. America's "Good Roads Movement" of the late 1800s and early 1900s relied on expertise in the form of engineers. The movement emerged as a grassroots one from the local to the state levels, and national authorities had little to do with successful implementation of new roads plans. This was a time before the massive Interstate Highway Act of the 1950s when federal transit oversight undertook widespread highway building. At its core, the call for better roads in the United States started at local levels to be administered by local officials.

Propelling the Good Roads Movement forward were the efforts of the Legion of American Wheelmen, a group of cyclists who promoted road modernization and advocacy. The

[251] CE Drayer, "What Have We Done in 1921?," *Profesional Engineer*, 1922, http://babel.hathitrust.org/cgi/pt?id=mdp.39015080074878;view=1up;seq=5.

U.S. Office of Road Inquiry, which would evolve into the Bureau of Public Roads, became a large part of this effort as well from its start in 1895. The ORI developed a method in conjunction with its parent agency (the U.S. Department of Agriculture) called the "object-lesson construction program." This program formed to demonstrate how to make a modern road by building a small stretch for locals to observe. With the proper supervision and tools, the program became "instantly popular" in helping locals build roads to support farming and cycling. By supporting local road building, Seely argues that the ORI's engineers established themselves as the go-to source for road building information in the United States.[252]

Woodrow Wilson's 1916 Federal Road Aid Act became America's first national highway legislation, granting federal funds to localities to build modern roads, and satisfying a decades-old crusade of the Good Roads Movement.[253] In this legislation, the federal government did not build the roads, but instead empowered local and state officials to do so with federal money. After this point, road building became an increasingly common aspect of life to everyday Americans, changing the landscape with materials like asphalt. Although bituminous surfacing had been discovered in Biblical times, its widespread use did not take hold in the modern sense until the British began using asphalt in the 1830s.[254] In the 1870s the material began to be used in the U.S. only in urban settings. But, outlying areas still saw little improvement in road paving. Gravel or dirt roads, as long as they drained properly, were usually effective for horse traffic. The problem was that even well-draining roads utilizing cambered laying methods still required

[252] Bruce Seely, *Building the American Highway System: Engineers as Policy Makers*, (Philadelphia, PA:, Temple University Press, 1987), 14-15.

[253] Ronald J. Pestritto, *Woodrow Wilson and the Roots of Modern Liberalism* (Rowman & Littlefield Publishers, 2005), 260.; Carlton Reid, *Roads were not Built for Cars*,(Washington DC:, Island Press, 2015), 1. Oddly enough, this book looks to have been a crowdfunded project, but possesses a key thesis for historians to grapple with.

[254] Reid, Roads were not Built for Cars, 119.

a lot of resources and labor rural areas lacked.[255] Not to mention that those methods were hard on bicyclists' newfangled rubber tires. Wilson's highway act began to change that lack to abundance.

Federal funding granted to localities would open new doors for infrastructure building nationwide in both urban and rural areas. Major hard-surfaced highways in the Midwest both connected major cities, and served as arteries for smaller communities in between. The major Dixie Highway running between the Midwest and the South became increasingly modernized with hard surfacing in the 1920s.[256] Through the 1920s and 1930s, farming roads were decreasingly affected by the elements with the application of asphalt and tar-based pavements. After humanity's long experiments with various crushed-rock surfacing methods, European pavements including wood block, brick, and even the Roman marble roads of Biblical Ephesus, the wide use of asphalt was transformative and historic for building larger scale road networks. Asphalt became the material of choice to fit the needs of an era of automobile transport.

The position of engineers in these endeavors only expanded their status in the succeeding years. Engineers cut their teeth on making authoritative suggestions about how roads should be built in "standards" guides distributed to state and local road builders. Suggesting proper angles of road crests and widths became the realm of engineers. In fact, the push for standardization through the 1920s and 1930s became so strong that Herbert Hoover himself noted that the standards movement resembled more a "crusade" than anything else.[257] With uniformity becoming a greater concern, the law mandated that every state highway office had to be staffed

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[255] Ibid., 42.

[256] Tammy Ingram, *Dixie Highway: Road Building and the Making of the Modern South, 1900-1930* (UNC Press Books, 2014). 155.

[257] Seely, Building the American Highway System: Engineers as Policy Makers, 120.

by a professional engineer to receive funding through Wilson's act. With increased road-building, engineers' visibility was changing from importance into ubiquity.

Civil engineers may have carried the day in road planning, but the ancillary engineering industries touched by road building also saw wide expansion. Any engineer involved with designing automobiles, building materials, or road equipment benefitted by the road building fever. Even DuPont Explosives' chemical engineers supported the Good Roads Movement. Advertisements of the 1920s stated that DuPont dynamite was "particularly adapted to road construction," by clearing away rock and earth. Because of its wide use, DuPont's engineered explosives had gained "preference with engineers and contractors everywhere."[258]

The genesis of road-specific engineering programs proves instructive for postwar development work of American technicians abroad. The earliest formal courses in highway engineering were offered at Harvard University's Lawrence Scientific School in 1893.[259] Supported by geologist and good roads advocate and Dean of the Lawrence School Nathaniel Shaler, The course was taught by William Edward McClintock, a self-taught civil engineer from Maine. In the process, he gained an interest in the good roads movement, garnering an appointment as the President of the Massachusetts State Highway Commission. McClintock became public voice for the good roads movement, giving orations and penning articles in the press.[260] The highway course itself seemed planned by the scientific school in a rather hasty

[258] The Rensselaer Polytechnic, October 8, 1924, 2.
[259] Harvard University, *General Catalogue Issue* (1892), 97.
[260] Charles Bancroft Gillespie, *Souvenir Edition of the Chelsea Gazette Issued by Request of the Board of Trade and Entitled The City of Chelsea, Massachusetts: Her History, Her Achievements, Her Opportunities* (Chelsea, Massachusetts: Chelsea Gazette, 1898), 61-62.

manner. The Harvard course bulletin of 1892-1893 did not even list an instructor for the class, although McClintock was properly included in succeeding years.[261]

Offered as a half-course meeting three times a week, "Construction and Maintenance of Common Roads" taught students in the ways of road construction through lectures, modelling, and "lantern slides." Students also had the opportunity to experiment with various road materials in lab work on campus, and were encouraged to visit the areas surrounding Cambridge to inspect the available improved roads themselves.[262] The course only made up a small part of Harvard's engineering degree program, but solidified that indeed road building held an important place in the future of the field. As modern road building continued to gain steam in the U.S. in the first decades of the twentieth century, similar programs emerged nationwide to train experts to oversee such projects.

As a part of his duties as a local commissioner in Missouri, Harry Truman emerged as a big promoter of road building in the 1920s. His military service in WWI had taught him to appreciate French country roads, and his life growing up in the Grandview, Missouri area exposed him to the burdens of living with bad infrastructure. When he rose to his first elected office, Truman lobbied to improve the rural road systems that served local farmers needing to get their crops to market. Funding a modern road system proved a high priority for Truman. Individuals were affected deeply by access to passable roads, and he advocated in Missouri for local bond investment into a multi-million dollar project. David McCullough noted that Truman hoped to build the "best roads in the state, if not the country," through the project. He promoted the idea that farmers would not be further than two miles from a new road, and that in the end,

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[261] Ibid, 97.
[262] Nathaniel Southgate Shaler, *American Highways: A Popular Account of Their Conditions, and of the Means by Which They May Be Bettered* (New York: The Century Co., 1896), 235-236.

the project would provide 224 miles of modern roads for his largely rural constituents.[263] Ultimately successful, the roads project taught Truman a great deal about the importance of roads, and engineering, to modern communities.

The roads project in Missouri might be instructive for understanding Truman's later backing of development projects to serve the less prosperous regions of the world. In some ways the Third World in the 1940s resembled rural Missouri in the 1920s. The vast majority of workers made a living off the land, and saw little of the modernity that touched urban centers. Infrastructure was the connective tissue that made places in rural Missouri matter, literally putting them on the map. More than just road building, Truman's success in the roads project reflected that he shared a belief in improvement and progressive development efforts. The program's success in Missouri only propelled him to see similar modernizing efforts implemented on a more widespread basis later in his career.

Engineering and "Fixing" the Great Depression

Much like they did in the roaring twenties, engineers found ways to make themselves useful as prosperity faded into a Great Depression. Few engineers turned a blind eye to this new crisis, as the event brought sagging sales, especially in manufacturing sectors which depended on high-level engineering to operate. Published opinions of engineers regarding the Depression reflected a reality that engineers were constantly expanding their areas of concern to contend with the economy's effects on their profession, even as they continued to organize as a social group.

[263] David McCullough, *Truman* (New York: Simon & Schuster, 1993), 176.

During the Great Depression, engineering, like most other fields, suffered declines in employment and incomes. Engineers of all ages experienced contracting wages, and the youngest and least experienced engineers lost approximately 50% of earnings between 1929 and1934 alone. Their employment opportunities fell with wages in that span, leaving the field in a state of crisis it had not yet experienced.[264] Engineered goods like automobiles actually saw a contraction of registration in 1932 to the lowest number since 1927, throwing auto workers, and by consequence, engineers, onto the street.[265] If the middle of the 1930s was any indication, engineers were in just as much trouble as everyone else.

Engineers responded in a number of ways. Some engineering organizations created avenues to serve the needs unemployed engineers through various programming efforts. Engineering groups established free occupational training to give out-of-work engineers skills for jobs like managers or construction supervisors. Other projects sought to study in-depth the mental state of those unemployed engineers with probing questions regarding confidence and happiness levels.[266] Even with their interest in helping their own kind, engineers more often looked outward to understand how they could help the greater public deal with the effects of the Depression. The Depression made engineers question important aspects of their trade. As it turned out, their status as public benefactors and problem solvers was not limited to technological issues, and the Depression brought that reality to light. Besides general notions of progress and advancement, social and economic reform also emerged during the crisis as a part of the collective engineering consciousness.

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[264]Andrew Fraser Jr., *Unemployment and Earnings in the Engineering Profession 1929 to 1934* (Washington, D.C.: Government Printing Office, 1941), 143.
[265] "EE Adams, "Light-weight, High Speed Passenger Trains," *Mechanical Engineering* 55 no.12 (, December 1933): 735.
[266] Metz and Viest, *The First 75 Years*, 107-111.

Just as in World War I, engineers turned to face the national crisis in ways fitting for their mentality. Across specializations, the Depression grabbed the attention of engineers during professional conference discussions and in the articles of trade publications. They desperately sought to identify how the crisis occurred, and over the course of the Depression, these inquiries grew in frequency. For instance, many of the discussions at the 1933 annual meeting of the American Society of Automotive Engineers (SAE) revolved around the Depression. A summary of the conference stated that "from start to finish, the Society events of Annual Meeting week…were characterized by an alert and understanding attitude toward the hard fact of the present and the sensible possibilities of the future. From [SAE President] Dickinson…to the man who discussed matters of engineering detail-all seemed to be forging ahead steadily with an optimistic eye toward the way out of a complex situation."[267]

Although engineers did not always share precisely the same interpretations for why the crisis broke out, two themes emerged more often than others in engineers' discussions. The first was that engineers, as propellers of modernity and technology, usually saw themselves as at least *part* of the problem. As many engineers expressed, the Depression came about as a result of their too-deep entrenchment in technology, rather than applying their knowledge to society at large. Engineers needed to get more involved at the policy level to influence the course of big events. Conversely, the second theme posited that engineers also saw themselves as the solution to the Depression. As Bruce Sinclair stated in his history of the ASME, hardly any engineer observed the crisis without having "some conviction" of its causes.[268] In the tradition of their problem

[267] "Engineers Seeking way out of Economic Morass," *Society of Automotive Engineers Journal*, 32 no.1 (February 1933): 11.
[268] Bruce Sinclair, *A Centennial History of the American Society of Mechanical Engineers 1880-1980*, (Toronto: University of Toronto Press, 1980), 160.

solving nature, engineers proposed solution after solution to the crisis over the course of the Depression.

One of the most critical engineering voices came in the form of C.F. Hirshfeld, chief of research at the Detroit Edison Company. Hirshfeld's comments on the Depression sometimes seemed harsher than others regarding the ways engineers contributed to the crisis. In December 1931, Hirshfeld gave an address entitled "Who's Fault," in which he boldly claimed that "I believe I am right in assuming that this cloud is of our own making…you will discover that each new application of science ultimately brings in new problems of political, social, and economic characters…these have been the by-products of our work and have often developed into things of even greater importance than our primary products."

His bold blaming of the crisis on engineers was tempered only by his conception of a solution to that problem: "[The depression] will continue to oppress us until we have the sense and the ingenuity and the determination to apply the research method to oppose those larger problems that we unwittingly created and nurtured as we applied that tool to its more simple and more obvious uses."[269] Hirshfeld elaborated years later in a March 1936 article when he wrote that in light of the Depression, engineers should "formulate a philosophy on social welfare" based on notions of human efficiency and self-reliance. The recently-passed Social Security Act that he was referring to supposedly undermined the liberty and self-reliance that undergirded industry for decades before. With further construction of an engineering social ethic, society could progress without impinging that liberty like the Social Security Act did.[270]

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[269] CF Hershfeld, "Lecture delivered at the Annual Meeting of the American Association for the Advancement of Science New Orleans , LA, December 29, 1931," *Mechanical Engineering* 54 no. 3 (, March 1932): 173.,

[270] CF Hirshfield, "Social Security," *Mechanical Engineering* 58, no. 3 (, March 1936):, 145-148.

As later sociological studies would show, engineers as a body overwhelmingly identified as political conservatives, so Hirshfeld's impulse to fix economic problems via private capital and programming does not make him unique. The uniqueness came in the suggestion that more engineering could be the key for making private sector solutions work. For Hirshfeld, the key for fixing Depression lay in the world of research. Since engineers knew about "research," technicians sat uniquely positioned to apply the "research method to the solution of that large class of problems involving huge masses of people."[271] For Hirshfeld, it seems that engineers had been applying their research methods to the wrong things. While occupying themselves designing bigger and better technologies and consumer goods, engineers neglected to apply those skills to "social problems" left by industry like factory automation.

In a response to Hirshfeld, in the September 1932 issue, engineer for the Rio de Janiero Tramway and RPI graduate Charles Jay Siebert, wrote that although he agreed with Hirshfeld's argument that engineers are to blame for Depression, he challenged the idea that they were *the* cause. Rather, because engineers lacked power in the sense of politicians or businessmen, they could not have blame pinned on their kind wholesale. Other forces combined to cause the crisis, including "human greed and avarice." But, echoing Hirshfeld, "research" may have been able to shed light on those problems more directly.

Periodicals like *Mechanical Engineering* reflected other engineering solutions to the Depression perfectly. The publication showed that engineers remained quite conscious of the ways they might help alleviate the strain of Depression through problem solving. Notably, the Depression bought more social justice ideals to the front of engineers' minds. An April 1932 piece by later ASME President, and U.S. Senator, Ralph Flanders, entitled "Engineering, Investment, and Social Well Being," argued that the world of engineering was ultimately

[271] Ibid, 178-180.

designed to serve the less fortunate. Flanders began his treatise in direct language: "The responsibility of the engineer for the present social order is generally admitted." Flanders continued to suggest that the "cure" for Depression was a sort of engineered government: "The new area to which engineering control must be extended is in the governmental field," most importantly as a control over excess spending inefficient accounting. According to Flanders, the key to engineering's magic was its emotional detachment from governance: "Such emotional instability of purpose must in some way be replaced by a more consistent and foreseeing policy, as has been done in the better-managed private business." Engineers were exempt from emotional swings of voters and political pressures, and thus more able to make rational budgeting decisions. Flanders further cited investment into "falsely attractive projects" that in the end did not return increases to investors as foolish moves that drove the nation into depression. Engineers saw through such baubles, and supposedly could objectively contain themselves in making policy and investment choices that were informed and safe.[272]

In an October 1931 article entitled "The Industry's Obligation to the Unemployed," engineer James W. Hook of the Connecticut's The Geometric Tool Company argued that engineers could alleviate the pain of lost work by rehiring. He stated that engineers had a "responsibility" to look out for workers, more so than other professionals did.[273] He suggested that, on balance, industry had the capability to sustain workers over periods of Depression: "The experience in our plant has led us to believe that industry can, without very great expense, provide reserves to tide that portion of its stable working force, whose incomes are substantially limited, over extended periods of depressed business and pay reasonable dismissal wages to

[272] Ralph E. Flanders, "Engineering, Investment, and Social Well-Being," *Mechanical Engineering* 54 no.4 (April 1932): 254-255.
[273] James W. Hook, "The Industry's Obligation to the Unemployed" *Mechanical Engineering* 53, no. 10 (October 1931):, 707.

those who are dropped from the payroll entirely."[274] In other words, engineers at the top of certain firms like Hook could set aside funds in order to keep as many people afloat as possible during depressions, and only dismiss people when they can offer appropriate severance.

Similar to Hook, a 1933 disclaimer in the American Society of Automotive Engineers' *SAE Journal* stated in large print "Employment to the Rescue! When a man is discharged there is a loss in net national income, expressed in dollars, about 3.5 times the saving through this cut in wages." The post later turned to say "To bring about recovery…it is only necessary to reverse the present trend; to start either large scale purchasing or large scale reemployment." The post concluded by stating "Remember a Member!" ostensibly a call for engineers in hiring positions to look out for fellow SAE members by considering rehiring unemployed engineers.[275]

These discussions were in league with one another in the ways they articulated the problems and solution in terms of science. Rather than suggesting that economic reforms be installed, many suggested that research could lead to social stability. Technicians did so in a deeply triumphalist manner, an odd response for a field that so prominently blamed itself for the problem to begin with. The "research" solution was supposedly fool-proof in Hirshfeld's eyes simply because "In times past the American Society of Mechanical Engineers has organized committees for various purposes and I have never heard of one that was not successful and did not accomplish what it set out to do." [276]

These articles were certainly not the only engineering responses to the Depression, but they serve as a window into how the broader field viewed its role in the quagmire. To them, Depression reflected bad or incomplete engineering. Better research or analysis, applied in the

[274] Ibid 711.
[275] Society of Automotive Engineers Journal 32, no. 4 (April 1933): 24.
[276] Charles Jay Siebert, "Principal or Accessory to the Crime?," *Mechanical Engineering* 54, no. 9 (April 1932):, 613-617.

right places and at the right times, would undoubtedly provide solutions to keep future depressions at bay. However, the details regarding how "research" would fix the Depression remained consistently vague across commentaries. Engineers seemed to believe research stood as their most useful skill for fixing the Depression, but rarely gave in-depth details regarding how that concept would make a difference. Prescribing, for instance, that engineers create large cooperative engineering councils like FAES to research "general business problems and interpreting them," stopped short of detailing why such a council would change the conditions leading to, or intensifying, Depression. Was it all about unemployment? Were they most concerned with maximizing human workplace output? None of the commenters were clear on these points. But, despite the vagaries surrounding engineers' solutions to Depression, it was clear that technicians viewed themselves as problem solvers for the national crisis.[277]

It is important to note that normal engineering research continued on throughout the Depression, albeit with some challenges. The Engineering Foundation, a group renowned for its research support, experienced constraints through deep in its grant investments. The agency changed its research grant policies to focus more on collaborative projects in an attempt to benefit more individuals' work efficiently, along with other budget related reforms. In 1934, the Foundation stopped accepting grant applications entirely for the remainder of the fiscal year due to lack of funds.[278]

Directly alongside their Depression-related articles, journals like *Mechanical Engineering* continued to chronicle new engineering advances. One column published throughout the 1930s and beyond, entitled "Progress in Engineering" reinforced the reality that despite deep questions about its role in perpetuating depressions, engineering progress beat on.

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[277] Ibid., 617.
[278] Metz and Viest, *The First 75 Years*., p. 111.

In the same issues that contained articles about creating “an engineering social ethic” to combat economic downturns, readers also saw profiles of “Military Aircraft Engineers of the Future” and advanced “Aluminum Connecting Rods.”[279] Faith in technological advancement persisted, even during depression.

Outside voices agreed with the engineering profession regarding its culpability for the Depression, but not its ability to redeem itself. The most salient example of this suspicion came in the form of critiques of technocracy, a movement with post-World War I roots that came to the attention of the general public in the 1930s. The technocracy movement, as it were, began as a meeting of mainly engineering minds who sought to study social issues like the economy, and believed that experts like technicians would bring about better management of society. Given the questions surrounding democratic capitalism in America at the time of the Depression’s depths, the movement seemed to some a viable alternative, while others saw it as enabling those who were behind the innovations that threw Americans out of work to begin with. One commentator wrote that the machine innovations that increased production in the economy of the 1920s came at the expense of the workers who logged fewer man-hours. To critics, engineers’ machines bluntly “eliminate employment.”[280]

Engineers seemed to in part buy into the criticism of technocracy. By blaming themselves for the crisis, technicians fell in line with critics that viewed their labor saving innovation as the root of the problem. But, their deeply held progressive belief in technological triumph rendered the “blame” for the crisis as a starting point for more engineering. The dichotomy of blaming engineering for depressions, while at the same time promoting its fruits, teaches us about the engineering mentality more generally. The coexistence of progress and regression seemed

[279] “Table of Contents,” *Mechanical Engineering* 58 no.3 *(* March 1936).
[280] Wayne Weishaar, “Technocracy: An Appraisal,” *The North American Review* 235, no. 2 (1933): 123.

natural to engineers who did not at all seem aware of the contradictions imposed by those concepts. While engineers quickly identified themselves as the cause of broader problems in the world, they just as often saw themselves as the solution. Despite the long running crisis, engineers seem convinced that progress carried on alongside what looked to most observers like giant steps backward. If engineers' habits were to blame partly for the Depression, tempering those habits would probably have helped that crisis. But, progress was perhaps the most deeply held principle of engineers in that time, and crisis, no matter how dire, could shake that foundational belief. To stop innovating would be anathema to impulses of engineers' mentality. In their minds, their culpability in causing crises provided all the more reason to put engineers closer to state administration and policymaking.

As historian David Ekbladh has written, the Depression-era Tennessee Valley Authority of Roosevelt's first New Deal was a significant starting point for liberal American development practices. To stimulate the rural American South's "problem" economy, the TVA undertook a number of large scale federally funded development projects in the region, such as dam and steam plant building.[281] To make these large plans a reality, Roosevelt looked to engineers to help remedy the Depression. Engineers were central to both the implementation of TVA projects, and TVA administration more generally. John Blandford and James Lawrence Fly worked in administration near the top of the TVA in the 1930s as General Manager and General Counsel, respectively, for example. Blandford earned a master's degree in engineering and Fly was a Naval Academy graduate with the requisite engineering exposure received there.[282] This is to say

[281] David Ekbladh, *The Great American Mission: Modernization and the Construction of an American World Order* (Princeton: Princeton University Press, 2010). 49.
[282]Biographical Sketch of John Blandford," accessed June 2, 2016, The Harry S. Truman Library & Museum, www.trumanlibrary.org/hstpaper/blandford.htm; United States Naval Academy, *Annual Register of the U.S. Naval Academy* (Washington, D.C.: Government Printing Office, 1921), 62.

nothing of the many engineers who manned the specific engineering offices of the TVA such as Chief Power Engineer and Chief Design Engineer, to name a few.[283]

For years after the Depression, engineers continued to study the TVA's structures in professional conferences and detailed written engineering analyses.[284] In effect, engineers claimed the TVA for themselves as monuments to American engineering ingenuity. Their acknowledgment that the TVA's most visible markers were products of their doing served as a sort of justification for their long-held beliefs that engineering could fix the economy. The TVA and New Deal may not have actually stopped the Depression, but by being so key to the TVA's operation, engineers had proof that they were indeed needed to make recovery efforts like the New Deal happen.

In the end, engineers carried little sway in directing state policies through the Depression. Their proposals for how to fix the problem were essentially ignored by policymakers, due to the facts that the crisis stemmed from economic issues, and the fact that smaller anti-technology movements like Technocracy threw into question engineers' ability to fix the problems they had ostensibly caused.[285] In any case, the Depression stood as a moment of crisis for engineers just as it did for the rest of the population. It would take World War II, and the war's unique utilization of engineers, to draw engineering closer to the federal government.

By the 1940s, engineers of Gifford's generation had experienced plenty in their adulthood. The latter years of the Depression saw engineers regain some of their lost wages and opportunities, contributing to a greater sense of need within the field itself.[286] World War II

[283] Division of Public Inquiries Office of War Information, *U.S. Government Manual, 1937* (Washington D.C.: Government Press Office, 1937), 395.
[284] "Design Developments- Structures of the Tennessee Valley Authority: a Symposium," *Proceedings of the American Society of Civil Engineers: Technical Papers and Discussions* 71, no. 8 (October 1945): 1193-1224.
[285] Sinclair, *A Centennial History of the American Society of Mechanical Engineers*, 166.
[286] U.S. Department of Labor, "Employment Outlook for Engineers," 78.

would in some ways act as a crucible for all these experiences. The war put engineers on an ever-higher pedestal by pulling them into new spheres of important work in the service of the federal government, and their job prospects increased as a consequence. By 1943, American engineers saw an overall average 16.3% increase in median earnings over 1929.[287] Clearly, the war had increased engineering's labor demand, and pushed a previously self-important field into even greater sense of prestige. Furthermore, the war did not end up stopping engineering advancement or progress; research became an even more central aspect to the state through newly established organizations that ensured that the U.S. government would back scientific research for generations after the war's end.

The outcome of the conflict thrust engineers into positions of importance out of what looked like sheer necessity. The decimation of the war caused infrastructure, productive facilities, and personnel in previously productive parts of the world to be unusable. America enjoyed abundance in these areas. American resources of all types became useful for the global rebuilding process, and the human capital of engineers provided one significant source in itself.

Engineers in World War II

On the morning of August 6, 1945, an American B-29 bomber took off from Tinian, a remote, forty square-mile island in the South Pacific, to deliver the first atomic bomb to Hiroshima.[288] The island contained little in the way of modern roads and airports, its only real development came from earlier Japanese colonizers who built fortifications there during World War I. And yet, the island transformed into a vital piece of strategic infrastructure in the Pacific

[287] Ibid, 67.
[288] "Tinian Island," Last modified 2016, http://www.atomicheritage.org/location/tinian-island.

theater by the end of 1945 by the work of American technicians.[289] In just under two days, American engineers using crushed coral surfacing constructed one of the largest airfields of the Pacific theater, capable of launching both fighter squadrons and heavy bombers like the B-29.[290] Blasting nearby coral reefs, crushing it with heavy road rollers, and mixing it with cement produced a surface well suited for light and heavy aircraft use.[291] American forces built suitable accommodations for American warplanes on the island post haste in 1945 after taking Tinian during Douglas MacArthur's island hopping-campaign of 1944-1945. The massive airfields were the product of planning and the quick work of military technicians.[292] Those engineers did more than just build runways. Every type of supply or construction work during the war came under the purview of engineers. Engineers on Tinian provided water distillation and purification systems, POW facilities, swept minefields, used flame-throwers to clear caves, and created marine craft landing points in quantities.[293]

As General Douglas MacArthur once plainly stated, "This is an engineer's war. This is an air and amphibious war; because of the nature of air and amphibious operations…Never before have engineers played such an important role."[294] Indeed, the war made use of American engineers in novel but important ways. The reality of the war's expansiveness dictated that infrastructure had to be laid in all types of terrain and landscapes. Historian Paul Kennedy notes that "It is difficult to imagine a military victory without engineer, but all too often historians of grand campaigns take their work for granted and assume that troops, fleets, and air squadrons

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289 Ibid.
290 Carl W. Hoffman, *The Seizure of Tinian* ([Washington], 1951), http://hdl.handle.net/2027/mdp.39015008730882, 82-83.
291 William B Luce, "Airfields in the Pacific," *Civil Engineering* 15, no. 10 (October 1945): 453-454.
292 Nathan N. Prefer, *Battle for Tinian, The: Vital Stepping Stone in America's War Against Japan* (Casemate, 2012).
293 Hoffman, *The Seizure of Tinian*., 96, 138.
294 Stuart Godfrey, "Airfields Constructed in the Far East," *Civil Engineering* 15, no.2 (, February 1945): 72.

can be moved long distances by the stroke of a pen on a large scale map."[295] Forward engineer units did the grunt work that made the large military campaigns in Africa, the Pacific, and Europe possible. The jungle islands of the Pacific, the deserts of North Africa, and the mountains of France all needed at different points to be utilized as spaces for troop and supply movements. The engineers of the Army Corps of Engineers and the later Naval Combat Battalions (Seabees) made use of such terrain to move military goods through to their targets at paces never before seen. In this, engineers were vitally important for pursuing and ultimately winning the war for the Allies.

Engineering had long been a part of the American military apparatus before the U.S. entered the war in December 1941. A long-standing relationship between the military academies and engineering education had been drawn up as a necessary adjustment to a world demanding engineering advances for military purposes. The first-ever courses of study at the U.S. Naval Academy included chemistry, gunnery, and steam classes. Naval Academy students of Gifford's generation were required to take courses in naval engineering, electrical engineering, and physics, in addition to the still existent gunnery and steam courses.[296] Such courses ran throughout each of the students four years at the academy- there were no years of relief from engineering related courses as a midshipman. Regardless of major, students in the 1930s by law received Bachelor of Science degrees because of the science and technology-heavy core curriculum all midshipmen received.[297]

The U.S. Military Academy in West Point, New York, also emphasized a strong emphasis on engineering education in its cadets. To wean the United States from the need for

[295] Paul Kennedy, *Engineers of Victory: The Problem Solvers Who Turned The Tide in the Second World War* (Random House, 2013), 307.
[296] United States Naval Academy, Annual Register of the *U.S.* Naval Academy (Washington, D.C.: Government Printing Office, 1915), 52-53, 189.
[297] "A Brief History of USNA," http://www.usna.edu/USNAHistory/.

foreign engineers and technicians, the Academy sought to increase its homegrown trained corps of engineers through training at the United States Military Academy (USMA). In the first half of the 1800s, civil engineering became central to the Academy's curriculum. [298] All cadets of Gifford's generation were required to take courses in military engineering and technical drawing.[299] Like the Naval Academy, West Point Graduates beginning in the 1930s received a B.S. regardless of major.

Some of those of the engineering generation who entered the military academies eventually became known through another more well-known distinction. The USMA class of 1915 earned the moniker, "The Class the Stars Fell On," due to the class' high rate of at least one-star generals relative to previous or succeeding classes. Out of the class' 164 graduates, 59 (36%) became at least brigadier (one-star) generals during their careers. Most reached the height of their military paths during World War II. Out of this class came high ranking World War II generals President Dwight Eisenhower, Omar Bradley, and James Van Fleet, among others. Some of the class of 1915 entered the Engineer Corps, achieving leadership roles in World War II. One such individual, Donald A. Davidson, led the Corps in North Africa as chief aviation engineer. In this capacity, he organized logistics for airfields and air service facilities that were so central to the Allied campaign against the Germans.[300] As a portion of the engineering generation, the USMA class of 1915 embodied the technically trained individuals who earned places of importance in the military during the war, or, and at least in Eisenhower's case, much higher office afterward.

[298] "A Brief History of West Point," http://www.usma.edu/wphistory/SitePages/Home.aspx.
[299] United States Military Academy, *Official Register of the Officers and Cadets of the U.S. Military Academy, West Point, N.Y.* (United States Military Academy Print. Office, 1915)., 14, 76.
[300] Michael Haskew, *West Point 1915: Eisenhower, Bradley, and the Class the Stars Fell On* (Voyageur Press, 2014).

The emphasis on engineering was a direct response to broad application of engineering principles in the active military. Officers who graduated from the Annapolis and West Point were heavily trained in science and technology, which would prove significant for the military workforce. One important outcome of widespread engineering education at the academies was that officers were almost always appointed to lead the numerous defense agencies that provided engineers for the war effort. Although identified first through their military rank, academically trained engineers emerged throughout the U.S. defense structure in World War II. Their contributions were visible in both high profile projects like the development of the atomic bomb, and more discreet projects like replacing a P-51 Mustang fighter engine with faster British-designed Rolls-Royce engine.[301]

Officers in both services had plenty of work opportunities during the war as evidenced by the numerous defense offices that employed engineers. The Navy Bureau of Ships carried out naval engineering duties during the war, and evolved out of an older agency, the Bureau of Steam Engineering.[302] The Office of the Chief of Chemical Warfare Service was charged with dealing with chemical weaponry for the Army, and was staffed and headed by engineers. The Naval Bureau of Yards and Docks housed one of the key engineering agencies of the war, the Seabees. The Navy Bureau of Ordinance often employed naval engineers as well. This agency was responsible for developing new weaponry, and released a number of weapons like the "bat" guided missile in 1944.[303] Additionally, engineers populated the Navy Bureau of Aeronautics, an agency in charge of naval airplane design.

[301] Kennedy, *Engineers of Victory*. 151, 207.
[302] Division of Public Inquiries Office of War Information, *U.S.* Government *Manual*, 19*43* (Washington D.C.: Government Press Office, 1943), 237, 607.
[303] "George F. Hussey, 88, Dies; Led Navy's Ordnance Bureau: [Obituary]," *New York Times, Late Edition (East Coast)*, April 20, 1983, sec. B.

At home, the shortage of engineers during the war due to deployment gave way to the first significant overtures toward including women in the profession. The Curtiss-Wright Corporation sent volumes of women to engineering colleges across the country in the early 1940s to train them to understand and assemble the company's aircraft. The Army employed women as "draftsmen" and in some limited examples, actual working "mechanical and heating" engineers.[304] RPI added women to its degree programs for the first time in 1942, while other women became faculty members in physics and English. Even with the new opportunities, women but did not have on-campus housing accommodations.[305]

Abroad, the Army Corps of Engineers took up much of the major on-the-ground wartime engineering. The Corps' history was older than country itself, stretching back to the middle of the Revolutionary War. Befitting of an organization emblemized by a medieval fortress logo, the Army Corps of Engineers became known for executing challenging fortification and infrastructure projects both at home and abroad, and providing relief for natural disasters and public works projects. The Corps served in a plethora of contexts during times of war and peace thereafter, but the demands of World War II placed unprecedented importance on the Corps' capabilities. Continuing its long tradition of military service, the Army Corps of Engineers mobilized in droves in 1940 when Nazi forces invaded France. The Corps began preparing all manner of personnel to provide infrastructure support in the event of American entry to the war. It developed surfaces for airfield runways in unforgiving terrain, along with new army vehicles for use in the field. The products of its work ended up in wide use once America declared war in December 1941, and engineer battalions in the Pacific were some of the first to enter combat

[304] "Historical Vignette 016 – Women's Contributions to the Corps of Engineers During World War II," Updated March 2001, http://www.usace.army.mil/About/History/Historical-Vignettes/Women-Minorities/016-WWII-Women/./

[305] Thomas Phelan, D. Michael Ross, and Carl A. Westerdahl, *Rensselaer: Where Imagination Achieves the Impossible* (Albany, N.Y.: Mt. Ida Press, 1995), 123.

operations. In one episode, engineers stationed in the Philippines actually *deconstructed* vital infrastructure to slow Japanese invasion in late 1941. [306]

The Army Corps of Engineers was first deployed to North Africa in 1942. Its work, besides fending off Italian and German forces in active combat, was to serve as forward mine sweepers and constructing infrastructure that would ferret American Calvary divisions through the arid terrain. The engineers similarly made headway during Project Overlord, making way for American landing forces to move supplies ahead into the Normandy beachhead. Corps bulldozer drivers made headway through beach cliffs, which made possible further Allied penetration of the northern French coast.[307]

Engineers continued to expand their ranks throughout the war because their necessity was growing especially as the war in Europe intensified. Army engineers followed their success at Normandy by working with General George Patton to facilitate supplies to his third army on the move toward Paris. Due to bombed-out bridges and railways, the Corps devised the most efficient way to repair and move supplies to the fighting force. Working around the clock, the engineers were able to cleverly prop up a disconnected bridge segment over the Selune River, and continue the rail path to the Patton's army. All this was finished under the three-day deadline set by Patton himself.[308] Other units saw extensive action in Europe in building bridges across the Rhine, and facilitating other supply movements through Western front in the latter stages of the war.

While the Corps covered the engineering needs of the Army, Seabees came to serve in a similar capacity for the Navy. The Seabees were founded by military engineers Ben Moreell and RPI graduate Lewis B. Coombs as a unit of civilian tradesmen who could efficiently construct

[306] US Army Corps of Engineers, *The History of the US Army Corps of Engineers*, 83-89
[307] Ibid.
[308] Department of the Army U.S. Army Corps of Engineers, *Historical Vignettes Volume II* (1979): 55-56.

the infrastructure American forces would need. Coombs, like Moreell, was a university trained engineer (RPI class of 1916), and viewed the war as MacArthur did: a challenge for technology and engineers. Ever the amateur historian, Coombs knew the long legacy of Naval engineering in the U.S. (and RPI) and proudly served as a continuation of that tradition. As the assistant chief of the Navy Bureau of Yards and Docks, he embodied the wartime engineer well as he implemented his problem-solving mentality to great acclaim.[309] Coombs and Moreell saw the logistical challenges of executing a war in unorthodox terrain like the Pacific islands. The construction of airfields, not to mention barracks to house the occupying soldiers, posed a challenge that Americans had not yet encountered in places like the South Pacific. Without having to teach these men requisite design and building skills, the force was quickly utilized in the field in Bora Bora in the battle of the Coral Sea. At Guadalcanal, Seabees quickly ran bulldozers and road rollers to build airfields *in between* Japanese air raids.[310] The Seabees thus were designed as a highly mobile construction force that could tackle infrastructure problems in large scales using new methods. Floating pontoons, for instance, provided dry docking facilities in nearly any location. Such facilities could be erected in a matter of hours, which in turn made repairs faster, and thus increased the number of ships at the Navy's disposal. By the middle of 1942, the Naval Construction Battalions (CBs or Seabees for short) took on the brunt of military infrastructure building across the globe.

The Seabees emerge as perhaps the most underestimated weapon in the American military arsenal during the war. The end of the conflict saw the Seabees' ranks swell to over

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[309] Commencement Address by Lewis B. Coombs, October 24, 1945, Admiral Lewis B. Coombs Papers, Rensselaer Polytechnic Institute Archives, Box 1; Lewis B. Coombs, "Alumni Hall of Fame – Lewis B. Coombs," Updated 2010, https://www.rpi.edu/about/alumni/inductees/combs.html.
[310] "RPI and the Navy's CEC" in," *Alumni News,* January 1944, Admiral Lewis B. Coombs Papers, Rensselaer Polytechnic Institute Archives, Box. 1

325,000, with 10,000 officers.[311] Their modus operandi was directly in line with the typical engineering mentality: a preoccupation with practicality and clever problem solving in tight time constraints. Edward Ludwig's 1944s feature film, *The Fighting Seabees,* engaged those themes directly. Although likely a better reflection of Hollywood hype, the depictions of the Seabees as a unit obsessed with "getting the job done" was inspired by reality. In one climactic scene, Seabees stationed on a Pacific island engaged in full-on combat operations against invading Japanese forces. The Seabees overcame their smaller numbers by utilizing their problem solving skills. Without dedicated armored vehicles and tanks, the Seabees used construction equipment as military vehicles. Some Seabees used bulldozers to plow Japanese tanks off cliffs, while others scooped up with steam shovels enemy snipers who would have otherwise picked off American troops. After the battle, a commanding officer asserted a sort of Seabee rallying cry: "we build for the fighters; we fight for what we build." Incidentally, the film also featured bulldozer blades manufactured by the Buckeye Ditcher Company of Findlay, Ohio.[312]

Technicians and the Arsenal of Democracy

Engineers remained keenly aware of the new value placed on them in wartime, and their work and dialogue reflected that consciousness. Combat engineers penned special articles revealing their awareness of their own power, with titles like "Their Knowledge Saves Lives."[313] The president of the American Society of Civil Engineers, Elmer A. Holbrook, said in the weeks following the attack at Pearl Harbor, "We who remain in civil life must carry on our common profession. A prominent government official told me the other day- 'War is no longer a mass of

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[311] Robert Mcg Thomas Jr, "Adm. Lewis B. Combs, 101, Seabee Founder," *The New York Times,* May 24, 1996, sec. U.S., http://www.nytimes.com/1996/05/24/us/adm-lewis-b-combs-101-seabee-founder.html; A. Olsen, *The King Bee: A Biography of Admiral Ben Moreell* (Naval Institute Press, 2011).
[312] Borden Chase and Aenas MacKenzie. *The Fighting Seabees*. Film. Directed by Edward Ludwig, (1944).
[313] David Anderson, "Their Knowledge Saves Lives," *Civil Engineering* 15, no. 1 (January 1945): 25.

men fighting apart from the rest of the population, it is a technological phenomenon, involving all-out production in which the trained engineer is a necessity.'" He continued to say "Our profession suddenly has become very important; let us live up to our responsibility."[314] Engineers internalized the Second World War in this way; the scale of the conflict was a challenge to be met with society's greatest problem solvers.

Although plenty of American engineers were not of fighting age by 1941 (including those in the engineering generation), home-bound engineers did not let that diminish their awareness and duty to country. The undertakings of home-bound engineers ranged widely, and often reflected an interest in practical application of engineering to benefit the home front war effort or that of the developments abroad. For example, some engineering groups produced detailed studies about the importance of readily available bituminous surfacing and expertise for wartime roads.[315] Other groups organized studies of efficient community rubber and food drives, adhering to a principle of constantly unearthing where they could be made effective, even if they were not asked.

Similar sentiments proliferated though the field during the course of the war. One civil engineer noted to an audience at the University of Minnesota in 1943 that, "Suddenly we have discovered that there is no other professional man so greatly in demand in the present emergency as the engineer; also, that an engineering education better fits a man for industry and the armed services than any other type of education."[316] Wheeler's observation was at once self-referential and accurate. Despite their perhaps overly-sensitive-or egotistical-tendency to see themselves in

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[314] Elmer A. Holbrook, "President's Message," *Civil Engineering* 12 no. 1 (January-February 1942): 3.
[315] Committee of the Highway Division on Military Road Construction and Maintenance of the American Society of Civil Engineers, *Military Roads in Forward Areas;the Construction and Maintenance of Roads in the Theater of Operations.* ([Washington, 1941), http://hdl.handle.net/2027/mdp.39015065767793.
[316] Walter Wheeler, "The Professional Organization Comments on National and State Societies," *American Engineer* 13 no.2 (March-April 1943): 26.

every problem and in every solution, engineers were justified in their thinking in the case of World War II. If the work of the military engineers chronicled above were any indication, the engineer proved important, and in some cases, decisive in determining the outcome of a number of military campaigns. Their work sustained movements of military forces in all types of environments. The war demanded problem-solving and technology in ways that were in line with engineering's mentality, and that mentality proved more useful than perhaps even they realized at the time. Engineers' strong interest in solving the problems of the Great Depression may have been overstating their importance, but World War II proved perhaps the opposite reality.

Of course, engineers involved in heavy manufacturing also proved important to the war effort. More often than not, military contracts found their way to Midwestern factories whose engineers were central to keeping up with high product quotas. The now-famous American "Arsenal of Democracy," was partly a testament to engineering's power to influence the war from overseas. As the U.S. turned toward war production in 1941, American factories converted from consumer goods to war materiel. With Roosevelt's War Production Board under would-be General William Knudsen, major auto manufacturers moved into full war production, fulfilling orders often in numbers higher than during any peacetime years. Most companies undertook multiple projects, with certain high profile products included. The Ford Motor Company converted to high-volume B-24 bomber construction, General Motors produced heavy ammunition, and Packard made Rolls Royce 12-cylinder aircraft engines for use in the P-51 Mustang fighter.[317] In all, the automobile industry produced more than four million military engines and approximately three million tanks and trucks during the war[318].

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[317] A. J. Baime, *The Arsenal of Democracy: FDR, Detroit, and an Epic Quest to Arm an America at War*, Reprint edition (Mariner Books, 2014)., 86-91.

[318] Automobile Manufacturers Association: *Freedom's Arsenal :the Story of the Automotive Council for War Production.* (Detroit, Mich. :, 1950), http://hdl.handle.net/2027/mdp.39015071183795., 40-41, 199. The numbers are

Retooling for war production was itself a project for specifically manufacturing engineers and process engineers. The working capacity of each factory served as a metric understood best by company engineers, who would have to oversee factory system alterations and new machinery implementation to accommodate these special war projects. Engineers' streamlining of production improved as the war went on, allowing factories to meet quotas quicker. The results were the staggering levels of production mentioned above, which in their way contributed to the Allied success on the field.[319]

And yet, American factories did not always retooled for war production as in Detroit. Certainly, the military demanded enormous amounts of specialized war materiel and vehicles like the Willys-Overland Jeep. But, there also came a steady demand for construction equipment. Midwestern manufacturers were called on to continue much of their peacetime production of bulldozers, shovels, and tractors, only this time the machines were used in various building projects on military bases and airfields. Midwestern companies like Huber, Allis-Chalmers (Wisconsin), and Caterpillar (Illinois) continued to produce such heavy equipment throughout the duration of the war. These pieces of equipment did heavy lifting across the war's theaters. In one notable instance, the Euclid Company of Euclid, Ohio produced tractors that ended up moving earth and clearing obstacles on Omaha Beach in 1944.[320]

During the war, Huber built its now-famous three wheel and tandem road rollers for the U.S. Navy and War Departments through 1945. Hundreds of Huber rollers of the 6, 8, 10 and 12-ton varieties were sent to inland supply depots at Mechanicsburg, Pennsylvania, seaports near

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approximate, as per notes in the report, but these numbers align to a general range cited by a number of other sources.

[319] Baime, The Arsenal of Democracy, 197.

[320] Arthur Herman, *Freedom's Forge: How American Business Produced Victory in World War II*, Reprint edition (Random House Trade Paperbacks, 2013). 310.

San Diego, California, and directly to Washington D.C. for export.[321] Although the Huber records do not disclose where every machine ended up after export, a later Huber corporate record states that some wartime rollers ended up in Egypt, multiple regions in Europe, and the Pacific for the construction of airfields and supply infrastructure. In one recorded instance, Huber road rollers provided the crushing power for building airfields in Allied-occupied Cyprus in 1943. With the help of Cypriot peasant women, Allied forces collected rock that Huber road rollers subsequently turned to gravel usable for airfields.[322] On top of this, Huber also sent off over two hundred of its young men to combat.[323]

In becoming such a big supplier of construction materiel for the war effort, the importance of Huber's turn toward road building equipment must be revisited. Without Pat Gifford's work on the gasoline road roller in 1923, Huber would not have had much to offer the War Department for World War II. The War Department directed Huber to stop making its tractors and farm machinery during the war, meaning Gifford's innovation was much to credit for Huber's later contribution to the war effort.

The Manhattan Project

Engineers continued to distinguish themselves throughout the war, but perhaps their most memorable contribution came in the development and implementation of the atomic bomb. The heads of the Manhattan Project were mainly engineers. At the top of the early program sat Vannevar Bush. Still working as professor in the engineering program at MIT, Bush oversaw the project from the beginning in close coordination with top policymakers. Later project director

[321] Sales Ledgers for the Huber road roller 1944-1945, Huber Machinery Museum , Marion, Ohio. These records are not cataloged; the ledgers reside in a metal filing cabinet in the museum office.
[322] "Island Airfield Repaired for Fighters," *Engineering News-Record*, February, 11, 1943, 87.
[323]The Huber Manufacturing Company, *The Huber Story 1863-1948*, 3.

General Leslie Groves graduated from West Point, and had extensive work experience in the Army Corps of Engineers. The reason for the engineering input was that the principles surrounding the project were deeply reflective of the engineering mentality. The process of experimentation during the project saw a very practical set of ideas emphasized. Atomic energy was important only to the extent that it could be integrated into a useable weapon. The bomb certainly embodied a dangerous piece of equipment, but engineers envisioned its application to extend much further than just the battlefield. In this way, the Manhattan Project came to punctuate the engineers' role in the war with an exclamation point.[324]

The research process of creating a nuclear reaction depended on the physics of atomic energy, a knowledge base held by mostly physicists and chemists. Even so, Hungarian-born engineer Eugene Wigner served as a part of the "Uranium Committee" in the early stages of the project's development.[325] The reality was that Bush and policymakers knew that coordination across both scientific and engineering professions was key to the project's success. Thus, engineers were an unshakeable part of the project at every stage. This truth was reflected in the makeup of the National Defense Research Committee (NRDC) of 1940 which oversaw weapons technology (and eventually housed the Uranium Committee). The group was populated by engineers and scientists alike, from backgrounds as diverse as the academy and the U.S. military. These figures belonged to the engineering generation almost to a man. If his past provided any indication, Bush became a technology triumphalist by World War II- he had spent much of his life pursuing ground-breaking technology like his differential analyzer (a sort of early computer),

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[324] To further connect the symbols of the Manhattan Project to engineers, the project's emblem featured the outline of the Army Corps of Engineers' fortress logo.

[325] Bruce Cameron Reed, *The History and Science of the Manhattan Project*, (New York: Springer, 2014), 120.

and viewed technology via science as a way to bring that triumph to bear on the coming U.S. war effort.

Bush's NDRC carried great importance to Roosevelt, and he reported directly to the President about its developments, bypassing often-tedious congressional oversight. In this capacity, Bush had direct access to Roosevelt and the cabinet, often meeting one on one and delivering and receiving hand-written notes from the President regarding the project. Bush further carried his status in the NDRC into a position in Roosevelt's "Top Policy Group" alongside War Secretary Henry Stimson, Vice-President Henry Wallace, General George Marshall, and Harvard president and chemist James Conant.

Bush's maneuverings throughout the early stages of the bomb's development shed light on the critical role engineering played in the Manhattan Project. From that initial incarnation of the NDRC, the project took a number of other forms. But in each, engineers held visible roles in the organization, often making up entire branches of his team, with important collaboration with scientists throughout.[326] By 1942, the project had received FDRs full blessing and financial backing. New engineers were gradually being added to the fold. The earliest military figures who took a role were also engineers, such as Col. George C. Marshall, a West Point graduate and Army Engineers Corps veteran. In the middle of 1942, Leslie Groves took over Marshall's place, and appointed his own cadre of engineers to assist him in overseeing the expanding bureaucracy of the Manhattan Project.[327]

These engineers served as overseers and implementers. They not oversee experiments with uranium, but rather spent time selecting sites and designing facilities to do that testing in. Designing the Clinton Engineer works in Tennessee, where much of the final uranium testing

[326] Ibid., 145.
[327] Ibid 155-156.

was to be completed, presented a challenge engineers matched. The testing facility needed to be large enough and in the correct dimensions to house the equipment and staff needed for enriching plutonium. But, it also had to possess easy rail and highway access, characteristics that made Anderson County, Tennessee a good fit.[328] Stone and Webster, a Massachusetts engineering firm subcontracted for the job of designing much of the new town of Oak Ridge, which would house thousands of workers to support the project.[329]

Much of the day to day atomic testing was performed by experimental physicists and other scientists of various shades, but engineers remained a key constant at the Clinton, Los Alamos, and Hanford laboratories. Laboratory engineers were needed to implement the nuclear technology into a deliverable bomb, essentially weaponizing the technology for use in American bombers.[330] The Trinity test of July, 1945 and the deployment of two bombs over Hiroshima and Nagasaki marked the climax of the Manhattan Project. Years of planning, research, and experimentation, not to mention state spending, culminated in effective use of the weapon to end the war in the Pacific.

The massive effects of the weapon shocked the general public, and resulted in widespread introspection by the engineering community. It produced responses by technologists eager to comment on the broader significance of the weapons' use. It is important to note that engineers surrounding Manhattan project were not blindly driving the world toward potential nuclear war. They were suspicious of the technology, and questioned its usefulness even as it was being developed. Bush wrote in his much-read work, *Modern Arms and Free Men,* that the bomb

[328] Leslie R. Groves, *Now It Can Be Told: The Story Of The Manhattan Project* (Da Capo Press, 1962), 25.
[329] Ibid., 176. The firm did not end up completing the project alone. The order to build an entire city by itself was a bit too great for the company to take on, and its role was scaled down a bit.
[330] Ibid, 157-158.

represented nothing short of a devastating device, "indeed a terrible weapon."[331] Leslie Groves noted the deeply divisive and complex effects of the atomic energy on modern society in his account of the Manhattan Project: "In answer to the question, 'Is atomic energy a force for good or for evil' I can only say, 'As mankind wills it,'" echoing a general awareness that atomic energy's future was up to its practitioners.[332]

Yet, the notion of a technological triumph still remained in the engineering mentality. Bush himself noted that the bomb could bring peace to the world rather than total destruction, and repeatedly pointed to the millenarian impulses of commentators as overreaction. "I believe…that the technological future is far less dreadful and frightening than many of us have been led to believe, and that the hopeful aspects of modern applied science outweigh by a heavy margin its threat to our civilization." Bush pointed to democracy as a safeguard against technological excess in wartime, and the preservation peace in the face of nuclear war.[333]

Other engineers saw their field as both the bringers of bad news and good. Specifically, chemical engineers took special note of the bomb's detonation. In the months following August 1945, and the entire calendar year of 1946, the journal *Chemical & Metallurgical Engineering* devoted much attention to atomic energy. The journal incorporated columns that covered both technical analysis and broader commentary on the bomb's significance to humanity. Of special note was a February 1946 issue with a mushroom cloud on the cover, containing a special report entitled "Chemical Engineering's War-Ending Achievement: the Atomic Bomb," which proclaimed the bomb, and the Japanese surrender, as a crowning achievement of engineering expertise. The publication unanimously bestowed a special award of achievement to the

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[331] Vannevar Bush, *Modern Arms and Free Men: A Discussion of the Role of Science in Preserving Democracy*, First Edition edition (New York: Simon and Schuster, 1949) 91.
[332] Groves, *Now It Can Be Told*., 415.
[333] Vannevar Bush, *Modern Arms and Free Men: A Discussion of the Role of Science in Preserving Democracy*, First Edition edition (New York: Simon and Schuster, 1949), 2-3, 90-91.

Manhattan Engineer District for its achievement because engineers guided the project from start to finish, "Following and coincident with the research came the need to development engineers to translate the unique results of the laboratory into workable processes and equipment…Closely behind were the design engineers- mechanical, electrical, and metallurgical- to serve as the vanguard of the civil engineering and construction forces." And, "Finally, came the plant operators, all technically trained men, capable of quickly mastering the complicated procedures and controls that were essential in the large scale production of dangerous sand exceedingly valuable materials that had never before been made…"[334]

The weight of the bomb did cause some concern for engineers. S.D. Kirkpatrick, editor of the journal *Chemical and Metallurgical Engineering,* wrote a number of editorials addressing wider concerns with the bomb's implications. Those editorials often reflected a common pattern, befitting the engineering profession's habits and already-held ideas about itself. In a November 1945 editorial, Kirkpatrick wrote in relation to the bomb's detonation, "unheeded at that time, by most of us, these words of sound advice are worth recalling now that scientists and engineers find themselves at the very storm center of a hurricane of political debate…Never before in history has science been asked, and expected, to do so much for humanity." Atomic energy had opened the way again for technicians to be more visible in American society as they held the keys to controlling the new nuclear discovery. Due to nuclear power' volatility and dangerous traits, engineers, therefore, held responsibility to humanity through their administration of this technology.[335]

[334] Sidney D. Kirkpatrick, "Chemical Engineering's War-Ending Achievement- The Atomic Bomb," *Chemical and Metallurgical Engineering* 52, no. 2 (Feb 1946): 107.
[335] S.D. Kirkpatrick, "Science, Politics, and Humanity," *Chemical and Metallurgical Engineering* 52, no. 11 (November 1945): 95.

Other engineers noted the importance of engineering expertise in future nuclear regulatory programs and committees. One engineer of Stone & Webster Engineering, A.C Klein, addressed Congress in February 1946 in reference to Senate Bill 1717, which was covering federal control of atomic research and use. Klein sought to argue for the inclusion of an engineering division into a policy commission that had already included research, production, materials, and military divisions. Engineers "would have an important part in passing on such recommendations from the standpoint of determining plant investment costs and operating savings (the latter in conjunction with the division of production). It would also explore and report on the ability of industry to furnish any new equipment required and would prepare time schedules of the work involved." And finally, the division would oversee design and construction of factories. As Klein noted, engineering and construction amounted to around 90% of the total costs of the Manhattan Project. Why, then, would engineers not have a specific role in future nuclear controls?[336]

Similarly, in an editorial in the December 1945 edition of *American Engineer,* one author stated that the realization of atomic energy required management of engineers. "To be perfectly blunt about it, we in America must have in government a liberal application of Scientific Method and the engineering method of handling technological issues," mainly because most officials lacked such a capacity.[337] In effect, the editorial argued that the effective management of future atomic power lay in the skill set of engineers. Echoing the sentiment of Klein, engineers were uniquely situated to accomplish proper dealing with the new technology, and must be allowed to by the government.

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[336] A.C. Klein, "Engineering Representation is an A-Bomb 'Must'," *Chemical and Metallurgical Engineering* 52, no. 3 (March 1946): 117.
[337] "Science and Society," *The American Engineer* 15, no. 12 (December 1945): 15.

Together, these figures reflected much of the triumphalist notions about technology and progress that defined their generation. Their internal discussions of the bomb testify that not only did they agree on the direction of the bomb as a progressive ideal, but that their beliefs were almost directly echoed by the political leaders in charge during this time. American engineers had proven themselves capable, time and again, of orchestrating decisive projects to help win the war. Their authority became increasingly unquestionable, and their places in governmental, military, and private enterprises after the war positioned them well for the dramatic postwar undertakings the United States was to embark on. Perhaps more important was their mentality. Engineers of the engineering generation retained their belief in technologically-led progress, even after repeated crises.

As Paul Boyer writes, the general public expressed contrasting views toward science and technology in the post atom-bomb world. While engineers saw that the challenges presented by atomic power could be satisfactorily met by them, the public expressed alternating suspicion and reverence for those in charge of the project. He notes that American media outlets and novelists portrayed scientists at times as "morally blind," and at other times, triumphant crusaders. [338] The *Washington Post* published an editorial in September 1947, arguing that atomic energy had been presented as a "dread and dangerous and altogether destructive mystery," effectively underlining a fear that continued in the years following the bomb's use.[339]

Yet, for engineers and those high in the Truman administration, such trepidation gave way to a broader trust in engineers that manifested itself in more than just atomic policymaking. Engineers' tendency to identify problems, and useful solutions, had proven incredibly effective in wartime, both in combat operations and atomic energy. As U.S. policymakers pivoted to face

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[338] Paul Boyer, *By the Bomb's Early Light: American Thought and Culture at the Dawn of the Atomic Age*, 1st edition (Chapel Hill: The University of North Carolina Press, 1994). 268-276.
[339] "Lords Of The Atom," *The Washington Post (1923-1954)*, September 27, 1947. 10.

a postwar world that looked nothing like the world before the war, they naturally turned to their engineering allies to execute what amounted to an equally wide-ranging set of challenges facing the country and the world.

Facing a Postwar World

At the end of the war, President Harry Truman had to deal with a damaged global economy which the U.S. viewed from a position of strength. Not only that, the geopolitical relationships that had underwritten international relations had frayed, needing to be stitched back together, or created anew. Roosevelt and Truman's entreaties for British decolonization portended much of that coming shift, as did the Bretton Woods Conference of 1944. Stability became an increasingly important facet of the world order that Truman inherited. Postwar Soviet power emerged from the war as a potential rival in ensuring that stability, and poorer parts of the world that lacked supposed strength from within became target for American foreign policy interventions in many cases for the first time.

Against this backdrop, postwar American foreign policy with Turkey and the rest of the Third World appeared starkly different than what came before the war. As postwar U.S foreign policy would make clear, undeveloped parts of the world carried importance that did not register before the war. That importance came tied to stability and the poor states' ability to resist the charms of Soviet forms of improvement. In the case of Turkey, the war had left the nation in a state of relative isolation. Europe's decimation limited Turkey's already restricted trade opportunities, as markets were in no shape to import Turkish products. More important, Turkey lay due south of the Soviet Union, and continued to struggle with Soviet calls to allow USSR access to the Bosporus and Dardanelles Straits. This pressure caused suspicion in the White

House, and the postwar reorientation of US policy towards countries like Turkey had begun in full. Turkey was in need of military assistance as a bulwark against Soviet entreaties to amend the Montreux Conventions, but US policymakers would gradually see that Turkey's problems extended beyond military need. Turkey was suddenly found to have a "backward" traditional culture and economy, a "problem" that could not go without diagnoses and cures.

Aid, and lots of it, became a means to address all of the concerns voiced by Turkish and American policymaker. Despite not engaging in combat in the war, Turkey received postwar aid funding from the Truman Doctrine, Marshall Plan, and Point Four program, one of only two countries to take funding from all three programs. Each program had its specific aims, but taken together they form the bulk of American postwar development policy. In the end the programs served to provide "improvement" of conditions on the ground in Turkey, with wide reaching effects. Thus began the overt developmental impulse in peacetime foreign policy.

Truman's approach to dealing with poor parts of the world marks a distinct departure from foreign policies before his. This policy was directly in league with progressive thinkers and politicians before him, and posited that above all, the poor parts of the world suffered grave deficiencies that could not be ignored by countries like the United States. Poverty had not always been articulated as a reason for American intervention abroad, but it became so after the war, in ways that largely reflected a sudden general American concern with the rest of the world's internal problems. The "Third World" became a thing to be fixed, and no one was better positioned to do so than Americans.

Engineers became involved in postwar U.S policy for this precise reason. Engineers represented America's problem solvers and assented to the shift in foreign policy through their internal discussions. Solutions to poverty and general national security required the expertise of

those problem solvers en masse, and engineers rose to the occasion with plans and designs on how to achieve the dual goal of eliminating the communist threat. That impulse was naturally shared by both American policymakers and engineers, making their cooperation easy and unsurprising. Progress needed its greatest ambassadors to lead the way in the rest of the world, and politicians saw to it that engineers' unquestioned authority took its rightful place at the forefront of the developmental project.

Engineers emerged in all sorts of programs in Turkey and other poor countries that had the language of development tied to them. Implementing new farming practices, educational methods, and transportation infrastructure in Turkey shared a common progressive ethos that came natural for both engineers and policymakers to embrace. The Turkish road building program (*karayollari programi*) developed by American and Turkish policymakers came populated with engineers from top to bottom. The heads of the Bureau of Public Roads and Turkish Public Works, the groups that took the lead in the program, were educated professional engineers. The people directly subservient to them in their respective offices also worked as engineers, as were those who oversaw day to day operations. Furthermore, outside engineers contracted to assist in the project brought their expertise to bear on the roads program.

Pat Gifford became one of these contractors, hired to share his very specific skills for a very specific purpose. In surveying the infrastructure conditions in Turkey, engineers identified their practical problem. The next step was pursuing a technological solution.

Chapter Four: New Era, New Problems to be Solved

For someone with Pat Gifford's engineering experience, taking a position in Huber's administration seemed like a natural postwar career step. By this time, Gifford was the highest ranking engineer in a company that had never been in better financial shape, with a bigger than ever product line. He earned respect from both his fellow engineers and factory workers with whom he regularly spoke when making the rounds on Huber's factory floor. Other firms came calling from time to time, but he always shrugged off those job offers. Given his contributions to the company, and his rapport with his coworkers and administration, there was little doubt that Gifford had cemented his place at Huber for the long term.

But, Gifford had no interest in a position in Huber's front offices. Perhaps this was for the best. As an executive, he would not be able to craft things like engineers are wont to do, and he valued working in a position in which he felt his strengths were being used. His personal life bore evidence of his anemic ability managing money and running his household. His wife had always controlled the family checkbook, and he fell short in capitalizing financially on his innovative patents. He kept detailed engineering notes and saved most of his sketches in folders and boxes, but rarely noted the cost of the equipment and parts he designed. Those details, it seemed, were best left to someone else. He remained most at home doing what he had always done: designing products to fix practical problems.

In the end, Gifford's choice to stay put as a Huber engineer actually took him further, at least geographically, than any administrative job would have. Throughout the war years and after, Huber sent Gifford abroad to various foreign countries to troubleshoot problematic equipment, and to teach operators how to handle the complicated machinery. He traveled to

Mexico in the early 1940s in response to a defective Huber steamroller purchased by the Mexican government. Gifford also visited Huber vendors in Belgian Congo, France, Iran, and Switzerland, just to name a few. His missions abroad reinforced the notion that Huber's engineering innovations proved useful the world over.[340]

And yet, Gifford's biggest adventure still lay ahead of him after the war. Global postwar economic conditions were bleak, and American policymakers adjusted in a way that seemed almost engineer-like. America stood above the fray, able to collect itself after the war and push on in better shape than before the conflict. To fix global economic problems, and the issues associated with them, U.S. policymakers constructed elaborate aid programs to help damaged economies and militaries rebuild. These policies changed the posture of American foreign policy from intermittent isolationism to a permanent state of internationalism in which American aid would, for the first time, reach previously ignored sections of the world on a frequent basis.

What made American foreign policy engineer-like came in its problem-seeking and problem-solving nature. In the process of helping war-torn places rebuild, policymakers discovered new problems in places they rarely cared about before. Economies were affected by other issues contributing to instability, a growing concern as Cold War grew in intensity. Bad infrastructure in foreign countries emerged as a consistent source of instability identified by American policymakers. In the postwar aid programs, road and railway building became commonplace all across the globe. Engineers, as the highest authorities in road building, served as key cogs in this development machine, deploying their knowledge to improve infrastructure, and opening backward economies to the global marketplace. As a result, Gifford was hired as a

[340] "Huber Engineer Travels 20,000 Miles…Visits Eleven Countries," *The Huber News*, March, 1951, 4-5.

government contractor for the first time in his career, and went globetrotting in the name of American development.

For those of the engineering generation, this dramatic reorientation with the rest of the world would not measure up in significance to their work in World War II, but it would still have long run effects on their careers. Engineers weighed in on the developments in American postwar foreign policy just the same, continuing to point out areas in which they could help the cause. Engineers did not necessarily form policy, but they did possess an influential voice in the policymaking process. They did not select the sites for American aid intervention or other foreign policies, but they legitimized American presence in those places by identifying and addressing problems that necessitated their attention and American intervention. More generally, engineers' thoughts on the postwar world reflected consistency; a deep awareness that there was always a problem to be solved, and technicians were best qualified to do just that.

But, before engineers could talk about their roles in postwar development policy, those policies would have to be enacted by the Truman government. The concerns of American policymakers extended well beyond simple economics, and their debates over the merits of these new development programs emphasized a reality that the United States had entered new territory. Luckily for policymakers, navigating the unknown was made manageable by the willing attitude of American technicians looking for new practical problems to fix.

Truman Courts Engineers

Engineering's involvement in Turkish development was emblematic of a wider trend that saw American technicians doing analogous work in more countries as part of Truman's foreign policy. The Republic was near the start of the development wave, and stood as an early proving

ground for engineers' increasing roles in foreign policy. An unspoken alliance was forged in this process between engineers and policymakers that conveniently reinforced both the legitimacy of engineering as a viable foreign policy arm, and the rightness of policymakers' development legislation. The engineering generation was on the front lines of this trend. As Truman expanded American foreign policy reach through development, it was the engineering generation that first led the projects and benefitted from the changed status of engineers in American society.

The reason for the growing reach of American engineers during and after the Turkish roads program had to do with the common and mutually reinforcing worldview policymakers and engineers held. Engineers shared a progressive and triumphalist view of history that politicians recognized as useful for the promotion of American policies that could incorporate technology to further their aims. Policymakers saw the world largely as engineers did; as space ripe for improvement, albeit for specific state interests rather than the greater good as engineers saw it. Engineers then justified American foreign policies that sought to change the conditions in other countries by consistently finding new problems that only *American* engineers could fix. Only American engineers enjoyed a still robust postwar heavy manufacturing sector that could combine with their engineering mentalities and American geopolitical leverage to further American security interests in places in need of problem solving. But in continually enlisting engineers into foreign policy programming, American policymakers further reinforced the always-growing sense of importance engineers had about themselves. This alliance between engineers and policymakers became closer as time passed and as engineers were deployed in more locations. Technicians had allies all over: in universities, Congress, and most importantly, the White House, which made a problem-solving foreign policy an easy sell throughout the late 1940s and 1950s.

In certain instances, politicians made overt entreaties to engineers to reinforce their aligned worldview. The most outstanding example of this was the address given by a newly elected President Truman at the 1949 annual meeting of the American Society of Civil Engineers in Washington D.C. Truman had attended the meeting to promote his just-announced Point Four plan on technical assistance. In his address, he did little to clarify the proposal, but spoke very highly of the engineering field as a whole as a part of his program's vision. He referenced his promotion of farm-to-market roads in Missouri early in his political career as a result of a partnership with local engineers. Regarding his respect for the field, Truman quipped, "if I have my way, the Department of State will have some engineers before we get through." Although he was playing to the crowd, his words reinforced the already high opinion the field had of itself.

When his focus shifted to the global issues Point Four engaged, his praise of the field only grew. This excerpt from the address revels both how closely his perspective on the world aligned with the engineering mentality, and how he perceived the connections between national security and engineering for the greater good.

> *I think that the contribution that you gentlemen make to the welfare of this great nation, and that you can make to the welfare of the world, should be a very great satisfaction to you…There is a struggle now going on between two ideologies. One of those ideologies is backed by a moral code and one is backed by no moral code. My ambition is to show that ideology backed by a moral code can do the best for the people of the world. I am just as sure of that as I stand here. And I hope that all the engineers of this great United States of ours, and all the other great technical men – the architects, the physicians- everybody who has a special skill for the welfare of humanity, will inform himself on just exactly what I mean by Point Four. It will mean: if we can make a contribution in the know-how, and raise the standard of living just two*

percent of the rest of the world, our factories and our businesses never could catch up with the demand that would be on them. Just think of that! That's all we need to do. It is not beyond the bounds of possibility. There are resources in this great world that never have been touched. There are resources in Africa, in South America, in Asia--the most wonderful resources that the world can produce. And if those resources produce things for the welfare of the people of the world, to keep the world from being hungry, then no one would have any idea of carrying on a destructive war for the purpose of obtaining something that didn't belong to them. That's what the cause of wars has been. It has been the idea of grasping something that the other fellow has.

Now, let's try to make the other fellow as contented as we can be, by helping him develop his resources for his own welfare and benefit. [341]

Truman's appeals to engineers were genuine, but also calculated. Those with the ability to solve problems were first in line to use their skills abroad in development projects that went far beyond road building as the 1950s wore on. Executing Truman's broader foreign policy aims through development programs necessitated engineers of all types, and Turkey, he knew, was just the start. As a result, engineers of all stripes - and not just the old guard, civil, mechanical, chemical, and mining specialties - found places in the development apparatus.

Along with Truman, the 80th Congress, in session between January 1947 and January 1949, deserves special mention as a boon for engineers and aid programs. Not incidentally, that Congress contained a number of engineers. In the Senate alone there were seven trained engineers when the Truman Doctrine was enacted, which stands as a sizeable number for a non-law profession. One member of the 80th Congress was one of the most visible engineers in the

[341] Harry S. Truman,: "Remarks to the American Society of Civil Engineers," November 2, 1949, online by Gerhard Peters and John T. Woolley, *The American Presidency Project*, http://www.presidency.ucsb.edu/ws/?pid=13348.

country at the time: Republican Senator Ralph Flanders of Vermont.[342] Already mentioned in this thesis for his arguments in support of aid programming, Flanders became one of the most visible engineers in the country by the 1950s. In the 1930s, Flanders served as President of the American Society of Civil Engineers, penning think pieces in response to various national crises, some of which were cited in earlier chapters of this thesis. By the time he reached Congress, Flanders became an ardent supporter of the postwar development policies, and voted for both the Truman Doctrine and Marshall Plan. He would still be a member of the Senate in 1950 for the Point Four program vote, and it was stated in the record he would have voted for that bill as well if he was not absent during the roll call vote.[343] Millard Tydings, a Democrat from Maryland, was another engineer in the Senate, and held perhaps more influence that even Flanders. Tydings served on the Senate Foreign relations committee during the 81st Congress when Point Four legislation passed, and he also voted in favor of all three development policies.

Members of the 80th Congress, and those who won reelection to the 81st, were quick to support other engineering-related legislation as well. On the occasion of renewing an Army Corps of Engineers appropriation in 1952, Tennessee Senator Kenneth McKellar stated, "I wish to digress long enough to say that I believe the Army engineers to be the greatest organization of engineers anywhere in the world. They know their business; they are honest and upright, and efficient in every sense of the word…Their management and control of the work entrusted to them has been characterized by ability and professional skill."[344] Politicians' appeals to engineers were emblematic of a wider shared worldview, and those congressional members who voted in favor of aid did so with a belief that American expertise and technology could be at least a part of the future of American foreign policy. Certainly, the geopolitical expediencies of the

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[342] "Roll Call Vote," *Congressional Record* (March 13, 1948) 2793.
[343] "Roll Call Vote,", *Senate Bill 3304* (May 5, 1950): 6490.
[344] "Remarks by Kenneth McKellar,", *Congressional Record, Senate* (Thursday, June 19, 1952): 7583.

time emerged as a more significant aspect of their choice to pass aid bills than a belief in American modernity, but the forces of technology were not ignored. Especially for technicians in Congress like Flanders, engineering and American technology offered plenty of evidence for supporting an American modernizing mission in the world.[345]

Forming a Turkish Mission

Out of the Truman Doctrine came an initial allotment of $400 million to fix problems in both Greece and Turkey. The aid package for both Greece and Turkey seemed like an optimistic amount at the time. In truth, that allotment was magnified to serve an impressive number of purposes over the bill's life span. The $100 million for Turkey funded the work of a centralized military coalition that carried out remarkably widespread aims for such a small amount of money. Specifically, the aid provided funding for a new Survey Mission to identify Turkey's needs and how to allocate the funding. The Survey Mission began its work in May 1947, suggesting that the earlier State Department reports were accurate about Turkish military and infrastructure conditions. Pushing men and war materiel through Turkey in the case of Soviet aggression would demand an efficient and sturdy network of all-weather roads, something the current system lacked. Specifically, they reinforced the standing notion that Turkish roads and maintenance equipment were inadequate for a nation on the front lines of an emerging Cold War. Consequently, part of the funding package would be dedicated to infrastructure building.[346]

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[345] "Roll Call Vote, S938,", *Congressional Record* (April 22, 1947): 3793.
[346] *FRUS* 1923, Vol. V, (1947), 879.

After the Survey Mission, the Truman aid package funded a new military task force, the Joint American Mission for Aid to Turkey (JAMMAT).[347] The JAMMAT served as a multi-faction group established with the goals of training Turkish military servicemen, providing new weaponry, and improving infrastructure - all in the hopes that these reforms might be used to execute Truman's vision of creating a Turkey beyond Soviet reach.

Under the purview of U.S. Ambassador to Turkey Edwin Wilson and program coordinator George McGhee, officials organized the JAMMAT into four sections. Three of them directly oversaw training and supply for their respective military branches: the Air Group, Army Group, and Navy Group. Each branch addressed the specific deficiencies possessed by their Turkish counterparts and worked to improve them. The total military personnel after the war sat at around 1.7 million men, meaning reforming the force would require quite an effort from all sides. [348] At this time, the Turkish Air Force was small (about 300 usable planes) and deficiently armed with a hodge-podge of European-made aircraft. It possessed mostly old models of British Spitfire and Hurricane fighters, and had almost no bombing craft. Moreover, the Turks had little ability to train their own elite fighter pilots. The Turkish military mandated military service for all-able bodied young men (called the *askerlik* in Turkish), and had a hard time stationing each soldier in units best fit for them. The result was often that the best potential Turkish fighter pilots were not identified by Air Force staffers, which speaks to the organizational issues in the Turkish military.[349] As for the other military branches, the Turkish Navy lacked vital training capabilities

[347] The American Mission for Aid to Turkey (AMAT) was reorganized into the Joint American Military Mission to Turkey (JAMMAT) in 1949. Most histories dispense with the AMAT acronym for simplicity's sake, and this one will, too.
[348] Osman Yalçın, "İkinci Dünya Savaşi Sonrasinda Sovyet Tehdidi Karşisinda Kalan Türkiye'nin Bati İle İşbirliği Yapma Süreci" (The process of Turkey's Cooperation with the West against the Soviet threat after World War II), *Turkish Studies* 8 no. 5 (Spring 2013): 919-958.
[349] Craig Livingston, "'One Thousand Wings': The United States Air Force Group and the American Mission for Aid to Turkey, 1947-50," *Middle Eastern Studies* 30, no. 4 (October 1994), 781-782.

for advanced ship and radar technology, and had only a limited collection of small submarines.[350] The Army of 1947 was largely outfitted as the Poles were at the time of the Nazi invasion in 1939: riding horseback with outdated small arms.[351] In each case, the JAMMAT had its work cut out for it in order to improve conditions in all three branches.

American military men with engineering backgrounds made up a great deal of the JAMMAT's leadership. West Point graduate Horace L. McBride served as a top military advisor for the program in Ankara, and had the requisite extensive engineering training while at the academy.[352] Colonel Thomas H. Lipscomb, another Army engineer, became central to the JAMMAT's later organizational operations in Turkey, instituting an engineering-specific branch of JAMMAT in 1949.[353] Lipscomb's motivation to create the new branch had to do with the increased need for Air Force facilities and infrastructure in the JAMMAT. An engineer group staffed with military technicians would take over those concerns and become the centralized construction section of the JAMMAT.[354]

The JAMMAT's Army, Air, and Navy Groups dramatically altered the complexion of the Turkish defense system. The Turkish force itself may have been large thanks to the *askerlik*, but the JAMMAT drastically changed the function of that sizeable force. American leaders seemed intent on reorganizing how the Turkish military worked from the ground up. As a part of its Air Force shipments, the Turks received American P-47 Thunderbolt fighters and various training

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[350] Munson, "The Joint American Military Mission to Aid Turkey," 81.
[351] RAYMOND DANIELL, "Turkey -- Uneasy Buffer Between East and West: She Fears Russia's Power as She Stands at the Crossroads and Looks for Guidance. Turkey -- Uneasy Buffer Between East and West," *New York Times*, April 27, 1947, sec. Magazine.
[352] United States Military Academy, *Official Register of the Officers and Cadets of the U.S. Military Academy, West Point, N.Y.* (United States Military Academy Print. Office, 1913) 30.
[353] Robert P. Grathwol and Donita M. Moorhus, *Bricks, Sand, and Marble: U.S. Army Corps of Engineers Construction in the Mediterranean and Middle East, 1947-1991 (Paperback)* (Government Printing Office, 2009), 18. Incidentally, Lipscomb was later court-marshalled in the 1960s for "illegal command influence" while at a different post.
[354] Robert P. Grathwol and Donita M. Moorhus, *Building for Peace: U.S. Army Engineers in Europe, 1945-1991,* (Washington, D.C.: Center of Military History and Corps of Engineers, 2005), 83.

craft.[355] The Navy received new radar technology and training, a torpedo shop, and newer American destroyers and submarines.[356] The Army was improved with more capable M-24 tanks and M-36 tank destroyers, among other war materiel.[357] Beyond this, the JAMMAT provided training in all the requisite operation of new the technology. In a curiously engineer-like fashion, the JAMMAT undertook a variety of efficiency and effectiveness studies in Turkey, with the goal of reorganizing how the Turkish air defense, communication, intelligence, and military education systems worked.[358] Although these studies doubtless served American interests through buttressing potential Soviet detection mechanisms, they were also consistent with the engineering-minded officials at the head of the various military group branches. Additionally, a number of Turkish sailors, troops, and pilots were sent to U.S. service schools for advanced training in their respective areas. Some of those military personnel were specifically sent to the U.S. Army Engineering School in Germany for instruction in advanced aeronautical engineering methods.[359] American policymakers acknowledged that the aid rendered had been to credit for the lack of violent overtures by the Soviets toward Turkey. The aid given up to March 1950 had produced some noticeable benefits to relieving the financial pressures on the Turkish military. Notably, the aid program reduced the Turkish fighting force's size since the start of the program, which had around $236 million thus far. The paid program for 1951 was slated to bring additional aid that would specifically be used for purchasing agricultural equipment to continue to service European food imports from Turkey.[360]

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[355] Munson, "The Joint American Military Mission to Aid Turkey," 77.
[356] Ibid, 79.
[357] Ibid, 91-92.
[358] Ibid., 86-88.
[359] US Department of State, Fourth Report to Congress on Assistance to Greece and Turkey, NARA, RG 30 (Bureau of Public Roads, Classified Central File, 1912-1950), .015, NARA,box 509
[360] Ibid, 1236-1238.

Staffing the Roads Group

The fourth section of JAMMAT, the Roads group, was made up of a markedly different band of staffers. Civilian engineers under the purview of the U.S. Bureau of Public Roads- the same organization that saw its advent during the Good Roads Movement in the United States as the Office of Road Inquiry- worked alongside engineers of the Turkish Bureau of Public Works to survey and plan the modernization of vital infrastructure across the entire country. The Army Corps of Engineers became involved in the Turkish aid program on a much smaller scale than they were in Greece, where Army engineers spearheaded much of the bridge and road building in that country during the Truman Doctrine.[361] Turkish infrastructure, however, became a job for the Bureau. Even with the vast engineering expertise in the military arms of JAMMAT, the highway group emerged as a bastion of engineering thought and practice during its work in Turkey.

By the middle of the 1950s, large-scale American road projects abroad would become commonplace as the Cold War expanded in geographic scope.[362] But in 1947, big road projects abroad were nothing if not experimental exercises for policymakers and engineers. For now, implementing this new U.S. foreign aid package would remain, as noted by historian Edwin Munson, an exercise in learning on the job.[363] Turkey, along with the Philippines under the Philippine Rehabilitation Act of 1946, stood among the first of these large scale state-led foreign road programs the Bureau oversaw.[364] Funding for the roads group came on the order of four and

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[361] US Army Corps of Engineers, *The History of the US Army Corps of Engineers*, 113.
[362] Bruce Edsall Seely, ‚Donald El Klinger, and Gary Klein, "'Push' and 'Pull' Factors in Technology Transfer: Moving American –Style Highway Engineering to Europe, 1945-1965," *Comparative Technology Transfer and Society* 2, no. 3 (December 2004): 236.
[363] Munson, "The Joint American Military Mission to Aid Turkey," 72.
[364] Department of Commerce, *Annual Report: Bureau of Public Roads* (1950):, 24.

a half percent what was given to the Army, Navy, and Air branches of JAMMAT by the fall of 1948. No matter, as the Bureau found ways to stretch its initial allotment across a variety of tasks.[365]

For years before the Truman Doctrine, Bureau staff led the way in road engineering in the United States, completing massive modern road systems that were among the most expansive modern systems in the world. Notably, the daring Alaska Highway was completed at the end of 1943 after just twenty-one months of work, a project which required thousands of workers and covered over 1,500 miles of roadway across forested and hilly terrain. The road itself ranged between 1000 and 4500 feet in elevation, effectively testing the capability of the Bureau to tackle single-track projects over such varied environments.[366] Since the Turkish project would eventually encompass Thrace in western Turkey to the Ağri Provence in the east, the Alaska Highway became a model of sorts for the Turkish project. On repeated occasions, American engineers shared graphs, maps, and images of the Alaska project with Turkish officials. Not only that, the Bureau brought on people like Jack Killalee who served on the Alaska project directly to contribute their experience to the Turkish context. Bureau officials promoted their achievements in places like Alaska to reassure Turks that they were capable of doing the same in Turkey, but were reminded that, although the Bureau had the knowledge base needed for big projects, it also required advanced equipment to make them a reality. Since the Turks did not manufacture heavy equipment or automobiles themselves, a great deal of the Truman Doctrine

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[365] Fifth Report to Congress on Assistance to Greece and Turkey, for the Period ended September 30, 1948, Truman Library, Official File, Box 426.

[366] William Eager and William Pryor, "Ice Formation on the Alaska Highway," *Public Roads: A Journal of Highway Research* (U.S. Federal Highway Administration., 1945), Vol 24, no 3, p. 55 .

funding would be allocated to purchasing American heavy construction equipment and parts, usually from Midwestern firms like Huber.[367]

Engineers featured prominently in the language of American road development policy in Turkey from the start. The text of the agreement between the U.S. and Turkish ministry of Public Works to establish a roads program noted that the project would be carried out partly through the "training of Turkish nationals in the use and maintenance of certain highway equipment…" Technical experts were initially addressed in the document as "selected personnel of specialist character" who would help put large scale projects into action at the Roads Bureau's direction [368] Consequently, engineers pervaded most aspects of the project. From the engineers at the top of the Bureau and Turkish Ministry of Public Works, to the private contractors who trained groups of Turkish operators, the roads project became the realm of engineers and their problem-solving mentalities.

Their initial purpose as a part of the Roads Group was to "establish a long-range highway improvement program" in Turkey. The steps on the path to this end included:

1) *Inspection and studies of the topography, the present condition of the roads, and such other physical factors as soil types and available local materials;*
2) *Economic studies of present and potential kinds and uses of improved highways, particularly with reference to the national security and the distribution of essential commodities;*
3) *Preparation of estimates of cost of proposed improvements;*
4) *Methods and types of construction and maintenance and their application to the actual operations;*

[367] Dispatch no. 616- Annual Automotive Report, May 21, 1951, NARA, RG30, box 209.
[368] Agreement Between the American Mission for Aid to Turkey and the Ministry of Public Works of Turkey Pursuant to the Agreement of July 12, 1947, NARA, RG 59, Box, 30;

5) *A study of equipment and equipment maintenance shop requirements to carry out a national program;*
6) *Establishment of highway laboratory facilities designed to meet Turkish requirements; and*
7) *Training of Turkish personnel in highway construction, maintenance, and administration* [369]

The head of the Bureau at this time was Tom MacDonald, an Iowa State College-trained civil engineer who manned the Bureau helm in Washington from 1919-forward. MacDonald loomed large over road-building practices in the U.S. before the war, advancing the Bureau agenda with greater research funding and pursuing more national control over road building practices.[370] MacDonald's staff at the Bureau was comprised of a cadre of mostly civil engineers, many of whom remained in their posts for decades alongside MacDonald.

The top American on the Turkish roads program was Harold E. Hilts, a civil engineer trained at the University of Pennsylvania. Born in 1882, Hilts moved throughout the country after receiving his degree in 1905 pursuing various engineering opportunities. His early appointments took him to the Mexican International Railroad and the New York Central Railroad. Later, Hilts moved into a position with Portland Cement, main player in the road paving industry, first working the Northeastern U.S., and later in San Francisco offices. In the 1920s, he won a patent for an innovative road surface-finishing machine that made the process of smoothing a new roadway more efficient with wide track "side forms" that allowed the machine

[369] US Department of State, *The Turkish Aid* Program (Washington DC: Government Printing Office, 1948), NARA RG30, box 509.
[370] Landis, Leo, "MacDonald, Thomas Harris," *The Biographical Dictionary of Iowa*. University of Iowa Press, 2009.: http://uipress.lib.uiowa.edu/bdi/DetailsPage.aspx?id=241

to be set up outside of the roadway being smoothed. His machine adapted to different surfacing materials, and was cambered to account for a surface arc on a given roadway.[371] Although it is unclear whether he was able to parlay his invention into any commercial success, his innovation proved his bona fides in engineering.

Hilts joined the Bureau in 1933, and reached a Deputy Commissioner position by 1946.[372] In this capacity, Hilts contributed to various engineering periodicals and research studies to improve further the nation's infrastructure. As American engineers became more experienced in different types of road building and grades, Hilts promoted expressway construction to connect better the nation's big and small towns.[373]

After the approval of the Truman Doctrine in 1947, Hilts received a promotion to head the Bureau's project in Turkey while retaining his Deputy Commissioner position. Hilts remained in his Washington office most of the time, with periodic extended visits to Turkey. Nevertheless, the no-nonsense Hilts quickly began assembling his staff in October 1947.[374]

Hilts focused his efforts on finding engineers of similar experience in the field, rather than newly minted technicians. As a result, he largely promoted from within the Bureau. The head American engineer permanently stationed in Turkey was Jesse E. Williams, who served as

[371] Harold E Hilts Harold E, Finishing-machine for roads and the like, US1392161 A, filed February 9, 1921, and issued September 27, 1921, http://www.google.com/patents/US1392161. "Harold Hilts," , *Engineering News-Record* (McGraw-Hill Publishing Company, 1917). 579.
[372] Division of Public Inquiries Office of War Information, *U.S. Government Manual, 1946* (Washington D.C.: Government Press Office, 1946), 405.
[373] John F. Bauman,"The Expressway "Motorists Loved to Hate:'": Philadelphia and The First Era of Postwar Highway Planning, 1943-1956," *The Pennsylvania Magazine Of History & Biography* CXV, No. 4 (October 1991): 526.; H.E. Hilts, "Planning the Interregional Highway System," *Public Roads* 22, no. 4 (June 1941): 69.
[374] "Memorandum for Director P & O Division from General HL McBride," RG30, .015, box 209; the Roads program was officially severed from the military arms of JAMMAT in 1947, to be fully run by the American Ambassador in Turkey and the Bureau.

a district engineer for the Public Roads Administration in Santa Fe, New Mexico before moving into the Division Engineer role in Ankara.[375]

Jack Killalee took a similar path to Turkey through the Bureau. After his 1925 graduation from Berkeley, Killalee wed his longtime girlfriend, Gladys, and immediately took a position with the Bureau in Arizona building roads near Pleasant Valley.[376] He continued to work on Arizona and California projects until 1935, when he was transferred to the Bureau's planning office. In 1943, Killalee transferred to help oversee construction of the Alaska Highway.[377] When the Truman Doctrine legislation passed, Killalee sat on the Bureau's prospective staff list immediately, and joined the operation in late 1947.

Killalee's experience in Turkey provides valuable information regarding the perspective of the workaday engineer in development. Unlike Hilts and MacDonald, Killalee made his home in the Republic, and worked more closely on the project than either of them. He recorded his excruciatingly detailed habits in journal entries (he made note of what he ate for dinner many nights) which reveal more depth regarding the American engineering experience abroad. Also, his position in the middle ranks of the Bureau provides insight into administrative dealings and more menial engineering events in equal measure.

Killalee's greatest strength as an engineer laid not in his creative problem solving, but rather his exactness and attention to detail. His contribution to the Turkish roads program came in his deployment of these skills- managing record keeping, inventories, and budgets emerged as an increasing challenge for the Bureau as the project got underway. With the immense scale of the program, detail-oriented and managerially inclined engineers like Killalee became some of the Bureau's most valuable assets. Given his two decades of experience with the Bureau by

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[375] Turkish Aid Program- Personnel, April, 7, 1948, NARA, RG30, .015 Box 511
[376] Killalee Family Scrapbook, Jack A. Killalee Papers, Burlingame Historical Society.
[377] American Society of Civil Engineers, "Jack Aldabert Killalee, Killalee Papers, Burlingame Historical Society.

1947, Killalee understood that the agency required ordered relay of information and closely recorded data to function. Killalee's daily duties as a highway engineer in Turkey entailed meetings, report production, and even the evaluation of what to put in the reports in the first place. He had to consider personnel concerns and delays, demand information from his staff from the field, and deal with funding constraints and report them to his superiors.[378] Killalee's duties reveal that the operation of the roads program required more than just creative minds like Gifford's to work. Killalee's detail focus combined with his knowledge of road planning and building made him a valuable asset to the Bureau's work in the Republic, and he served effectively as an efficient project manager.

The engineering expertise at work in Turkey was not limited to Americans. Turkish engineers were keys to the program's effectiveness as well at the highest levels of the Turkish administration. The most important of these was Vecdi Diker, who would become the Turkish Minister of Public Works during the bulk of the program's planning period. Diker was significantly younger than his American counterparts, but his background made him perhaps more similar to Americans than it seemed at first glance. He attended the American-run Robert College in Istanbul, and graduated from the University of Missouri with a B.S. and M.A. in Civil Engineering in 1936.[379] With his American education, Diker obtained a wealth of exposure to American engineering methods, and spent a great deal of time learning road engineering in the field. He then became the Turkish Water and Roads director shortly after graduating from Missouri. Even before the U.S. enacted its postwar aid programs, Diker embarked on

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[378] Journal entry, April 3, 1946, Killalee Papers, Hoover Institute Archives, Box 2.
[379] *Missouri Alumnus* (University of Missouri Alumni Association, 1948).14; Mehmet Barlas, "Yol Vergisinden T.C. Karayolu'na," (Taxes from roads to Turkish Republic highway agency), *Sabah*, August 22, 1997.

engineering learning missions in the U.S., which further convinced him that certain aspects of the American system were needed in Turkey.[380]

When he later took the position of Director of Public Works, he pushed for a Turkish highway overhaul project in which he collaborated with Americans like Hilts and Killalee. During their working relationship, Diker and Hilts communicated and traveled together regularly, creating a rapport along the way. Like any working relationship, there were points of strain and disagreement between the two project heads, but there was also consistent mutual admiration. Their ability to discuss on the ground events, and their shared belief in how engineering could help Turkey's problems, made for a much more orderly program as can be expected for such an unwieldy and unprecedented undertaking.

Hilts encountered difficulty finding qualified and interested engineers in the early stages of the Roads Group staffing process. He repeatedly exchanged cables regarding the need for specialty engineers, especially bridge experts. One reason for that difficulty had to do with the fact that candidates often turned the Bureau down when asked to join the Turkish program. They usually did so over concerns with being apart from family while working abroad, especially those technicians with children. The result of the staffing process helpfully explains how the engineering generation became so central to the complexion of postwar development work. As could be expected, working abroad brought with it a number of logistical challenges. Not the least of which was the problem of moving an engineer's wife and children to a foreign place. Living apart from family for perhaps months at a time became the other more challenging option.

[380] "Vecdi Diker, Form-I466 Information Sheet," March 28, 1945, NARA.; Arrival: *New York, New York*; Microfilm Serial: *T715, 1897-1957*; Microfilm Roll: *Roll 6934*; Line: *1*; Page Number: *101B; Howard Teaf echoes this take on Diker's faith in modern roads in* Teaf,, H. Morris. *Hands across frontiers: case studies in technical cooperation* (Ithaca, N.Y.: Distributed by Cornell University Press, 1955).

Especially for those young enough to have served in the military during World War II, living far apart from family again so soon after the conflict became was a familial obstacle for most.

Those of the engineering generation took most of the roles abroad because they were usually too old or valuable for the war effort at home- but were still young enough not to be retired yet. Engineers born before 1904 lay just outside the initial peacetime World War II draft through the Selective Service Act of 1940. Further, engineers had been specifically singled out as experts vital for the domestic war effort, compounding the reasons for keeping many more-experienced engineers home.[381] The later temporary expansion of the Selective Service Act to include engineers born between 1897 and 1904 produced less than 2% of the total U.S. Army fighting force. In other words, even with the draft, those of the engineering generation were the least likely still-practicing professionals to serve in the war effort. Most of the engineers who took foreign posts were older engineers with grown children or widowers. In the end, while younger engineers may have been discouraged from leaving the U.S. again so soon after their military service (or simply not experienced enough yet as engineers), the engineering generation was freed up for extended postwar foreign assignments in Turkey without shirking family obligations. Some of the engineers of the generation did bring over their families, but they were usually smaller families or those with teenaged children. Those individuals that finally took positions in Turkey would entrench themselves for years as Turkey's highway program was defined and widened.

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[381] "Selective Service Act" in I. C. B. Dear and M. R. D. Foot, eds., *The Oxford Companion to World War II* (Oxford ; New York: Oxford University Press, 2002).; "United States World War II Draft Registration Cards, 1942," NARA microfilm publications M1936, M1937, M1939, M1951, M1962, M1964, M1986, M2090, and M2097. Washington D.C.: National Archives and Records Administration.; Selective Service System, *Occupational Bulletins Nos. 1 to 44 and Activity and Occupational Bulletins Nos. 1 to 35* (Washington, D.C.: Government Printing Office, 1944), 4.

Despite delays filling certain individual positions on the Turkish roads project, private engineering firms pounced on the opportunity to work on the program. The State Department and Bureau of Public Roads fielded inquiry after inquiry regarding potential contract work in Turkey from American and some foreign engineering firms. Throughout the latter half of 1947 and into 1948, these firms presented their cases for why they could provide requisite expertise to help move the Turkish project along. In some cases, firms broadly angled to subcontract the entire Turkish program wholesale by citing other large scale road engineering projects their firms completed in the past. Foreign governments even contacted the Bureau about potentially selling their homegrown manufactured equipment for use in the Turkish program.[382]

The Bureau typically filed away foreign sales pitches for posterity, but American equipment manufacturers gained much from the Turkish roads program. The aforementioned equipment gap in Turkey only amplified the role American manufacturers, and their engineers, would play in the Republic. Over the course of the roads program, the same firms that the U.S. government depended on to provide equipment for the war effort continued to contribute to American foreign policy aims through postwar development projects. Many of these makes came from the Midwest, and their machines became vital tools due to their capabilities to change landscapes and make modern highways a reality in places that saw nothing of the sort before.

The Roads Group internally organized itself with respect to its duties, establishing ultimately seven sections under which to administer various functions of the group: planning and programming, surveying for roads and bridges, materials testing, construction, maintenance, accounts and procurement, and administrative. Each section was headed by a Bureau engineer who would report to Williams, who would then report directly to Harold Hilts and MacDonald in

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[382] "Dane to Helmintoller" August 7, 1950, NARA, RG30, .015, Box 507; "Thomas to Curtis," December 1, 1947, NARA, RG30 box 509.

Washington. Although the Bureau could use their past experiences like the Alaska Highway to inform their approaches, the Turkish highway system still presented unique challenges. Bureau projects in other countries were considerably less ambitious than the work the Bureau undertook after the war and its logistics proved to be a central obstacle especially in the project's early years. Tackling those challenges demanded a mindset that engineers readily deployed.

Indeed, the Turkish aid program presented an overabundance of work for engineers at all levels. Engineers were needed at the broader planning levels of the Bureau and Turkish Ministry of Public Works, in the Turkish project sites themselves, in testing laboratories and repair shops, and to instruct Turks in the use of the heavy modern equipment. Engineers at home like Gifford contributed early on by continuing to produce heavy machinery for export to Turkey. As will be shown, the work of engineers on the ground in Turkey utilized their skill sets in a variety of ways. Regardless of their positions, it became clear that the nature of engineers' expertise came to reinforce their self-important notions of their profession. The more demanding the challenge, the more engineers found ways to overcome those barriers, and with government support, their work fueled a positive feedback loop regarding their roles in remaking the Turkish landscape, and development thinking in general.

Engineering in Practice in Turkey

In December 1947, two Bureau engineers embarked on a trip to survey the state of roads running between the Mediterranean town of Iskenderun and Malatya in the Turkish interior. The process the two engineers undertook involved much more than terrain measurements in the traditional sense of "surveying." This sort of surveying involved taking full inventory of the conditions in the space between the two towns; they noted the quality of the roads, the state of

the terrain, climate environment, along with the natural and human resources needed to make all-weather infrastructure a reality in the region.[383] They reported to Division Engineer Williams with their findings, noting that large portions of the region's roads needed "heavy" repair work to be truly operable.[384] The report would be used to develop a portion of the broader Iskenderun-Erzurum road improvement program that would later be approved by both the Bureau and Public Works Ministry officials in 1949.[385]

Over the following years, this process repeated many times over across Turkey as Bureau and Public Works officials attempted to get ahold of the specific challenges ahead of the roads program. Surveys revealed that the Turkish road system was, as expected, outdated compared to American counterparts. The system amounted to approximately 20,000 kilometers of roadways which required some level or reconstruction or maintenance.[386] Included in that sum were a number of narrow or light duty bridges unsuitable for auto traffic. In 1946, the totality of Turkey's asphalt paved roadways was 530km, and the rest of the nation's roads had largely been untouched by any improvements for decades. And, without proper expertise, those improvements could not me made. In Killalee's words, the Turkish highway system functioned like a cart without a horse: "Imagine trying to run a mechanized project with no operators or mechanics available."[387]

For each section of roadway to be built, Turkish Public Works Ministry and U.S. Bureau of Public Roads officials collaborated on elaborate reports and agreements to be signed jointly by

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[383] "Hilts to MacDonald, "Report for week ending December 12th," December 24, 1947, NARA RG30 ,.015, Box 509.
[384] Williams to MacDonald, "Report for week ending July 10, 1948," July 14, 1948, NARA RG30 Box 509
[385] Project Agreement 5-403, February 10, 1949, NARA, RG 30, Box 511
[386] Memorandum to George McGhee, 12 October , 1947, NARA RG30, .015, Box 209, Later reports noted that Turkish officials estimated that Turkey possessed 147,000km of roads "passable at least to ox-carts." See "The Roads Program" US Bureau of Public Roads- Department of Commerce, February 15, 1955, NARA, RG30 .015, Box 207.
[387] Killalee to unknown, January 15, 1948, Killalee Papers, Burlingame Historical Society.

the two parties. These reports were extensive and comprehensive, covering all material and labor estimates, with detailed drawings and calculations, and rational for using a particular grade and surfacing method on a given stretch. These agreements listed the required hours needed and equipment appropriate for the job. The reports noted where less intensive work was required, and the elevations and widths of each road section.

The Turkey-wide project's scope gradually expanded as the Bureau and Turkish Public Works officials inventoried more of the nation's roads. Surveys were carried out in all regions of Turkish territory, with the ultimate master plan dividing the nation up into eleven regions, essentially groups of a handful of provinces, in which work would be monitored. Regions in western Turkey were numbered first; Istanbul and the Marmara region were Division I, and the numbers went sequentially up, moving east all the way up to Division XI. The roads to be improved were categorized under four groups in order of priority. Those roads repaired for shipping, military, and population centers took "first priority" and those that demanded complete ground-up construction were more likely second or third priority. Roads connecting Ankara in all directions received high priority treatment. Turkish national Route 1, which ran from Hatay Province and the Syrian border in the south, north to Ankara, and pivoted west toward the Bulgarian border, was a high priority. Other key routes were the previously mentioned 870-km Iskenderun-Erzurum highway, and the southern highway that followed points west of Toprakkale. Set apart from the general classifications was the nearly 900-kilometer southern stretch of road around Iskenderun, which, due to its seaside location, was to serve as a centralized transit artery for all aid material and personnel being brought into the country.[388]

[388] Report on the Road Progress from the Ministry of Public Works – Department of Roads and Bridges, September 1949, NARA, RG469, entry 1399, box 53 ; "Priority map," ,NARA, RG469 (Mission To Turkey, Box 53

Engineers' survey reports reflected the engineer mentality in their consistent adherence to a positivist belief in engineering technology. In all sections of the country, engineers noted various obstacles to road improvements. And yet, they always found a way around those obstacles using different technology, labor, or construction methods. In backing their findings up with statistics and numerical measurements, engineers solidified that they could in fact overcome any terrain, personnel, or environmental obstacle with supposedly objective and quantifiable reasoning. The reports for each highway section were, thus, authoritative and definite policy markers for the Turkish project.

In essence, these surveys were engineers' first forays into their new roles as development experts. Engineers were known as problem solvers, but the Turkish program brought another of their skills to the fore: problem *finding*. American and Turkish officials knew the basic problem with Turkey's road years before the improvement project began. In a vague sense, Turkish infrastructure hindered security and economic capabilities that the Republic needed to move them into a state of "stability" during the Cold War. The entire Truman Doctrine was created in response to that very broad problem. But, the specific conditions that caused bad roads in Turkey were not fully understood. With their adeptness at finding ways to insert new technology and methodologies into any situation, engineers were able to identify the smaller problems that caused the larger issue of bad infrastructure. It was not, in the end, that the Turkish road system was just bad. With the ways engineers identified the smaller problems in Turkey's system, "bad" became synonymous with "lack." Turks were found to have not enough trained personnel and engineers, not enough modern equipment, or advanced maintenance facilities. They lacked automobiles and trucks, a natural result of a lack of modern road surfacing methods. In fact, each and every roadway surveyed was found to have at least some smaller problem to be fixed at

some level by engineering work. Engineers could surely remedy those gaps through proper planning, and strove to do so whenever they identified a perceived need. As a central component to American work abroad, engineers would encounter, time and again, new “problems” which for one reason or another, supposedly contributed to Turkey’s present state of backwardness.

The aforementioned surveys became the keys for that expansion. These surveys served as tools for grasping the scope of the program’s path by producing plenty of data for Hilts and Diker to use in their planning. Through them, they gathered the needed specifics about how much work needed to occur, and where. While roadways between Ankara and points south seemed to be in better shape than expected, other roadways, especially in the southern provinces, were in need of total reconstruction or relocation.[389] Hilts and Diker personally experienced driving on extended stretches of roadway in Western Turkey in such condition that they reportedly averaged “16 miles per hour.” Hilts chalked up the disrepair many roads were in to the fact that Turks in the interior had not had to yet confront automobile travel on a mass scale. The result was that the roadways were obviously not built with cars and trucks in mind, but livestock carts and caravans. Bridges were generally found to be too narrow for cars to cross safely, and in many roadways needed surface treatments to keep them from eventually eroding.[390] Further, the surveys found that the low elevations of some roads needed new grades to keep them above the floodplain. For example, surveys found that the plans for a Toprakkale - Tarsus road in southern Turkey required a great deal of new grading work due to the low lying elevation and potential for flood overruns.[391] Helpfully, some road projects lay serviceably close to important resources. Engineers noted when a certain stretch of road could be supplied by a gravel or timber source, for example, which might help along the projects being planned.

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[389] Report for the week ending December 12th, Dec 24, 1947, NARA RG30, Box 509.
[390] Report No. 5a from Hilts to MacDonald, January 3, 1948, NARA, RG30 Box 509.
[391] Hilts to Williams, August 24, 1948 NARA, RG30, Box 509

Engineers involved in the Turkish project thus became the authorities in identifying problems, and their word was usually taken at face value by those in Washington. Policymakers trusted the administration of the Bureau to the engineers in charge, and their use of any development funding was up to the discretion of the same engineers who found the problems to begin with. This is not to say that engineers had subversive intentions when given the ability to allocate development funding, but that control did further empower engineers in their endeavors. With the loosening of American development purse strings, these associated projects were not much of a problem, in the end. Over the succeeding years, the $5 million fund for the roads project out of the Truman Doctrine would be far overshadowed by later programming that supported the expanded work being done in Turkey.

Day to Day Operations

Once officials approved a certain roadway for improvements, engineers were most in their element in the day-to-day operations of the roads project. As the project moved forward, engineers tackled smaller issues relating to road and bridge construction which fit their mentality as problem solvers. The suitability, for instance, of welded I-beams for bridge trusses instead of rivets or turned bolts, were small problems that engineers needed to weigh against their available resources, standards set by the Bureau, and funding. Should a fillet weld be used on one or both sides of a truss angle joint? In what situations should curbs be added to bridges? Should it be a matter of length or traffic volume? What about locating appropriate paint to cover steel beams with that would appropriately protect the steel?[392] These questions covered the everyday challenges encountered by engineers on the ground in Turkey. Although they lack the broad

[392] "Hilts to Williams- Standard Welded Truss for Bridges in Turkey" August 16, 1950, NARA, RG30, .015, Williams to Hilts," July 14, 1950, box 509.

interest and implication for foreign policy, someone (engineers) had to deal with these issues on a daily basis. Since large scale development projects globally demanded similar attention to detail, engineers came to symbolize the managers of those smaller scale problems that could delay or enable a project's progress.

In the field, engineers tested building materials for strength and durability and experimented with new designs. Fred Hartford, a Bureau bridge engineer once noted that he and Turkish engineers Nihat Bolgen, Nadir Uluc, and Orhan Mersinli designed a tested bridge truss designs while in the field. The group set up closely measured welded trusses and piles, using steel plates to simulate auto loads on the trusses. Using Aims tension dials, the group measured distribution of tension on bridge trusses, and inspected welds under different loads. The group reported the results of the experiment to prove that "welding done in Turkey can be reliable," and that this rather simple bridge design method could actually be implemented quicker than concrete bridge making. In contrast to concrete bridges, these welded-truss bridges requires less material, and in turn cost less than typical bridges.[393] Accompanied by the requisite charts and graphs showing effects of the different loads, this type of experiment assumed a sort of authority that only trained engineers could imbue in their work. When questions arose in reference to bridge construction in a particular region of Turkey, decisions could be made on the basis presented by the results of those experiments. In sum, engineering experiments made a difference in how the roads projects progressed. In the event resources were low, alternative cheaper bridge designs could be utilized to great effect. Those alternative bridge designs may not have been an option if not for field experimentation.

[393] "Williams to Hilts," July, 19, 1950, NARA, RG 30 Box 509, The overall experiment was conducted under the eye of Salih Kuyaş, Asst. Bridge Engineer.

Besides bridges and roads themselves, other building projects operated as well. Fixing a roadway was never as simple as clearing, grading, and paving. The way engineers saw it, what good would new roadways be if they were not maintained correctly after they were finished? And how could engineers hope to maintain a roadway without new administration and oversight? What about facilities to deal with equipment breakdowns and storage? In Turkey, engineers constructed parking and storage facilities, requested more equipment than originally planned, and extra spare parts to cope with breakdowns of those pieces of equipment. Because they supported the long-range goals of the project, engineers articulated these side projects as being just as important as actual highway building.

Road building itself presented a general challenge, both logistically and design-wise. In each division of the Turkish program, any number of road building operations could take place at a time. Segments of a longer route were attacked piecemeal depending on how intensive the required work would be.[394] To complicate matters further, Turkish building firms would contract certain portions of the project, adding logistical challenges and red tape. Not only were Bureau and Public Works engineers charged with managing the personnel, they had to keep an eye on both supply levels, costs, and any potential obstacles that might hinder progress.

In a clear example of learning-as-they-went, engineers found that "modern" building methods were not synonymous with "cost-efficiency." Although the possibilities for mechanized construction went far beyond what existed before American aid, the costs of doing modern road building sometimes outpaced its benefits. By one estimate, using gasoline powered equipment to excavate new roadways was on the order of four times as costly as horse-and hand-powered methods Turks had used before. Seeing cost estimates mount as road projects progressed,

[394] Hilts seemed preoccupied in his cables about the change of seasons. He often warned Williams about speeding up the roadwork in Turkey because of the coming autumn or winter seasons, even as early as July.

officials used slightly anti-modern logic to find a solution. Drawing on their experiences in other foreign settings and the cheap costs for Turkish laborers, the Bureau found that utilizing some hand labor in tandem with modern machines was a cost-effective way to achieve faster results.[395] At least in this context, a modern-traditional hybrid type of engineering had its uses.

The work undertaken by the JAMMAT and the Truman Doctrine aid had proven to be both wide ranging and effective in its aims. Turkish defense concerns were slowly being met satisfactorily by the mission's labors, and American policymakers began to look beyond the Mediterranean as loci for instability. Turkey's economic concerns, however, were not fully met by the Truman aid program. President İnönü campaigned for additional assistance that might be earmarked for strictly economic programming. Although military concerns remained İnönü's first concern, economy trailed closely behind, as evidenced by the order of priorities in diplomatic cables. New submarines and fighter planes may have gone a long way toward steeling the Turks from being overrun by Soviet forces, but they did little to address the still-standing issues of Turkish economic stagnation. The Turkish President wanted aid for capital expenditures, for new manufacturing enterprises, and better funding for non-military ends. The Marshall Plan would provide that infusion, further locking Turkey into a dependent economic relationship with the United States.

Engineers Comment on the New World Order

The increased American interest in the inner workings of the rest of the world's internal issues in the late 1940s was mirrored by professional engineers. Jack Killalee clearly understood that his mandate as an engineer in Turkey had everything to do with geopolitics. In a letter from January 1948, Killalee recounted his arrival in Turkey a month earlier: "We…are part of a

[395] Hilts to MacDonald, March 11, 1948, NARA, RG 30, Box 509

Mission of military, economic, agricultural and engineering people to implement the Truman plan. That plan is to stop Russia. This certainly is a good place to do so if we have time as the people are most hostile to the Russians. They need our help badly, as they appear to be prostrate."[396]

More generally, engineering publications emphasized the postwar development programs and foreign development projects on a much more regular basis than before the war. The shift really began during the war as journals sought to chronicle the work being done by American military engineers in all theatres of war. In 1943, the *Engineering News-Record* started a regular column entitled "Engineering Abroad as Seen by ENR Editors," that initially ran as a way to chronicle engineering exploits in the conflict. These features profiled construction like bridge and airfield-building for Allied use, and usually mentioned the specific engineers at the heads of the projects.

After the conflict, the "Engineering Abroad" column remained, focusing more broadly on engineering work of all types across the globe. The trend spread to other engineering publications after the war, especially once American postwar development programs were enacted. Coverage of foreign projects visibly increased after the Truman Doctrine was approved. *Civil Engineering* dedicated only four feature articles to overseas projects during the entirety of 1947. Four years later, the journal would publish at least one such article a month, along with columns about the role of engineers in the Cold War world intermittently. Engineers were not just interested in the projects being built abroad. They were also focused on the bigger themes regarding their roles in this rapidly changing Cold War world and the policies American officials put forth.

[396] Killalee to unknown, January 15, 1948, Killalee Papers, Burlingame Historical Society.

Engineers showed deep interest in global development issues in their professional conferences. A specific example of engineering commentary on Cold War affairs was E.M Hastings' 1947 presidential address to the American Society of Civil Engineers (ASCE). Hastings claimed that "the day is here when the creative mind of the engineer must be used for the revitalization of the world." In his view, engineering had been "used for so many things that have been concocted to destroy and finally to wipe from the very earth large areas and unnumbered peoples." Hastings' speech concluded with a call for peaceful development by "putting our talents to work and enter[ing] wholeheartedly into the tasks of democracy that are now before us….Let the engineering profession get into the affairs of the State, Nation, and the World as a profession that creates and revitalizes the future for a world of peace."[397]

Hastings' words clearly positioned engineering as a force in foreign relations apart from military or political institutions, which in his eyes had failed to keep peace in the world. It seemed that he and other like-minded engineers believed that engineering might be held to blame for the destruction of World War II (atomic bomb, V-series rockets), but only when it was co-opted by military or political forces. His call for engineers to assume positions of statesmen and world leaders suggests that engineers, if given the chance, would only use engineering to lead the world to peace.

Some engineers were even blunter. Parroting President Truman's sentiments about the importance of technical assistance in world affairs, a May 1949 *Civil Engineering* columnist stated that "the whole problem of world peace and prosperity requires for its solution the constantly increasing use of engineering."[398] In a June 1950 article entitled "Engineers Are Citizens First, Technologists Second," the author held up the engineer as a virtuous objective

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[397] E.M Hastings, "The Engineer in Building for Peace," *Civil Engineering* 17 no. 8, (August 1947): 444.
[398] "Profession Held Aware of World Obligations at UNESCO Conference," *Civil Engineering* 19, no. 5, (May 1949): 341.

party, both in their craft and in politics. "It can certainly be said that the average engineer is concerned with the spiritual values of life and does something about it. His profession may emphasize the material side of life but his sense of values goes deeper." As a group, the author wrote, "engineers have been consultants, not leaders, yet they can do more for us tomorrow than any other group in the whole country…[the engineer] can no longer be content with his post at the drafting board."[399]

Given the field's general response to preceding twentieth century events, such triumphalist rhetoric coming from the mouths of engineers was not surprising. Through all previous tumult, technicians found ways to tie themselves to possible solutions. When it came to postwar global development efforts, engineers were quick to do the same. Their perspectives on development work were not ignored by policymakers, and engineers' increasing participation in development programming reflected a reality that engineers were, if fact, deeply critical to those programs in the eyes of policymakers. Especially, with regard to Point Four, engineering came to embody what "technical assistance" really meant. Solving practical problems like low crop yields in poor countries was precisely how Point Four would combat Soviet ideology, and engineers would increasingly be sent out through the program to do just that.

Through all of the planning an implementation of early aid programs, Pat Gifford stood at his post in Marion, unaware that he would be directly pulled into this developmental process. He still innovated at Huber, filing a patent for a device that would make the connection between a road roller and the roll subject to less wear than usual in April 1947. Such were Gifford's everyday labors at Huber, and he had little reason to alter that routine. But like so many engineers of his age, he was summoned by the federal government to take part in development

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[399] B.P. Barber, "Engineers Are Citizens First, Technologists Second," *Civil Engineering*. 20 no. 6, (June 1950): 381.

work in 1950. Roads program staff in Turkey had raved the machines he designed, which had been batch-ordered here and there since the Truman Doctrine was enacted. They needed his guidance as an expert in the field of heavy machinery, and the Bureau would pay all his expenses to come to the Republic of Turkey and share it. So, in October 1950, Gifford took a Pan American Airways flight out of New York's Idlewild airfield bound for Istanbul. Gifford's experience as a development engineer was about to begin.

Pat Gifford in his Marion office, 1960; Gifford Papers

Jack Killalee in Lebanon late in his career; Courtesy of Burlingame Historical Society

Vannevar Bush serving as Chief of Scientific Research and Development, 1940; Library of Congress, Farm Security Administration - Office of War Information Photograph Collection

A Huber 10-ton diesel roller on a newly graded Miami street, 1941. Aesthetically, the machine remained almost unchanged since Gifford first designed it in 1923; Gifford Papers

Chapter Five: Engineers Cement their Place

Landing in Istanbul, Pat Gifford soaked in his surroundings. Although his was meant as a business visit, Gifford responded to his first exposure to Turkey as a tourist would. The age and vibrancy of the city excited him. He collected souvenirs for his family, a flower vase for his house and a Turkish *cezve* coffee pot for his beverage of choice. He carried a camera with him to chronicle the experience, and took special care to photograph ancient ruins

As he traveled through Istanbul, Ankara, and the Turkish countryside on his way to Iskenderun, Gifford found the juxtapositions evident in Turkey particularly interesting. A number of his photos captured what seemed to him to be old ways of doing things: a Turkish worker sweeping road debris, or a pack of mules carrying freight. All of these reminders of the old existed alongside increasing numbers of automobiles on the country's newly improved roadways. Gifford's preoccupation with how the old contrasted with the new put him in line with how most Westerners internalized Turkey- an enchanting space whose current midpoint on the path toward modernity laid visibly all around him.

When American government workers and journalists reported on the developments in the country in the late 1940s and early 1950s, they took note of the same contrasts Gifford did. The widespread changes occurring in the Republic left certain elements of the past alone, making fodder for State Department and press reports that emphatically made note of the "old vs new" dynamic. Photos taken by Bureau officials of old-style livestock caravans were contrasted with modern buses, while old canister-based fuel stations contrasted with new "de-luxe" service stations in the American style. In a particularly stark example, a lamb sacrifice, a tradition among village Turks before starting a building project, was photographed in front of an enormous driven

steel pylon for a new bridge in Anatolia- A more striking contrast between old a new could hardly be imagined.[400]

American reporters noted the same sort of juxtapositions. A February 1948 article in the *Saturday Evening Post* stated that Istanbul itself was split between two eras: "Old Istanbul, on one site of this [Bosporus] inlet, with its Roman aqueducts, its domes, mosques and splendid palaces…The modern city, on the other side, with banks and office buildings, streamlined apartment houses and stores remains a hastily thrown together movie set, and if it weren't for an occasional king size cockroach, a dead rat and the ever present aroma of mutton drippings, you might at times wonder just what part of the world you're in." The lives of Turks were also stuck in the in-between. Despite the fact that Istanbul Turks had access to modern restaurants and even a nightclub, "…the broad masses of the Turkish middle class still seek their fun where they've found it unwashed for generations. You can see them with their giant water pipes, immobile and silent, behind the windowpanes of the corner café…"[401] The author's perhaps overly-harsh account of Turkish society was summarily disputed by letters to the editor from American ex-pats in Turkey and others, but the preoccupation with juxtapositions are still useful for understanding Turkey through contemporary American eyes.[402]

It may be that most Americans did not know precisely what they meant when they wrote about the "modern," but they did so often enough to suggest that the concept mattered to them at some level. Much of the American sensibility of the modern rooted itself in the notion that, although change was underway in Turkey, it was not complete until the old ways of doing things had visibly passed away. American observers continued to fixate on Turkey as a middle ground

[400] Annex to USTAP Report no. 32, July, 1949 NARA Rg469, entry 1399 Box 53
[401] Ernest O. Hauser, "Turkey Lives on Borrowed Time," *Saturday Evening Post,* February 28, 1948, 26–110.
[402] Lloyd Mann et al., "Letters to the Editors," *Saturday Evening Post*, May 8, 1948, 4–8.

through the 1950s, always aware of the nation's state of progress under developmental aid while keeping a keen western eye on the population's often-puzzling traditions and rituals.

The engineered machines that Gifford and so many technicians like him had designed and imported to Turkey served as harbingers of that movement toward perceived progress. During the war and its immediate aftermath, Gifford and other Huber engineers continued to innovate for the company in ways that had kept the firm as a major player in the road building industry. By the time Truman's development policies were in full swing, one particular Huber machine, the Maintainer, saw high demand in Turkey's roads program. Gifford knew this machine inside and out, and was to credit for a number of the Maintainer's novel functions. As he traveled overland from Istanbul through Turkey's rural interior that October, a shipment of those machines arrived in Iskenderun to be used in a training course that he would teach for Turkish engineers. In doing so, Gifford became an active part of what would become his professional generation's most unexpected contribution: enabling America's ever-widening foreign policy.

Heavy Equipment and Turkish Roads

The new of batch Maintainers that met Gifford in Iskenderun that fall was first ordered in August 1950 by the Bureau of Public Roads. Like they did for many pieces of heavy equipment, the Bureau also ordered numerous attachments and spare parts for these machines, and did so for good reason.[403] Huber initially released the Maintainer in the early 1940s as a multi-purpose tractor, and likely the most versatile machine of its kind on the market. Huber created the Maintainer to be a useful tool for its entire customer base; farmers and construction workers could equally find uses for the machine thanks to the plethora of attachments the company

[403] Huber Sales Ledger, 11-1-1949 to 10-31-1950, Huber Machinery Museum.

created for it. With those attachments, the Maintainer could be transformed from a simple tractor into a mower, grader, berm leveler, bulldozer, snow plow, lift-loader, road sweeper, and pothole patch roller. That versatility mattered in Turkey, where most if not all of those duties were needed and purchasing specific equipment for each job would have been too costly. The Maintainer was advertised to have more horsepower than some dedicated road graders, which added to its utility in the various locations in Turkey. Further, the Maintainer had a drawbar attached, allowing it to tow heavy wagon and trailer loads.[404] Gifford himself had pioneered some of those attachments. He held a patent for the machine's mower implement and filed another for the berm leveler, which received approval in 1953.[405]

Other than the Maintainers, the Bureau purchased Huber tandem rollers, three-wheeled rollers, and motor graders over the course of the Turkish roads program. The descendant of Gifford's 1920s gas roller, the three-wheeled rollers were undoubtedly the most important piece of equipment the company built in the interwar period, and the product kept its place of importance during the war and after. In practice, technicians used three-wheeled rollers as a first-pass piece of equipment to compact the earth and break down larger pieces of dirt or surface clumps due to its heavy weight and wide track. Huber's tandem rollers would be used in some cases after the three-wheeled roller as a finishing compaction tool thanks to its more uniform rolling capabilities, and smoothing ability over asphalt.

The motor grader was a dedicated heavy duty road machine that featured an angled blade to create a uniform surface during the grading process. Graders make a roadway's crown and slope possible, necessary features for any modern road design, and the Huber was one of many

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[404] Huber Maintainer ad Literature, The Huber Manufacturing Company, c. 1952, Gifford Papers.
[405] Keeler, Raymond W., and Gifford, Clayton. Surface Leveling Apparatus, U.S. Patent 2652642, filed March 30, 1948, and issued September 22, 1953.; Gifford, C. E. Mower, U.S. Patent 2375912, filed June 18, 1943, and issued May 15, 1945..

makes that did so reliably. The Huber motor grader possessed hydraulic blade controls patented by Gifford in 1941, which made repositioning the blade nearly effortless.[406]

Huber built a decidedly positive reputation among program officials and technicians in Turkey. Previous Huber equipment purchases elicited high praise from those using the machines in the field, and Huber products were specifically requested for their usefulness. In fact, Huber became so popular that in a memorandum to Hilts, Jesse Williams adamant claimed that continued supply of Huber equipment and parts was important for the smooth operation of the project, seeing as they were the "most useful and economic maintenance tool" project staff had received.[407] To be sure, on rare occasions, the company's products ran into trouble. Officials identified problems sourcing Huber spare parts for maintenance, mostly because the company did not have a distributor in Turkey like it did in other countries. But on the whole, Huber maintained a high level of performance for the wide-ranging uses of its products.

Equipment concerns, procurement, and logistics had always been central to the roads program's administration, and general development programming, as far back as the JAMMATs first days. In this capacity, people like Killalee proved important for detailing equipment needs and their applicability to a specific project. With the logistical challenges in machine shipments, and constant evaluations of equipment needs and quality, the roads program was nothing if not a stage on which various manufacturers and their engineers performed. Early program memoranda indicated equipment standards that shipped machinery should meet. Machinery was to be in "first-class" operating condition, either brand new or "100% reconditioned." Upon arrival, Bureau staff road tested all equipment to prove their serviceability. Despite the massive amounts of equipment in service in Europe left over from the war, it seemed that those machines were not

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[406] Gifford, Clayton E, and Harrison, John F, Hydraulic control system, U.S. Patent 2256144 A, filed March 27, 1939, and issued September 16, 1941.
[407] Hilts to Williams, July 6, 1951, NARA RG30, 1951-1955, 015, Box 209.

in prime condition thanks to inadequate maintenance since war's end.[408] The Bureau even attempted to gauge the lifecycles of the roads program's equipment by producing reports covering the depreciation and operating costs of machinery using comparative studies from state highway agencies in the U.S.[409] The result was a rolling purchasing process in which Bureau officials procured new machinery from American vendors in volume across the life span of the Bureau's work in Turkey.

American equipment manufacturers involved themselves in foreign projects well before the Truman Doctrine's approval in 1947. Perhaps most surprisingly, American brands aided Vladimir Lenin's first Soviet "Five Year Plan' in 1928. In an effort to increase the new U.S.S.R's economic productivity, Lenin allowed Western technology to pervade the country in the form of expertise and equipment importation. American firms like Allis-Chalmers, Lockheed, and International Harvester established cooperative agreements with the Soviet State Committee for Science and Technology to sell their machines to the Soviets. The transfer of this American technology played a key role in sparking a period of economic prosperity in the country.[410]

Unattached to any wider American aid programs, Huber's machinery found a variety of foreign destinations after World War II. The company's relationship with the government of Mexico, forged decades earlier, continued after the war. Huber regularly received orders from the Mexican Directorate of National Roads for its three-wheel rollers. Those machines became integral parts of road improvement connecting Mexico City with Acapulco, Ciudad Juarez and

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[408] "Headquarters European Command to General Aurand," March 16, 1948, NARA, RG30, 1951-1955, .015, Box 209.

[409] "Rental Contract for Turkish equipment,", June 8, 1951, NARA, RG30, 1951-1955 .015 Box 209,

[410] George D. Holliday, *Technology Transfer to the USSR, 1928-1937 and 1966-1975,* (Boulder, CO: Westview Press, 1979), 188-192.

Laredo.[411] In British Malaya, Huber's road machines operated in often-dangerous environments. Huber rollers constructing roads outside Singapore encountered the effects of armed banditry, making operating on smaller service roads to mines and farms risky, especially at night. The country's instability following the withdrawal of Japanese forces after World War II left the government to issue a state of emergency over the whole country. Even so, infrastructure needed to be built and serviced just the same, and Huber machines came to fill that void. To cope with the danger, operators actually used bulletproof vehicles to safely transport themselves between Singapore and their outlying worksites.[412] Huber's foreign distributor network also widened after the war. New distributors opened in South Africa, Iran, and Uruguay, and came to symbolize the type of outward reach American machinery brands would grow in the era.

American manufacturers' global experiences would continue to dramatically widen through dedicated postwar aid programs. Specifically, in reading Turkish roads program equipment order forms, it becomes evident that machinery made in the Midwest mattered in the project in a noticeable way beyond Huber. Certainly, General Motors, Ford, and Chrysler emerge as common clients for the Turkish program's procurement officers. But, companies solicited were overwhelmingly lesser-known labels hailing from obscure Midwestern towns. On a single ECA loan to Turkey in 1949, equipment was procured from the likes of Huber, Iowa Manufacturing, Willys-Overland, Galion Iron Works, Oshkosh Motor Trucks, and Austin-Western.[413] Huber's Marion neighbor, The Marion Power Shovel Company, sold its heavy

[411] "Road Rollers Shipped to Mexican Government," Huber News, July 1949, 3.
[412] "In Far Away Malaya, Distributor Services Huber Machines with Bullet-Proof Truck," Huber News 1949, 5
[413] "Statement of equipment and supplies being procured under ECA $5,000,000 loan to Turkey," December 19, 1947, NARA, RG469, entry 1399, Box 53; these firms were all based out of Midwestern towns, most not exceeding 100,000 in population.

excavating shovels for Turkish use as well, finding work on the Kochisar-Aksaray highway route in Central Anatolia.[414]

The firms involved in supplying the roads program were not limited to big-ticket item producers like trucks, bulldozers, and graders. Firms making products supporting those types of machines also found a market in Turkey. The Timken Roller Bearing Company out of Canton, Ohio, produced tapered anti-friction bearings that permitted heavy equipment from toppling over when making sharp turns with loads.[415] The Galion Allsteel Body Company, also out of Galion, Ohio lay claim to the original pickup truck design, and produced lifting beds for Dodge trucks used in hauling work across Turkey.[416] On an even smaller scale, the Lempco Company out of Bedford, Ohio produced machine tools such as reamer blades for making finished holes in building materials, along with portable cranes.[417]

Just as in the early years of road machinery, the Turkish roads program operated in the context of a high-stakes competition among manufacturing firms. At the time, there were a number of lawsuits pending between companies dealing with patent protections on their machines. On top of piracy claims, the firms also faced competitive bidding wars with one another throughout the project. Through at least 1955, manufacturing neighbors Huber and Galion Iron Works made competitive bids on the same contracts for road machines.[418] These smaller firms went up against bigger companies as well for contracts. Huber notably won bids for various machine orders against Caterpillar through the 1950s.

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[414] Semimonthly activities report-, June15, 1950, , to July 25, 1950, NARA RG30, .015, 1942-1950, Box 508.
[415] Bettye H. Pruitt, *Timken: From Missouri to Mars-A Century of Leadership in Manufacturing* (Boston: Harvard Business Review Press, 1998),. 7-9.
[416] Some aspects of Highway work in Turkey, c. 1955, RG30, 1955-1959, Box 1060.
[417] "Kimmel to Dane,", February 177, 1953, NARA, RG30, decimal file 313.3, Box 289,
[418] "Kopru to Curtiss," April 27, 1955, NARA, RG30, 1951-1955, .015, Box 207.

One important point regarding equipment in the Turkish roads program, and any other Bureau project overseas, was that equipment preferences on the ground were often more dependent on consistency than overall superiority. Even though a certain manufacturer's machines may have been well made, that certain make was just as often requested because staff were familiar with using that make, and learning how to operate a new brand of machine might prove not worth the time involved. Companies made superior improvements to their products over time, but procurement officers often stuck with a known make when placing new orders as long as the company offered a competitive bid. In this climate, Huber maintained its presence in the field in Turkey, and there were approximately 300 Huber maintainers on the ground there by the mid-1950s.

Education from a Midwesterner

With all of its equipment purchases, Bureau and Public Works officials recognized the importance of training technicians in how to use the machines properly. Engineering education became a central aspect of the Turkish roads project and wider development programming, a mental manifestation of modernity moving through individuals who, in theory, would one day administer their highway system on their own without American help. In the eyes of American planners, while roads themselves needed improvement, so did Turkish minds. How would one expect Turkish technicians to manage a new highway system without better knowledge of the machines in use? To deal with that question, American engineers held courses in various mechanical and methodological topics for Turkish engineers relevant for the roads program. Americans distributed translated booklets in Turkish on specific skills and issues useful for Turkish engineers. Even more significant were extensive foreign study opportunities for Turkish

technicians in the U.S. The Marshall Plan's "Technical Assistance Project," among other programs, brought Turkish technicians to places across the United States to further orient them with modern ways of building roads.

Early Bureau training efforts in Turkey experienced plenty of complications. Jesse Williams remarked in September 1948 that early equipment training courses did not have the desired effects on technicians. "We find, in spite of our teaching at Iskenderun and our continuing campaign to impress the essentiality of proper operation and preventative maintenance, that equipment is being improperly used and is not being properly maintained. The result is dead-lining units far in advance of the period that should be anticipated, in excessive use of spare parts, in high operation costs, and [*sic*] materially shortens the life of the equipment. Our present personnel [are] not sufficiently adequate to successfully cope with the situation, etc."[419] These sorts of complaints precipitated the contracting of private engineers like Gifford, who arrived in Turkey to relieve the Bureau from managing training courses on subjects or machines with which Bureau staff members were unfamiliar.

Courses for Turks had been held by the Bureau since the program began, but the courses stretched Bureau resources too thin. For the Bureau to continue to conduct the necessary courses itself would have meant more staffing in the agency from equipment engineers, a costly option for the less well-funded arm of the Turkish aid program. Instead, the Bureau contracted with individuals employed by the companies from which they bought machines. In the middle of 1950, Huber received a request from the Bureau to assign an expert who could train Turkish workers inexperienced in using Huber's cutting-edge machines. Given Gifford's great influence in the design of these equipment pieces, he served as Huber's foremost authority in their use and maintenance, and emerged as the best person the company could send.

[419] Cable from Jesse Williams, September 16, 1948, NARA, RG30, .015, Box 511.

Studying these educational processes in full reveals a great deal about how engineering thinking manifested itself through educational courses administered by development agencies. Even more so, educational processes showed the personal side of development work: the thoughts and interactions that undergirded the roads building process in Turkey and the human face of development expertise. The phenomenon was not restricted to Turkey, but it was in the Republic that American policymakers and Bureau officials experimented with educational projects in ways that that would be later deployed globally.

Gifford's travel documents and itinerary secured, he departed for London from New York City on October 15, 1950, and then connected to Istanbul.[420] Upon landing, he spent a couple of days in Istanbul collecting his souvenirs before traveling by road to Ankara. After spending a few days in the capital city's Yüksel Palas Hotel (where Bureau staff regularly held meetings and social events), Gifford then moved between Ankara and Iskenderun to hold his first courses of instruction on the newly purchased Huber Maintainers.

The long road trip afforded Gifford time to take in the expansive Turkish countryside on a slowly improving highway system. He was well aware of the fact that the highways were still in rough shape, recording his travels through photographs and correspondence with family members. From his estimation, the asphalt-paved roads in Turkey were done poorly in most cases. The best roads he encountered were in the south, where he believed the French had constructed improved roads relatively recently.[421] To right the wrongs of the roads system, Gifford stated that "The maintainer is just the tool for this country, if [Turkish technicians] will

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[420] Pan American World Airways Passenger Manifest, October 15, 1950, NARA The National Archives at Washington, D.C.; Washington, D.C.; Series Title: *Passenger and Crew Lists of Vessels and Airplanes Departing from New York, New York, 07/01/1948-12/31/1956*; NAI Number: *3335533*; Record Group Title: *Records of the Immigration and Naturalization Service, 1787-2004*; Record Group Number: *85*.

[421] There has been evidence that French and German building firms had been given contracts to construct roads in Turkey around the time of World War I, which may be what Gifford was referencing. Later French road projects in Turkey are unclear; Report on Cooperation in American Export Trade, June 30, 1916 (Washington D.C.,: GPO, 1916). 139-140.

use it."[422] Indeed, by late 1950, the country still did not possess considerable asphalt paved roads, but advances had been made using modern machines. Illustrating the marked improvement the roads program achieved by 1951, a Bureau report stated that the travel time from Ankara to Istanbul had reduced by at least four hours compared to two years earlier. That kind of progress partly came as a result of the massive personnel investment made in education courses for using the equipment that could quickly grade or smooth patchy highways. By 1950, scores of Turkish technicians had taken instruction courses in the use of new machinery, turning the county's manual road maintenance force into an increasingly mechanized one.[423]

Upon reaching Iskenderun, Gifford held his first course right away. The course lasted three days, half of which pertained to classroom instruction, and the other half field training with the machines themselves. All of his pupils were Turks; some worked as project managers who would have charge of the Huber machines in their respective project districts. Eight of his Turkish pupils were college educated, and two held master's degrees in engineering. Gifford relayed that those engineers with advanced degrees in his class were referred to as "yuksek muhendisler," or, "high engineers," due to their advanced educations.[424]

After first reviewing the mechanics and principles of the Maintainer's functions in the classroom, the group decamped to the field where it practiced using the machines in real time. The class operated the machines with various attachments that might be used on specific roadways, like the front bulldozer attachment for moving earth to make way for new roadbeds. Later, their training covered the use of the smaller grader blade and mowing attachments.

[422] Pat Gifford to Glenn Gifford", November 7, 1950, Gifford Papers.
[423] Bureau reports advance conflicting estimates on travel times between Ankara and Istanbul. This is likely due to differing speed and end points at which the drive was measured under; Department of Commerce, Annual Report: Bureau of Public Roads, 1950 and 1951 (Washington D.C.: GPO,).
[424] The title of Yuksek Muhendis could also be a description of someone with a large amount of experience in the field, and not just educational credentials.

Photographs taken during the courses show technicians on Maintainers riding staggered four and five units wide as they cleared swaths of earth in one pass to make new roadway. Without the help of the Maintainer, such an excavation would have required exponentially more men and time. Turkish technicians were eager to use the more efficient machines, no doubt a result of decades of manual earth moving and construction methods.

In total, Gifford taught five classes with the Maintainer, each taking no more than five days to complete. At the end of his courses, Gifford seemed genuinely impressed by the Turkish technicians, claiming they were "very fast to learn" the various uses of the Huber machines.[425] He felt that his pupils were especially inquisitive. In his estimation, the Turks seemed like "very smart fellows and asked all kinds of questions." For a machine as multi-faceted as the Maintainer, mastering its many capabilities in such a short window of time required exceptional technical capacity from its operators. From what can be gleaned from his records, Gifford's pupils were up to the task.[426]

Although Gifford did not express an issue specifically, language differences presented difficulty in both the courses and the roads program generally. Translators remained a part of the project throughout, but naturally the language obstacle still challenged personnel on both sides. Because so many of the imported machines had never been seen in Turkey, Turkish had no terminology to apply to parts and equipment pieces trainees encountered. To cope with this challenge, language guides were produced by the Bureau that named each previously-unfamiliar part and aided instruction.[427]

Technicians from a number of other firms held similar courses during the roads program's lifetime, and not all were related to complicated construction machines. Even those

[425] "Huber Engineer Travels 20,000 miles…Visits Eleven Countries," *The Huber News*, March 1951, 4.
[426] "Pat Gifford to Glenn Gifford", November 7, 1950, Gifford Papers.
[427] Teaf, *Hands Across Frontiers*., 391.

vendors selling ancillary machines for construction projects sent experts to teach Turks how to operate their equipment. One such vendor was the Dempster Brothers Company out of Knoxville, Tennessee. Dempster had pioneered mechanized technology of another sort- trash hauling equipment- and sold a number of its machines to the Bureau for use on job sites. As the originators of the American colloquialism "dumpster," the Dempster Brothers sent a representative to instruct people in the use of their trash trucks.[428] From road rollers to trash trucks, it seemed that introducing modern technology to Turkey required expertise from unexpected corners of the engineering world.

Study Abroad- Engineering Style

The Bureau had hosted foreign engineers in the United States intermittently well before the Turkish program began. Jack Killalee's home in Burlingame, California served as a common destination for visiting engineers hosted by the Bureau's San Francisco office in the 1940s. During their visits to the San Francisco office, foreign technicians learned American highway building and management methods to take back to their homes, and were often entertained by the Killalees. The Killalees hosted officials from the Indian Reforms Commission, and municipal road engineers from Argentina and Venezuela, among others. Those who passed through wrote that they had been welcomed by the Killalees' hospitality, while extending invitations for Jack and Gladys to visit them in their home countries. One Indian engineer equated his experience in the Bay Area with India's own mountainous region, signing his name alongside the Hindi phrase for Kashmir, "If there were a heaven on this earth, it is here, it is here, it is here." Killalee's early contact with the foreign technicians no doubt influenced the Bureau's decision to fold him into

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[428] Helmintoller to Turkish Consulate,", October 13, 1950, RG30, .015, Box 510.

the Bureau's overseas programs, while revealing longer roots of the Bureau's transnational engineering activities.[429]

In mid-1949, the Bureau began a bigger effort to extend road engineering education for foreign technicians in the United States. Funded through the ECA as the "Technical Assistance Project" this program sought to bring foreign engineers to the United States to observe and train under direct supervision of Bureau personnel and other American experts in fields like machinery production and bridge-making. These foreign study courses typically included a four to twelve month stay in the U.S., and, like Gifford's courses, mirrored academic engineering curricula by emphasizing classroom instruction, followed by field observation and practicum. In the Turkish context, study abroad programs were a very common way to further orient Turkish technicians with American road and bridge engineering. Those chosen for the study abroad programs were usually already educated in Turkish technical colleges in universities before participating.

The technicians usually traveled to a selection of work sites across the U.S. to gain exposure in different terrain and climate settings. In the most extreme cases, visiting engineers traveled across the entirety of the United States in their course of study. One specific group of technicians disembarked in New York from Turkey, took classroom study in Washington D.C., and subsequently investigated highway design and surveying in Vancouver, Washington. Other training specializations included aerial surveying, bridge design, traffic planning, and equipment design. Highway design specialists learned, for instance, how to design a roadway for a given traffic volume or vehicle type. The capstone assignment for the Technical Assistance Project was an in-depth written analysis of an aspect of the pupil's experience of his choosing. This usually included a discussion of the application of that principle to the pupil's home context. Just as

[429] Killalee Family guestbook, Killalee Papers, Burlingame Historical Society.

college-level engineering programs often mandated theses from degree-seekers, study abroad programs attempted to cement educational gains with these capstone projects.[430]

Huber hosted multiple Turkish engineers during these programs at the request of the Bureau. The company specifically sponsored mechanical engineers who might have a leadership role in equipment design or management in Turkey. Some vendors selling other product lines paid to send Turks to American factories at their own expense to grow their knowledge of equipment they sold in Turkey. Those Turks who spent time at these machinery companies became well acquainted with the newest road building equipment, learning from manuals and observing the top-to-bottom construction of heavy machines. In time, these trainees would become Turkey's foremost experts in American-made machinery.[431] It should be noted that foreign studies were not limited to highway and bridge engineering. Gradually the program expanded to include foreign training for people in fields like geology, where the American context proved instructive for learning how to drill for bituminous asphalt resources.[432]

Turkish technicians took much away from their travels in the U.S. as reflected in their capstone reports. Some engineers recorded surprise that both American rural and urban dwellers enjoyed similar standards of living, and credited that uniformity to a road system that served the entire country, and not just the cities. Transit made goods easily accessible for even the most remote rural dwellers in America, a stark contrast from Turkey and other poor countries that dealt with severe dislocation due to inadequate infrastructure.[433] Other students observed that planning stood as the key to successful road building in the U.S., noting that state highway

[430] Department of Commerce, Annual Report: Bureau of Public roads, 1949- through 1960 (Washington D.C.: GPO).
[431] Halit Kosar to Chief of Equipment, July 1, 1950, NARA, RG30, .015, Box 507..
[432] "Tutle to McWhorter,", September 30, 1952, NARA, RG30, 1951-1955, decimal file 003.4, Box 96.

[433] Boyaciougly, Curayman, Cursoy, Iskit, Orhan: Interim Report of the above Trainees on their studies of Highway Bridge Engineering Practices," c. 1951, NARA, RG30, 1951-1955, 003.4 Box 96

departments spent a great deal of time simply expanding their knowledge of the region to build the "most economical" type of roads.[434] Those who observed machinery production, as one report put it, "...now have a good working knowledge of the complex system necessary to operate a maintenance and equipment department."[435]Across the board, foreign technicians always took something of note away from their time in the U.S. Whether suggesting greater utilization of American bridge designs, or simply promoting greater cooperation across road administrations, most program participants saw their time abroad as a useful exercise.

More broadly, the foreign training sessions produced in Turkish engineers an enhanced vision of the problems that could be attacked by new equipment and technology. Being closely exposed to the details behind modern machinery, materials testing, and building methods in the U.S. grew an awareness of the tools available to fix problems in their own country. Turkish infrastructure problems could be diagnosed with a new perspective by their own technicians, who, it was stated, would eventually administer the new highway program completely independent of American participation. At that point, the maintenance of heavy machinery would no longer be up to American experts who could make necessary fixes, but rather homegrown engineers who now had holistic understanding of the ways modern machines worked.

The Turks who travelled to the U.S. claimed they saw real uses for their new knowledge at home, but were also honest about the shortcomings of the program. Some Turks left their U.S. training with less-than-stellar reviews of their experiences, finding problems within the foreign education programming itself. Some viewed the program as too unfocused, and they preferred

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[434] Tan, Berkok, Kircali: Interim report of our studies on Highway survey and design in the United States," October 5, 1951, NARA, RG30, 1951-1955, 003.4, Box 96.
[435] Turkish Engineers: Mr. Selahattin Guneyiz, June 9, 1950, NARA, RG30, 015 Box 508; Turkish Engineers: Mr. Turan Alpdemir, June 16, 1950, NARA, RG 30, .015, Box 508.

more time in fewer locations to better understand their subject in-depth. They expressed complaints about the stipends provided for the trainees, with one Turk stating that he felt “put in the position of an undergraduate” on the meager stipend. Further, Turks suggested that more hands-on application of their just-learned principles should have been a greater focus. Rather than simply observing a road construction site in Colorado, for instance, they should have been encouraged to work on the mountainous worksites themselves to put their knowledge into real practice.[436]

Their complaints were well-founded. The Technical Assistance Project was likely a hastily produced operation, cobbling wide ranges of personnel and worksites together for long spans of time, and for sometimes ambiguous ends. But the purposes of the project still comprised a large part of postwar development programming, and American policymakers saw to it that the program grew over the course of the 1950s as more countries became targets for American development intervention.

More important, the Technical Assistance Project brought out certain traits in the Turkish engineers that suggest great similarity with their American counterparts. Like the Americans, Turks involved in the study abroad program exhibited an almost instinctive problem-finding inclination. While Americans had spent months identifying problems with Turkish roads on a rolling basis, Turkish foreign study participants baldly pointed out problems with *American* road building methods during their time in the U.S. These Turks noticed disconnects between American federal and state highway road standards and signage, suggesting that greater uniformity might lead to easier designs. Other Turks noted issues with basic logistics in

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[436] Ibid; Adli Yener, “Report to the Mutual Security Agency”, December 12, 1952 , NARA, RG30, 1951-1955, 003.4 Box 95;.

specifically urban environments. For towns with large populations, they found the lack of parking and dearth of city by-pass routes rather disappointing, and worth deeper investigation.[437]

In articulating the problems they identified in the U.S., Turkish engineers proved that they were more similar to American engineers than one might suspect. That inclination to seek out deficiencies in whatever context they found themselves, linked engineers across nationalities and cultures. The same tendency of the American engineering mentality that had driven dialogue amongst the field through global crises during the twentieth century, also drove foreign engineers in their environments. Armed with new awareness of Turkish and American lack in the ways of road building, Turkish engineers would now serve as even better problem-finders going forward.

As a window into American foreign policy planning, the Turkish study abroad program served as one example of a much larger project bringing foreign experts to the U.S. under Bureau supervision during the Cold War. Repeated hundreds of times over in the 1950s, participants came from an increasingly wide set of countries across the globe. Some years had more participation than others (1954 had only 61 participants worldwide), but the geographic scope always took in a broad swath of foreign technician from a variety of countries, and attracted individuals from 35 countries in a single year during its most robust annum. Bureau programming alone trained over 1200 technicians in America by the end of the 1950s, with other U.S. agencies hosting their own similar versions of these courses.[438]

The road building sites in Turkey also served as educational sites for Turkish engineers in-training at Turkish colleges. In 1952, engineering students from the Istanbul Technical University traveled to southern Anatolia to view the progress on the roads project, and the ways

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[437] Tan, Berkok, Kircali: Interim report of our studies on Highway survey and design in the United States, October 5, 1951, NARA, RG30, 1951-1955, 003.4 Box 96.

[438] Department of Commerce, *Annual Report: Bureau of Public Roads* (Washington D.C.:GPO, 1949-1959).

Americans contributed to the process. They specifically investigated the Mersin-Konya project site, route number 35, running toward the Mediterranean coast as a part of their degree courses.[439]

The educational programming through the Bureau quietly became one of many such foreign training efforts in the era. As American foreign policy interests continued to broaden, and engineering expertise became increasingly important means to serve those ends, American development agencies land exchange programs like the Fulbright program held all manner of foreign training courses on a regular basis. As a result, it is difficult to ascertain precisely how many engineers in total participated in such missions in the years after Truman development policy was enacted, but foreign study programming stands as a key in the expansion of Truman development policy, one that remains robust to this day.

View from Turkey

In the early 1950s, American observers took note of the ways American heavy equipment pushed Turkey along the path toward modernity. Progress on the high-priority Erzurum road project provided evidence that Turkey was changing from the cities to the country. In the words of one reporter, "There's no mistaking the meaning of year-round roads to the villages along the way. Relief from isolation, a chance to move their produce to better markets, access to doctors and hospitals…all these come with the new roads." The road's effects seemed to be almost as psychological as economic for rural-dwellers. A report claimed that Turkish engineers dealt with pleas from village leaders to bring equipment within sight of their hamlets, just so "people think something is going to happen."[440]

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[439] "Genc muhendislerimizden bir grup yollarimizi tetkik gezisine cikti" (Our young engineers went out to examine a group of our roads), *Cumhuriyet*, April 26, 1951, 2.
[440] Farnsworth Fowle, "NEW TURKISH ROAD POINTS UP U.S. AID," *New York Times*, May 7, 1950, 20.

One journalist described the new Turkish highway maps in terms of geographic anatomy. “Today the map of Turkey carries a maze of red and black lines denoting the arterial highways and feeder roads that are bringing the lifeblood of social progress to the most remote parts of the country.” In some ways, the account correctly reflected reality. The Turkish roads had stretched into the hinterlands, and the network sprawled nearly the entirety of the Republic. But, was the liquid running through the network truly just “lifeblood,” or something more complicated?[441]

Of course, journalists did not typically interrogate their metaphors, but progress of some kind had clearly been achieved in Turkey. One American columnist wrote in April 1950 that the new roads program clearly contributed to bringing Turkey out of its traditionalist doldrums. Almost with tangible relief, the author wrote “only three camels, visibly out classed by trucks, buses, cars, and jeeps, lingered along the ancient route of caravans and conquerors from Ankara to this city [Adana] today.” The new roads were augmented, the writer continued, by American experts like Bureau engineer Leslie Marsh, who emphasized that improved maintenance with modern machines, not simply new construction, was to credit for the improvements in travel times throughout the country.[442]

Imported American machines had uses far beyond road building, and their effects stood out visibly to those observing Turkish development processes. Another journalist wrote that the imported “U.S. Tractor” had contributed a great deal to Turkey’s transformation since the Truman Doctrine was approved in 1947. The writer quoted a Turkish official in saying, “Next in importance to the economic prosperity of this part of Turkey is the American Tractor. The machines have made it possible for us in a few years to grow more than enough wheat, among

[441] Special to The New York Times, “TURKEY ADVANCES HER HIGHWAY NET,” *New York Times*, May 1, 1955, 28.
[442] FARNSWORTH FOWLE, “TURKEY IMPROVES ANCIENT HIGHWAYS,” *New York Times*, April 30, 1950, 41.

other things. Four years ago, we had to import wheat."[443] Supporting this statement, the first months of 1950 had seen yearly Turkish exports rise while imports in the same period declined. But improving the true economic health of Turkey would take more than just a couple of years of data and a few tractors to make right.[444]

Even so, the rise of the American tractor abroad has been noted by agricultural historians as a boon to both postwar rebuilding processes and manufacturers. American engineers had been the world's leading authorities in road building since before U.S. entry into the war. With the devastation of Europe's production facilities, American mechanical engineers became the foremost authorities in heavy machine design, churning out their equipment unabated after the war. Specifically with regard to farm machinery, Paul Conklin writes that "New or improved tools were essential elements of growth. After World War II and the devastation of Europe, American companies dominated the market for farm implements. The competition was intense, and the pace of innovation unprecedented."[445] Thanks to the Truman Doctrine, Marshall Plan, and Point Four, self-propelled tractors helped farmers globally grow more and feed more in a market dominated by major American brands. Turkey itself was made into a pseudo breadbasket for grain exports to Europe using ECA funds to buy tractors and agricultural supplies. The result was Turkish fields littered with American-branded machines just like the highways.

Turkish journalists also noted that the roads program's progress served as an important step in Turkish advancement. One Turkish journalist from the nationalist newspaper *Ulus* commented that a new road built as a part of the program was gives Turkish communities "new

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443 Larry Rue, "TURKEY SHOWS A BETTER FACE AFTER 20 YEARS," *Chicago Daily Tribune,* January 29, 1953, A4.

444 "Recovery Guides- Participating Countries,": Economic Cooperation Administration, April 1950, p. 112, 141, Record of the Agency for International Development, Gordon Gray Papers, Truman Library, RG286, Box 19.

445 Paul Conklin, *A Revolution Down on the Farm*, (Lexington, KY: University of Kentucky Press, 2009), 99-100.

life where it reaches."[446] The writer noted that the mechanized rock crushing equipment in the field operates "like little factories" as they prepare to make a new roadbed.[447]

The modern road system led to changes in Turkish culture. As the system emerged, a burgeoning car culture emerged along with it, and teaching an entire country to deal with automobiles required adjustments. In an Ankara radio address in February 1950, Turkish engineer with the Department of Roads and Bridges, Orhan Barim, offered up suggestions for Ankara-dwellers who now how to contend with increasing traffic and the possibility of driving for the first time themselves. To decrease traffic fatalities, he suggested that Turks should "Always drive on the right side of the road" and "never stop or park at intersections…" among other basic directives.[448] In time, a population whose general habit was to drive as if "no other vehicle were on the road," would have to adjust to standardized right of way rules.[449]

The modernization of Turkish roads presented its own challenges for local Turks, but government officials seemed determined to see the nation through those obstacles. In all, the public reception toward Americans in Turkey, and the changes to the landscape therein, was one of trepidation, but the benefits of American aid for remedying the Turkish roads seemed worth any drawbacks to the media and Turkish policymakers. The dislocation of rural peasant communities served as a clear marker of backwardness, one that would haunt those Turks dreaming of a modern future. Using infrastructure as a revitalizing force, those backward traits could be replaced with a more functioning interconnected Republic.

On the Ground Relations

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[446] "Reports on a trip over the Iskenderun-Erzurunm Road and the important of road maintenance and repair shops,," *Ulus*, June 16, 1949 as cited in Annex 4 to USTAP Report No. 32, NARA, RG469, entry 1399 Box 53
[447] Ibid,
[448] Annex 4 to USTAP Report No. 39, March 10, 1950, NARA, RG469 entry 1399, Box 53
[449] Teaf, *Hands across Frontiers*,, 397.

As Begum Adalet argues in a recent dissertation, points of contention undoubtedly existed between American and Turkish engineers on the roads project. The pursuit of cost savings in construction, for one, existed at different times as a higher priority for Americans than Turks. Building a steel bridge may have saved crews time on the ground, but Turks were wary of the aesthetic costs to carelessly inserting steel where it had never been before. Also, the speed of progress was sometimes emphasized differently by American and Turkish engineers, which may have suggested wider disconnects regarding their mentalities generally.[450] There were complications on the ground that affected the progression of the project at different levels, likely compounded by inconsistent expectations by Bureau staff. In one example, Hilts, stated that he felt the Turkish approach to the program's planning was best defined as "catch-as-catch-can" due to Turkey's sometimes delayed initiative regarding starting a provincial road improvement program in 1950.[451] This sentiment was echoed at one point by Gifford, who noticed that he remained rather inactive for much of his time in the country. Outside of holding his courses, he did little more than travel through the countryside and observe his machines in action. He stated the Turkish motto for the roads program must have been "hurry up and wait" given all the standing around he had done.[452] Some Turkish delays were due to cultural differences. The Muslim *Ramazan* holidays conflicted with typical American work schedules due to the hiatus imposed on the projects in the summer and spring months.

Just as often as he complained about delays, Hilts conversely cited a too-hurried approach by Turkish administrators and technicians toward their work. In a letter to Vecdi Diker in May 1950, Hilts wrote that he was afraid of the "old slipshod" methods of Turkish construction that

[450] Begum Adalet, "Mirrors of Modernization: The American Reflection in Turkey, *(*PhD dissertation, University of Pennsylvania, January 2014).
[451] "Hilts to Williams,", August 29, 1950, NARA, RG 30, 015, Box 507.
[452] "Pat Gifford to Glenn Gifford,", Novermber 7, 1950, Gifford Papers.

preceded the aid program would come to cause long term problems. Hilts stated that he hoped that Diker would "begin to instill pride into your men for the appearance of the road…you will be losing a golden opportunity to achieve results for which the traveling public would commend you highly."[453] Slower more methodical progress, in this case, would supposedly bring the results that modern engineering promised, but Hilts' inconsistent expectations were no doubt a contributor to tensions within the program and him personally. Killalee recorded his personal frustration with the inconsistent timelines in April 1949, specifically with his own Bureau colleagues: "We have been criticizing Turks for procrastination, and here we cannot get a job out in three months!"[454]

Incidents of bad behavior involving program employees contributed to tensions on the ground as well. Such episodes reflected badly on the Bureau and Americans generally, and the Bureau quickly removed individuals who caused problems. Such incidents went on against a backdrop of wider issues between local populations and American ECA and military staff stationed around the world. Legal motions were made at isolated junctures against Bureau staff in Turkey. In 1950, a lawsuit issued against a Bureau employee claimed the American had apparently spooked local Turks on horseback while driving on the same road after dark, causing a rider to be "thrown off." Although the individual was found to be in good health after the incident, a suit was still put forth claiming that the Bureau employee drove "carelessly" and flashed his lights which led to the rider being thrown off. Defended, incidentally, by a Turkish Directorate of Highways Attorney, the case was dismissed citing conflicting reports by the plaintiff.[455]

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453 Hilts to Diker," May 26, 1950, RG30, 015, Box 508

454 Activities at the Anakara Office, April 8, 1949, Jack Aldabert Killalee Papers, Hoover Institute Archives, Stanford, CA, Box 2.

455 "Hearing in Damage Suit against Mr. Roy Kendall", April 24, 1951, NARA, RG30, .015 , Box 209.

Rivalries also existed within Turkish and American circles. Williams remarked to Commissioner MacDonald in 1948 that "The younger personnel in the [Turkish] Department of Roads and Bridges, particularly the American trained boys, are becoming more discontent and one or two have resigned. There exists a number of personal jealousies in the Department, and the two factions, the American trained boys, and the European and Turkish trained, are at odds a good deal of the time."[456] Within the U.S. Bureau, overly eager contributions by Americans were as problematic as unsatisfactory progress. Hilts reminded his staff members of their positions as outsiders. According to Hilts, to understand the conditions in a given project space, Bureau workers needed to gain exposure in the field before offering up design suggestions to managers and contractors.[457] Killalee dealt with his own rivalry within the Bureau. Although he never singled out any Turks as being especially uncooperative, Killalee repeatedly expressed frustration with fellow American Bureau engineer Leslie Marsh, who he complained did not deliver reports on time, and was generally "hard to work with."[458]

On top of it all, general rifts emerged between American and Turkish policymakers regarding interference of Americans into the economic affairs of Turkey under the greater administrative presence of the ECA. Feelings of mistrust pervaded the relationship between Americans and Turks at different points through the 1950s. As ECA officials attempted to ensure that American funding was not wasted on the development projects there, they presented an overbearing presence to Turks who were seen by Americans as "no better than Chiang Kai-shek's men in the days before the collapse of the Kuomintang regime."[459]

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[456] "Williams to MacDonald,", October 12, 1948, NARA, RG30, .015, Box 509.
[457] Hilts to Williams, June 19th 1950, NARA, RG30, 015, Box 508.
[458] Activities at the Ankara Office, April 8, 1949, Jack A. Killalee Papers, Hoover Institute Archives, Box 2.
[459] "Turks resent ECA 'Interference'" *The Washington Evening Star*, October 22, 1951, A-9.

The movement of American personnel into Turkey certainly created spaces for tension. Still, these examples of detrimental activity served as a counterweight for a spirit of civility and cooperation. Americans often expressed admiration for Turkish technicians and their abilities. Knowing, for instance, that the heads of the Turkish program possessed real engineering skill helped their status in the eyes of Americans. Hilts, Killalee, and Williams deferred to Turkish engineers and administrators regarding design "short cuts," and Turkish technicians expressed excitement with the equipment and techniques brought by Americans.

Even on personal levels, Americans attempted to assimilate to some degree and built friendships that suggested both sides grew closer through the project rather than further apart. Killalee spent much of his down time learning Turkish on his own, filling notebooks with hand-written verb tense exercises. By the end of his time in Turkey, his journal entries reflected a subconscious mixing of the two languages. He made friends with Turks, and regularly attended soccer matches between the Turkish league's "Üç Büyük" (big three) Istanbul clubs and national team matches in Ankara. Besides soccer, Killalee ate meals with Turks, spending plenty of his off the clock hours, not with other Americans, but with individual Turks.[460] In the field, Americans and Turks regularly tested materials and designs together, and seem to have come out of those interactions no less willing to work with their counterparts. In this vein, the effective collaboration, rather than any enmity, deserves proper notice. Given that such a large-scale intergovernmental development project had rarely been undertaken before, the relative cooperation that existed was anything but a sure thing. For a program and administration

[460] Journal Entries, May 1949, Killalee Papers, Hoover Institute, Box. 2.

supposedly just "figuring it out" on the job, the relationships between and among American and Turkish groups deserves special consideration in the context of wider development policy.[461]

Their shared engineering mentality served as one contributor to cooperation on the roads project. Disagreements that did occur among engineers regarding design or planning existed within the framework of a mentality that rewarded change through technology, even at a basic level. Official Turkish roads reports espoused a belief in such concepts as a "modern technical spirit" in their pursuits, and that the path the program was on would bring improvement to Turkish life.[462] Some American or Turkish engineers may have felt that different methodological approaches were in order in some contexts, but they did not promote wholesale rejection of the principles in which they were trained. All sides accepted that engineering brought improvement, and it was only the variations of that belief that brought tension among engineering ranks. Whether disagreements surrounded pace of work, types of construction, or materials use, engineers on all sides never settled on *less* engineering, only alternate versions of their craft.

On a broader scale of American foreign relations, American diplomacy experienced strain all around the world as the U.S. navigated the new geopolitical climate it faced. Wherever one looked, one could see a heavy or clumsy American policy hand at work- from the forcible overthrow of Mohammad Mossadeq in Iran to Truman continuing to prod Winston Churchill to speed decolonization. Development enterprises only added the most recent wrinkle to the U.S. foreign policy complexion, and encountered their own challenges wherever they operated. The case of a fully smooth and amicable diplomatic relationship surrounding development work, from the top levels of state administration down to agency representatives, was the exception, not

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[461] Frank Costigliola argues that personal relationships are connected with policy, that the fostering of personal ties between those of different nationalities has an effect on the success or failure of international endeavors; Frank Costigliola, *Roosevelt's Lost Alliances: How Personal Politics Helped Start the Cold War* (Princeton, NJ: Princeton University Press, 2012).

[462] Karayollari Bülteni, November 1951, NARA, RG30, .015, Box 208.

the rule, in this context. Contestation was the rule, regardless of the specific location the development program was deployed. On that scale, Turkish-American cooperation over the roads program resembles something closer to friendship than disdainful partnership. Because of its unprecedented scale, the Turkish roads program could have gone in any number of bad directions. Given the often-violent outcomes of later American development work in other countries, the Turkish case provides a rather tame example of American development interventions abroad.

Dam and Power Plant Development

Apart from road building, American engineers found work on other big projects elsewhere in Turkey. Beginning in 1949, the Zonguldak Coal Basin in northwestern Turkey near the Black Sea served as the site of a massive mining mechanization program with funding from the Economic Cooperation Administration. Because Zonguldak coal powered Turkey's railways, the nation's economic growth was directly tied to the ability of its coal fields to keep up with greater supply. Development in the Zonguldak basin also stood to benefit the Turkish steel industry, since the nation's only iron and steel plant lay in nearby Karabük. As American and Turkish officials saw it, greater extraction could turn Turkey into a dependable source of coal for the greater European postwar rebuilding effort, while supporting Turkey's growing industrial base.[463]

At the time, the Zonguldak fields contained a mess of mine shafts and old machinery which hampered greater coal extraction. The grand plan for the basin included combining

[463] Economic Cooperation Administration, *European Recovery Program: Turkey, Country Study, European Recovery Program.* (Washington D.C: GPO ,1949). 9; Loftollah Nahai, *The Mineral Industry* of Turkey, US Department of the Interior, Bureau of Mines, 1958, 35; "Chicago Group to Help Turkey in Mining Coal," *Chicago Daily Tribune,* March 12, 1950, p. A9; *Mining Journal* vol. 253 (1960), pg. 103.

existing mines, mechanization, and electrification of mine facilities. These improvements would provide services like underground haulage, hydraulic extraction, and more coal washing plants in greater quantity, all of which would prove a step up from the animal and hand labor that defined Turkish mining to that point.[464] To go along with the Zonguldak mines, American ECA money had been earmarked for developing the Black Sea port of Zonguldak. Providing an all-weather seaport near the coal fields would make year-round shipping possible, a key change for a region that experienced extreme northeasterly gale winds which made loading and unloading of coal prohibitively difficult much of the year.[465] Additionally, planners included designs for new rail infrastructure between mines and the new port for easy transport.[466] ECA director Russell Dorr boldly proclaimed that, "To Turkey…the [Zonguldak] field and the port represent the keystone in the country's industrial arch."[467]

American engineers in Zonguldak were primarily represented through private companies contracted by the Turkish ETI Bank (a state-owned institution that established the Turkish national coal company) to advise the program. The engineering firm concerned with coal operations on site was the Paul Weir Company of Chicago. Founded in 1936 by a Pennsylvania State College engineering graduate, Weir specialized in mine development consultation, and oversaw a number of projects across the United States by the late 1940s. Before embarking on its work in Turkey, Weir completed foreign mine surveys in Great Britain, Canada, and Chile.[468] The company's staff in Zonguldak was first led by mechanical engineer Lee O. Richards of

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[464] Nahai, 42-43.
[465] Wlles Hangen, "Turkey to Export More Coal to NATO: US-Financed Improvements at Zonguldak Mines Permit Year-Round Shipments," *New York Times*, May 18, 1953, 12; Robert P. Williams, Hearings before the subcommittee of the committee on appropriations House of Representatives, eighty-first Congress, first session on the Foreign Aid Appropriation Bill for 1950, (Washington D.C.: GPO, 1949), p 543.
[466] Ibid, 541.
[467] "Developments Abroad," *Engineering News Record*, May 5, 1949, 25.
[468] "CHICAGO GROUP TO HELP TURKEY IN MINING COAL," *Chicago Daily Tribune*, March 12, 1950, A9.

Illinois, while the mining-specific work was headed by John Everitt Good, a Pennsylvania-born mining engineer educated at the University of Michigan.[469] His employment at Weir in the 1940s came at the right time for the expansion of the company's international operations. He would later take a position as a Senior Vice President at the company in the 1960s after the company founder's retirement, but first proved his worth as a part of the expansive and challenging Zonguldak project.

In fact, the Zonguldak program experienced early problems at a number of levels. Calls to build the seaport portion of the project were followed by questions regarding ownership of the program. The ultimate contract to build the seaport had been awarded to a Dutch firm ahead of the multiple Turkish groups that attempted to place their own bids unsuccessfully. This seemingly selective elimination of Turkish contractors stoked resentment in some corners of the Turkish press. After port construction began, Turks and foreign contractors clashed over control over the port program's operations, a complication that would eventually plague other engineering projects in Turkey. Additional questions surrounded the wisdom of the port project as a companion to the mine improvements. The port had been negotiated contentiously between the ECA and Turks as many in the Turkish camp felt that the harbor stood as an unnecessary distraction to mine development, while ECA officials promoted it as beneficial for facilitating easy exports to Europe.[470]

A more logistical problem surrounded the unique layout of the usable coal seams in the region's mines. While American mining engineers were used to thick and easily accessible seams in the U.S., coal seams in Turkey turned out to be more diffuse and difficult to extract.

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[469] University of Michigan, *General Register,* 1922,. 762.; "Engineers to Spend Two Years in Turkey," *New York Times*, March 10, 1950, . 38.
[470] Turkish News Items of Economic Interest, ECA Special Mission to Turkey, November 14, 1950 , NARA, RG 84,Box 146.

Good reported that the Turkish seams required one mine for fifteen seams, when in the US engineers followed a “one seam, one mine” guideline. This issue forced Weir to devise new tools and methods for the Zonguldak worksite that they did not plan for at the outset.[471]

Another complication in Zonguldak had to do with personnel. Weir generally staffed its projects with leaders in their respective engineering fields, but electrifying the basin revealed some deficiencies of their own. Thanks to the basin’s size, electrifying the coal mines single-handedly proved more challenging than Weir was expecting. In response, Weir contracted with outside electrical engineering experts who would be able to confront issues specifically related to electrifying the mines that their own personnel were unable to handle. In one case, Weir brought an electrical engineering expert out of retirement to assist in managing the issue.[472] The company successfully adjusted to the challenge, but delays did ensue.

On top of these problems, an explosion in the basin 1952 delayed further work for six months as an expensive recovery process ensued. The explosion not only caused a fire in the coal mines, but resulted in six injuries.[473] The project then came under greater scrutiny by Washington officials due to cost overruns and delays. By spring 1953, the Zonguldak program had overrun original cost estimates significantly, with nearly $4 million spent on “engineering services” alone.[474] Washington legislators also noticed that construction progress had been delayed a number of times since 1950, a reality project defenders tied to the fact of the Korean War. The war consistently emerged as an obstacle to the basin’s progress because of both

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[471] George Weller, “US Helping to Modernize Turkish Mines,” *The Washington Post and Times Herald*, November 3, 1954, 10.

[472] Alumni News, *The Michigan Technic*, December 1953,.40.

[473] “Zonguldakta iki tren carpisti 6 kisi yaralandi”,” “Two trains crash in Zonguldak, six people hurt,” *Cumhuriyet,* September 18, 1952. 6.

[474] U.S. Congress, Senate, Committee on Appropriations, *Hearings before the Committee on Appropriations,* eighty-third Congress, first session, 1953, 755; the initial estimates for the
ECA contributions to Zonguldak were around $13 million in total. Most of which was supposed to go toward equipment and actual construction, and only $1-2 million dedicated to engineering advisors.

transportation delays and restrictions on supplies and raw materials. For example, steel shortages came about as a result of re-routing those supplies to the Far East and delaying the construction of reinforcing structures in the mines.[475]

MSA officials later found problems concerning chain of command on the Zonguldak project, leading to disagreements among the Turkish and foreign forces involved (American and European private engineers, MSA managers, and Turkish engineers). The MSA found that these tensions contributed to three major problems tied to the basin project: "1) Little to no coordination between procurement and installation of equipment, 2) no follow-up by MSA on the installation of installed machinery 3) lack of information as to Turkish compliance with their local currency commitments under the agreement."[476] In response came a coordinated overhaul of the program's administration between the MSA and Turkish authorities. At the start of the project, Weir shared contracting duties with other American firms. After the MSA investigation, the ETI Bank cancelled two other American firms' contracts due to their roles in producing "unsatisfactory" work and contributing to conflicts between foreign engineers and Turks.[477] Officials cited Weir as the only American contractor to provide satisfactory services. As a result, Weir took over the broad engineering services of the Zonguldak project from January 1954-on.[478]

The project progressed more smoothly under Weir's direction. By 1955, the Zonguldak mines produced 3.5 million metric ton of salable coal, a number that continued to rise through

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[475] Comptroller General of the United States-, Report to Congress, Examination of Economic and Technical Assistance Program for Turkey, International Cooperation Administration," July 1958, Eisenhower Library, White House Central File, Confidential File, Box 6.

[476] Ibid, P 763,
[477] Ibid, 755.
[478] *Examination of Economic and Technical Assistance Program for Turkey* International Cooperation Administration, Department of State," July 1958, Eisenhower Library, White House Central File, Confidential File, Box 6.

the decade into the 1960s.[479] Relations between Weir staff and Turks also improved noticeably, likely due to the clearer chain of command that emerged after other U.S. firms exited the scene. Late in 1954, the *Washington Post and Times Herald* reported that Turkish technicians on site were "fully competent and American-trained," as evidence that Turks on the job were worth continued U.S. investment.[480]

John Good credited Turkey's "strongly anti-communist" sentiment as another contributor to the project's progress. In a 1957 press conference from his office in Chicago, he noted that Turkey's general climate well into the Eisenhower administration still strongly leaned "pro-Western" as it had been during Gifford's time in Turkey. Still, Turkey's economy definitely faced challenges. In Good's words, Turkey had "tried to go a little too fast- and in the process, put itself into a delicate economic situation." But with the helpful progress made in the Zonguldak basin to increase coal outputs, Good predicted boldly that Turkey would be "set on its economic feet within 10 to 15 years."[481]

Weir personnel stayed on-site in Zonguldak until well into the 1960s, which presented new challenges for administrators. In 1965, the Zonguldak mine became the site of labor unrest, and a subsequent wildcat strike. What began as a small scale wage strike eventually involved most of the region's 46,000 workers. Turkish troops intervened in the five-day struggle, and two workers were killed by intervening soldiers. Even though Weir's presence in the basin at the time was minimal and had no effect on the strike's outbreak, the event marked a pivotal point in the

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[479] In a 1953 hearing before the Senate appropriations committee, ECA Chief Harold Stassen reported that the agency projected an eventual salable Zonguldak coal total to hit 3.7 million tons. That goal was met later than initial estimates, but was eventually exceeded by the end of the 1950s. Later growth goals were similarly met later than expected; U.S. Congress, Senate, Committee, *Mutual Security Appropriations* for, *1954*, 758; Mehmet Guney, "Underground Mining Operations in Zonguldak Coal Mines,," Middle East Technical University, Ankara, 1967, 114.

[480] George Weller, "US Helping to Modernize Turkish Mines," *The Washington Post and Times Herald*, November 3, 1954, 10.

[481] Joanne Knoch, "Holds Turkey Will Resist Communists," *Chicago Daily Tribune*, July 21, 1957, A11.

burgeoning Turkish labor movement as the first ever fatal labor demonstration in modern Turkish history.[482] Even in times of relative cooperation, it seemed, development consistently produced situations that took planners by surprise and revealed new tensions. True, mine labor sought greater pay to align with higher mine production numbers. But, they also had to account for the new dangers mechanized mines presented, a concern directly connected to the mechanization and electrification effort that began a decade and a half before.[483] In a broader sense, the movement of Turkey into a modern industrialized era produced new demands that the old "backward" model of unorganized Turkish labor had proven incapable of. In this way, Turkish and American policymakers who ventured to bring modern coal production to Zonguldak unwittingly invited the companion demands of modern laborers as a related cost and an unintended consequence of modern coal production.

For Weir, the Turkish project was only the beginning of its development work with American federal agencies. The company assisted in what would become a true hotbed of Cold War tensions in 1958 when it surveyed coal conditions in Vietnam as a part of the ICA.[484] By one account, the Weir contingent's stint in in the Southeast Asian country had been marked by a "feeble" and "spasmodic" Viet Cong presence, but the engineers still encountered unfriendly fire. At least in the minds of Weir technicians, their experience revealed that 1958 Vietnam was a "prevailingly peaceful" and "friendly" place.[485] It is unclear whether the firm returned to further

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[482] Delwin A. Roy, "The Zonguldak Strike: A Case Study of Industrial Conflict in a Developing Society," *Middle Eastern Studies* 10, 2 (1974): 142–143.
[483] Ibid., 180.
[484] Special to The New York Times, "EXPERT APPRAISES VIETNAM COAL PIT," *New York Times*, June 8, 1958, 14.
[485] Clayton Ball, "Coal Mining Experiences in Distant Countries," *Proceedings of the Coal Mining Institute of America*, 1962, 63-69.

assist in the coal development project after 1958, as cuts to U.S. non-military aid in free Vietnam were made beginning fiscal year 1960.[486]

Adventures in Sarıyar

Another large-scale engineering program running concurrently with Zonguldak was the Sarıyar hydroelectric power plant located on the Sakariya River in western Ankara Province. The Sarıyar Dam, approved for ECA funds in 1950, became a part of a grander national Turkish energy policy which sought to network the nation's power sources and boost production.[487] Positioned between Ankara and Istanbul, Sarıyar served as a key link to connect the northwestern power grid with central Anatolia and Ankara. The project required a 330-foot high dam to be built on the Sakariya River, and the adjacent power plant would provide ultimately 160,000KW of power at a U.S. cost of approximately $15 million.[488]

As a part of wider modernist thinking, the harnessing of the natural river for power stood as a favorite standby project for American planners going back to Roosevelt's first New Deal. As historian David Ekbladh writes, "Hydropower was essential to settlement and commerce as well as the extension of political authority and a capitalist order." As a result, Turkey was just one of many Third World countries to benefit from U.S. development aid for dam building. Naturally, Turkey's movement into hydroelectric power struck a chord with American ECA personnel who drew on their experiences at home to implement similar dam projects as a part of foreign policy "in the American style" abroad. [489]

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[486] U.S. Congress, Senate, Committee on Appropriations, *Mutual Security Appropriations for 1960*, 86th Congress, first session,1959, 528.
[487] Special to THE NEW YORK TIMES, "TURKS PLAN POWER PLANT, Biggest Facility in Country Will Be Built With E.C.A. Aid," *New York Times*, September 23, 1950, 8.
[488] U.S. Congress, House of Representatives, Committee on Foreign Affairs, *Hearings*, *Mutual Security Act of 1959*, 86th Congress, first session, 1959, 1524.
[489] Ekbladh, *The Great American Mission*. 49, 161.

The American firm contracted to work on the Sarıyar project was Charles T. Main Company, an engineering firm based out of Boston. Main had been founded in the late 1800s by MIT mechanical engineering graduate Charles T. Main and steam engineer F.W. Dean. Main himself became a pioneering expert in power production, and patented a steam engine regulator meant for use with the popular Corliss-type steam engine in 1889.[490] Main's stature grew nationally along with his firm through the turn of the century.[491] The company undertook a number of hydroelectric projects nationwide, especially during the New Deal's TVA projects in the 1930s.

The company's contract with Turkey came as a part of a more general pivot to more international work during the 1950s. After embarking on the Sarıyar project, the company proceeded to conduct surveys and studies in other TCA locales. One particular project the company worked on came on the Jordan River watershed in 1953, when the company's analysis influenced the choices made in Eisenhower's "Water For Peace" program.[492] Main's reputation was such that by the middle of the 1960s, the firm gained recognition as the largest engineering consultation firm in the United States according to *Engineering News-Record.*[493]

The engineer at the head of Main's operations at Sarıyar was University of Colorado-trained civil engineer Wilfred McGregor "Mac" Hall. Born in 1894, Hall graduated from

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[490] Main, Charles, Regulator for compound engines. U.S. Patent 397507 A, filed July 5, 1888, and issued February 12, 1889.

[491] Chas. T. Main Inc. Records, Northeastern University Archives and Special Collections Finding Aids, *http://www.library.neu.edu/archives/collect/findaids/m152find.htm;* Main served as a research assistant in the mechanical engineering department immediately after graduation, and wrote a thesis on marine engines his senior year. His experience in that research field contributed to his later work on hydropower. In the 1950s, MIT dedicated an on-campus textile research facility to his name,; Charles T.,. Main, "The Efficiency of Marine Engines," 1867, MIT Institute Archives- Non-circulating Collection,(B.S. Thesis, MIT, 1867).; "M.I.T. Dedicates Charles T. Main Textile Center," *Daily Boston Globe*, March 7, 1954, C6; . JOHN VALUE, "70-Year-Old Chas. T. Main Firm Does Business the Yankee Way," *Boston Globe,* December 15, 1963, 60A.

[492] *FRUS*, 1952-1954. vol. IX, The Near and Middle East pt.1 1273, 1299; *Ekbladh, The Great American Mission*. 164.

[493] Donald White, "If They Call You No. 1 Why Argue About It?," Boston Globe, January 20, 1966, 20.

Boulder in 1916 with honors and embarked on a career with Main upon graduation. World War I interrupted his employment at Main while he served in the Army, but he returned, only to leave again for his first foreign engineering assignment with other firms to Brazil and Puerto Rico.[494] When he returned to Main during World War II, he contributed to the company's retooling for war production, while spearheading Main's diversification into new engineering project fields like paper mill production and nuclear power plants."[495]

Just like the Zonguldak mine and port program, the Sarıyar Dam proved problematic for planners. Main found that Turkish authorities had granted earlier building rights to "inexperienced" Turkish firms that built inadequate structures for such a large scale-project. In order to facilitate the dam's construction, the river needed to be re-routed via pressurized tunnel, which would clear the water for building. Main found that the tunnel built by Turks was not made to handle the specified water pressure, producing delays and additional costs. The blame also lay with Turkish authorities who selected the building firm against the advice of Main's personnel. In the words of the Government Accountability Office, the ETI Bank was guilty of "Inefficient use of contracted services, inexperienced local contractors and poor workmanship."[496]

U.S. evaluators further noticed difficulties in Sarıyar linked to the broader problems of Turkish economic stability and the "reluctance of the Turkish Government to delegate authority

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[494] *University of Colorado, Catalogue of the University of Colorado, Boulder Colorado* (Times Print. Company, 1916). 271, Charles C. Noble, "Wilfred McGregor Hall" *Memorial Tributes-National Academy of Engineering,* vol. 3, 1989, 179.

[495] W.M. Hall and C.A. Dauber, *Chas. T. Main, Inc, A Professional Legacy* (Princeton, NJ: Princeton University Press, 1975), 5-20.

[496] "Report to the Congress of the United States-*Examination of Economic and Technical Assistance Program for Turkey* International Cooperation Administration, Department of State," July 1958., Eisenhower Library, White House Central File, Confidential File, Box 76.

and heed the advice of American Consulting engineers hired to supervise the building of these projects." Considering the Sarıyar project looked like an impending quagmire, the MSA decided

funds also went to expanding the Sariyar hydroelectric turbine capacity after Main personnel left in 1957.[497]

The Zonguldak and Sarıyar projects shared characteristics with the Turkish roads program apart from their expensive operations. Each program presented complication after complication, sometimes related to controllable factors like building quality and oversight, but sometimes due to uncontrollable factors, such as the outbreak the Korean War. Still, such obstacles simply served as speed bumps in the projects' path to completion. Program managers dealt with progress and delays in equal measure in all projects, but were faced with a single option when attempting to overcome those obstacles moving forward; more technology.

As in the roads program, one common driving force behind further American involvement in these projects was the notion that technology, specifically engineering expertise, provided a sort of cure-all for the program's ills in some way. Problems tied to engineering did not result in a wholesale indictment of engineering. Regardless of the obstacles encountered Washington and Ankara officials always sought more engineering rather than less. Washington officials noted the lack of "sound engineering practice" applied to the project, but as engineers did, also saw engineering as the solution. In talks with Turkish officials, including later Prime Minister Adnan Menderes, American policymakers emphasized that only through a "qualified firm of engineers" could the problematic programs be rescued from their plight.[498] Despite

[497] U.S. Congress, Senate, Committee on Appropriations, *Mutual Security Appropriations for 1954:, Hearings before the Committee on Appropriations*, 762-763; It was stated that the chain of command problems from before may not be solved in placing Paul Weir in a supervisory role, as the Turks seemed unwilling to respect previous US firms' authority.; Operations of the Development Loan Fund, House of Representatives, *Hearings before a subcommittee of the Committee on Government Operations,* Istanbul, Turkey, Monday September 21, 1959, 178.
[498] *FRUS*, 1952-1954, Vol. VIII, Eastern Europe; Soviet Union; Eastern Mediterranean, 924.

repeated cost overruns and unforeseen complications identified by engineers, it seemed that the only way out of the impending quagmires was indeed more engineering.

Truman and New Uses for Engineers

In the wider security context, and as development programs gained momentum abroad, American foreign policy increasingly found new methods of utilizing engineering expertise. Point Four not only spread American engineers overseas, but also engineering literature. Distributing technical knowledge itself became a key to Point Four's aims, and written forms of that information served as an efficient method of spreading it. As a result, American publishers sent foreign countries subscriptions to a variety of engineering periodicals, like *Engineering News-Record* and *Chemical Engineering.*[499] In what amounted to exporting the American engineering mentality, the further spread of engineering literature seemed to be a start of a longer term trend. Since the State Department added a science advisor to its ranks in 1949, the notion of spreading American technological information en masse through print had been a serious consideration.[500] The State Department also administered American book repositories overseas, which in 1950 numbered over 200 libraries and reading rooms. These libraries contained a variety of science and engineering literature, and by one measure, seventeen percent of all material loans were for science and technology titles. The dissemination of engineering literature certainly served American propaganda interests- American publications were chosen for Point Four based on their "correct" reflection of a desirable American life - but the global status of American engineering in the era was authoritative enough to warrant foreign demand for its

[499] The Importance of Scientific and Technical Books and Magazines in the Point Four Program, undated, David D. Lloyd Files, Truman Library, Box 20.
[500] Scott Adams, "Information for Science and Technology,: the International Scene," *University of Illinois Graduate School of Library Science*, 1973, 7.

journals. Through the 1950s, dissemination programs like this would only widen, most notably under the charge of President Dwight Eisenhower's United States Information Agency (USIA).

Engineers also found new support through the U.S. Government at home concurrently with the explosion of foreign development work under Truman. Central to the institutionalization of engineering under Truman, the emergence of the National Science Foundation became one of the nation's most visible supporters of science and engineering research. In January 1947, Truman held a meeting in the East Wing of the White House with 25 leaders in science and technology who together formed Truman's Presidential Scientific Research Board. Among those present were Vannevar Bush, who, after his work on the Manhattan Project, had now ingrained himself as the Truman administration's loudest pro-research voice. The purpose of the meeting and the board was directly tied to the research developments of World War II. The investment in innovation the government made during the war turned it into the greatest research arm in the nation. Continuing to benefit from that type of innovation in the Cold War would mean continued commitment to spending for research personnel and facilities. With so many arms of the U.S. government engaged in research, Executive Order 9791 sought to organize the research into a "sound long-range policy" that could assist in making recommendations to Truman regarding research and development policies.[501]

Previous attempts at such a comprehensive state backing of research, like Senator Henry Martin Kilgore's Office of Technological Mobilization proposal in 1943, faced various bureaucratic and personal obstacles. Most historians claim that Bush himself ultimately pushed Kilgore's civilian-monitored plan aside to pursue his own plan for a more libertarian science policy policed by scientists themselves. Kilgore envisioned a postwar scientific body that

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[501] Minutes of the First Meeting of the President's Scientific Research Board, January 2, 1947, Truman Library, Official File, Box 822; ideas for a national science research program were not first formed at this meeting, but its aims came closest to fruition there.

allowed more political oversight over its operations. Perhaps most offensive to Bush's engineering mentality, Kilgore's plan sought public control over patents funded by the foundation rather than assigning the patent to the individual innovator.[502] In an almost eerily similar scientific analogue to George Kennan's disdain for democratic policy formation and preference for elite-driven rule, Bush saw that the service-minded scientific community was at its base interested in the greater good, and needed no broader political oversight to operate effectively.

But, Truman sought to take the reins of the scientific establishment more directly, and he appointed his close advisor, John Steelman, to spearhead an inquiry into a scientific research program with the help of the board that gathered at the White House that day in January. At Truman's request, Steelman prepared a detailed study of science's role in American governance with the assistance of the board. The committee collectively gathered information about scientific research through most of 1947, revealing spaces of redundancy and budgetary needs across the government's research arms.[503] Steelman's release, "Science and Public Policy," became a widely circulated visible proof that the knowledge of technicians served key American interests. Steelman's report was published in sections addressing different facets of the science program's purposes. The report noted that as a matter of national interest, 1% of the national budget should be dedicated to "research and development in the universities, industry, and the Government," and that civilian oversight would be a central part of operating the research program.[504]

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[502] G. Pascal Zachary, *Endless Frontier: Vannevar Bush, Engineer of the American Century* (New York: Free Press, 1997), 250-253.
[503] Michael Hogan, A Cross of Iron: Harry S. Truman and the Origins of the National Security State (Cambrdge, UK: Cambridge University Press, 1998), 232.
[504] John Steelman, *Science and Public Policy : a Report to the President*, (Washington D.C: GPO,1947) 6, 55.

According to historian Michael Hogan, the Steelman report did not entirely change the way scientific research was conducted in the U.S. Rather, the armed forces that had conducted their own research programs would continue to do so without civilian oversight after all the policy discussions completed. The money at stake in military research demanded its own siloed structures that saw to it that a single unified scientific body would not completely displace what came before.[505] But one significant suggestion from the Steelman Report did come to fruition. On May 10, 1950, the National Science Foundation became reality through Truman's signing of the National Science Foundation Act. The Act emerged because of a widely supported notion in Congress and the Truman administration that the government held a vested interest in science and technology research. Echoing Theodore Roosevelt from four decades earlier, to slow innovation in the U.S. would disadvantage the country both domestically and in foreign policy. The NSF would serve as a reserve for American researchers in relevant fields to win grants that would enable useful knowledge to be discovered on a more regular basis. By providing a new resource for researchers to tap into, America's innovators and problem solvers found themselves in a place of visible importance once again.[506]

The first NSF grants came in 1952, and engineers sat among the chemists and medical researchers with winning proposals. Of that first year's grants, three separate engineering-specific projects were awarded funding. The winning projects went to researchers at Brown University, MIT, and Pennsylvania State College. The winning researcher at MIT was Dr. John George Trump for his research in vacuum technology. An electrical engineering professor, Trump would later win the National Medal of Science, while also holding the distinction of

[505] Hogan, 232-233.
[506] First Annual Report of the National Science Foundation, (Washington D.C.,: GPO, 1951), vii.

being the uncle of would-be New York real estate mogul and President of the United States, Donald Trump.[507]

Engineers also found themselves in demand to fill posts in the NSF's National Science Board. Individual scientific experts and educators would hold two-year board positions on the Board, and engineers were often among their ranks. Many of these board members came from the engineering generation, and made their mark significantly in their respective fields. Donald H. McLaughlin served on the first iteration of the board, and held the position of President of the American Institute of Mining, Metallurgical, and Petroleum Engineers.[508] Andrey A. Potter, a MIT graduate, became Dean of Engineering at Purdue University in the 1920s, and his work in West Lafayette elevated Purdue's engineering program to its status as arguably the Midwest's finest. He had led an investigation in engineering education back in the 1920s that found, among other conclusions, that a more "functional" engineering education should prevail to incorporate "humanistic relations" into an engineering education.[509]

Before realizing its benefits, some technicians voiced concern that the NSF seemed to emphasize unfairly the work of scientists while ignoring engineers. Of their discomfort with the new agency, historian Diane Belanger wrote that engineers felt that "Philosophically, perhaps even emotionally [engineering's] position seemed less than certain in this new government agency, which was established to support basic scientific research in the name of postwar national strength and security. Could research in engineering…be considered basic in scope and significance?" Some technicians scrambled to ensure engineers could consistently drink from the

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507 "JOHN TRUMP DIES; ENGINEER WAS 78," *The New York Times*, February 26, 1985.; The Second Annual Report of the National Science Foundation, (Washington DC, GPO, 1952), 44-46

508 The Third Annual Report of the National Science Foundation,(Washington DC.,: GPO, 1953), 61; Donald H. McLaughlin, Honorary Membership 1984, http://www.aimehq.org/programs/award/bio/donald-h-mclaughlin-deceased-1984 .

509 A Guide to the Andrey A. Potter Papers, 1893-1986, Purdue University Libraries Archives and Special Collections, http://collections.lib.purdue.edu/fa/pdf/potter.pdf; Society for the Promotion of Engineering Education, *Report of the Investigation of Engineering Education, 1923-1929.* (Pittsburgh, Pa., 1930). 1252-1253.

newly-opened government funding well. One idea floated in response suggested creating a separate national engineering foundation that would be specifically used for funding the work of engineers, not scientists. When the NSF was announced in 1950, the Engineers Joint Council (a voluntary grouping of members coming from various subfields of engineering) suggested to John Steelman that at least six of the 24 board members should be engineers, and the request came complete with a list of vetted candidates the EJC recommended for the posts. This suggestion resulted from the field's concern with engineering oversight through the program; without engineers backing it, a national research program would be of dubious status. To their mind, engineers produced the waypoints that marked technological research's advances, and their authority in such matters was key for legitimizing the foundation's work.[510]

Ultimately, engineers' concern for neglect from the NSF was unwarranted. The foundation turned out to be a boon to engineers at home who could benefit from the agency in a variety of ways. The NSF came to back no only individual engineering research projects as a part of its normal course of awards, but also fund various engineering association meetings and broader engineering endeavors to promote the field.[511] Further, the NSF would truly institutionalize engineering expertise in the formation of the Mathematical, Physical, and Engineering Sciences as a specific organizational group within the NSF.

Engineers did not only think of the NSF as a funding opportunity. They saw their participation serving on the NSF board and winning awards, as an extension of their service to humanity, a vote of confidence that their work was aligned with the pursuit of American interests. The NSF meant further invigoration for engineers, and their internal association

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[510] A.F. Bochenek, "Science Foundation Becomes Reality," *Mechanical Engineering*, 72, no. 7, (July 1950): 598.
[511] Lance E. Metz and Ivan M. Viest, *The First 75 Years: A History of the Engineering Foundation*, (New York: Engineering Foundation, 1991), 228, 237, 249.

discussions showed a collective sense of acknowledgement that their involvement in the foundation proved they still had plenty of work to do for the greater good.[512]

This pursuit of a national science policy had links to foreign policy considerations as well. The 1950 government report "Science and Foreign Relations" articulated that scientific exchange had a great potential to build good will with other nations, and served as an "instrument of peace." Conversely, scientific relations could allow American technicians the ability to keep a close eye on those developments in other countries that might be beneficial to American researchers.[513] By adding more State Department involvement with science as a foreign policy, the report argued, technicians and scientists would have easier access to foreign information and could promote more private partnerships for scientific research. Some of these goals were partially obtained through educational exchange programs such as the Fulbright and Smith-Mundt Act, where scientific and engineering students, researchers, and teachers were of great importance.[514]

In sum, the Truman administration's efforts to extend American power in the world as a deterrent to Soviet expansion demanded engineers join as partners for the long term. Truman had made it clear that the new American order both at home and abroad could not be undertaken without engineering expertise, and the range of policies enacted under his watch put engineers in places of importance for executing those plans. This new America was to be underwritten by technological prowess; the federal government would see to it that engineers had the means to refine their craft in perpetuity with grants through the NSF and, as always, the Department of Defense. Their skills would be deployed around the world in the name of American

[512] Dian Olson Belanger, *Enabling American Innovation: Engineering and the National Science Foundation* (Purdue University Press, 1998), 24.
[513] Department of State: International Science Policy Group, "Science and Foreign Relations," (Washington D.C.: GPO, 1950), 3-9.
[514] Ibid, 61-62.

development, their knowledge disseminated through various assistance programs and propaganda campaigns. Thanks to his engineering policies Truman acted as a contributing force propelling the field to the highest status it had ever enjoyed.

An Angst-Ridden Milestone

Besides signaling the final year of Truman's administration, 1952 brought a significant event for the engineering profession. That event was symbolized in the form of a humble three-cent postage stamp issued by the U.S. Postal Service on September 6. The stamp celebrated the centennial of the American Society of Civil Engineers, the field's very first national professional association. The stamp itself profiled the leaps the field had made in bridge design over its existence. Above a drawing of a rural wooden covered bridge with a horse-drawn carriage passing through it loomed an impressive image of the George Washington Bridge connecting Upper Manhattan with New Jersey. The George Washington Bridge was a marvel of steel suspension bridge engineering when it opened in 1931, and continued to be a symbol of the field's achievement and dexterity. In contrasting it with the wooden bridge, the ASCE chose a well-known subject to illustrate its advances over its century of service. The imposing steel bridge towered over the Hudson as the greatest landmark in upper Manhattan, not to mention reducing commute times from across the river. The bridge had embedded itself in the landscape as one of the markers of American ingenuity, and the public had the skill of civil engineers to thank for that.

More generally, the centennial came at a convenient time for the field. The moment allowed technicians to reflect on their past and broader contributions to society with the backdrop of postwar engineering efforts in high-gear. In just the past ten years, engineers had

played central roles in the preparation and execution of a world war-winning military strategy, and became joint partners in a large scale realignment of American foreign policy. But the centennial pulled the timeline of reflection even further back, and the ASCE stood eager to bring its full body of work to the surface.

Deemed "A Century of Engineered Progress," the centennial provided a celebratory moment for the field, and the ASCE planned a number of events surrounding it. The ASCE established a non-profit organization called the "Centennial of Engineering, 1952 Incorporated," to plan the activities during the year, and estimated spending approximately $1 million for the purpose. The group planned a sort of parade of engineering at the Chicago Museum of Science and Industry, and hoped as many engineers would attend as possible. There were international symposiums planned which would connected American engineering achievement with that of the rest of the world. Additionally, the ASCE produced a special commemorative issue of its magazine, *Civil Engineering*, to be published in September 1952.[515]

The September issue featured a number of revelations about how engineers internalized their work over the last one hundred years. For one, although the ASCE acknowledged its European roots, the group argued that from its start, American engineering was its own creation: "We did import the steam locomotive from Britain, but American engineering owes relatively little to European techniques and practices. It has grown and developed from pioneer beginnings in a particularly American manner to meet particularly American needs, wants, and conditions."[516] The writer continued to say that the abundance of timber allowed American engineers ample material to experiment with in building infrastructure, most notably the transcontinental railroad in the 1860s. The field continued to innovate with "vigor" and with new

[515] William Carey and E.L. Chandler, "Centennial of Engineering, 1952," *Civil Engineering*, Vol. 22, no 1, (Jan. 1952): 108-109.
[516] J.K .Finch, "A Century of Progress in Civil Engineering," *Civil Engineering*, vol. 22, no 9, (September 1952), 37.

materials and projects, they produced some of the most central landmarks in American society. The ASCE noted a key recent shift in their profession towards increased public work with governments and agencies attempting bigger and more ambitious projects. Through it all, engineers stood by, proud of their labors in making the building process faster and more efficient, while spreading its benefits to more people.[517]

Engineers had to take stock of what they had given to the world through their service. There was the "vital contribution" in winning the World War that they acknowledged as a first-order accomplishment. Echoing Douglas MacArthur, engineers claimed that World War II stood as an "engineer's war," and technicians had plenty of evidence to back that claim. But, their reflections on the postwar world also received focused attention during 1952. One writer stated that engineers had "been leaders in the creation of the greatest social structure of all time, so strong that with only 6 percent of the world's population and 7 percent of the world's area, we are supporting the rebuilding and rearmament of the entire Western world." Claiming postwar recovery for engineering seemed not out of character for engineers, and was likely as true as their ownership of their role in helping to win the war. In line with their modern notions of technological change, their contributions to humanity also broadly included eliminating the fear of natural phenomena displacing human life. "Our Western world no longer fears the ravages of nature-storm, flood, hunger, and cold. Science, technology, and engineering have dispelled these fears."[518] Triumphalism over nature, it seemed, held a prime place of importance in the collective memory of engineering's last hundred years.

At times, commentators read more meaning into the centennial than simple celebration. The milestone brought engineers to ponder the future of their profession, revealing a deeply

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[517] Ibid, 38-41.
[518] Ibid, 36.

rooted set of concerns. One engineer pointedly wrote, “Now this hundredth year of ours demands more than a great celebration and more than a demonstration of past accomplishments. This should be accepted as the year of the full maturity of our profession.” Through this future-focused perceptive, engineers managed to find a surprising number of problems in and around their profession through the robust 1950s that kept engineers engaged with their problem fixing tendencies. The future presented plenty of challenges for technicians, but they, as expected, saw that those challenges were often of their own making. The ever-present fear of atomic firepower in the nuclear age had engineers blaming themselves for inciting that concern. Tied to the fear of nuclear power was anxiety that engineers brought certain maladies through innovation, and that those innovations have proven increasingly unwieldy. “Men see science advancing beyond their ability to control its discoveries or to regulate its power for destruction.”

Another almost-constant tension among engineers was the fear of professional splintering, and a call for greater unity across specializations. Just as in the 1920s formation of the Federated American Engineering Societies, 1950s engineers expressed fear that tackling the challenges of the future was too daunting of a task without greater coordination among the broader engineering community. These commentators found that the future presented a lack of “direction” for the field, and that “Never has there been more confusion of thought and purpose” in the field as a whole.[519] For some, the fact that a single group of engineering specialists could not “speak for” the engineering profession provided reason for debate and planning for greater cohesiveness across the profession. The field of engineering suffered, consequently, from too many silos for its own good, and needed to reform or risk atrophy.[520]

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[519] Walter L Huber, “A Second Century of Service Begins,” *Civil Engineering*, vol. 22, no 11, (November, 1952): 34-35.
[520] “Is Our Professional Status Threatened?” *Civil Engineering* vol. 25, no 4, (April 1955): 66.

Engineers saw additional problems with the position of engineering manpower in the era. After the high graduation rate of 1950, when so many veterans finished their engineering degrees, college engineering graduation rates dropped in the years after, eliciting near-panic among the ranks of engineers. Technicians wrote articles and gave addresses that highlighted the importance of dealing with this "problem." S.C. Hollister, Dean of Cornell's Engineering College, noted in a September 1952 commentary, "All indications point to the fact that there will be a profound change in the engineering profession in the next quarter century. This will come about largely because the need for engineers will rise at a more rapid rate than the supply. Technological processes in almost all fields are becoming more complex. This fact alone calls for a larger annual output of engineers."[521] Over the following years, these calls to action brought critiques on *how* engineers are trained. In one particularly unique piece, John Wilbur of the ASCE's Trask Committee on Engineering Education wrote an article entitled "Is Engineering being taught backward?" Wilbur noted that instead of teaching science first and then learning to apply it to practical contexts, engineering programs should consider teaching "the art of engineering" before hard science is introduced. All this would ground the student in "spheres of function" and be able to take on problems more creatively before applying the applicable science.[522]

Beyond this, engineers also found problems with their status in a changing economy. Some found room to complain about the status of civil engineering supposedly becoming a "trade" rather than a "profession," to those on the outside looking in. With so many engineers refusing to engage in their professional association activities, the field risked becoming closer to a construction trade rather than an organization for the highly trained. Part of remedying this

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[521] S.C. Hollister, "Engineers Must be Upgraded to Solve Manpower Shortage," *Civil Engineering*, vol. 22, no 9, (September 1952): 82-83.
[522] John B Wilbur, "Is Engineering Being Taught Backward?" *Civil Engineering* , vol. 25, no 1, (January 1955): 57.

issue was educating the public about the proper place of engineers: “We cannot hope to grow in professional stature until the engineer and the public are made to realize just what the engineer is, what he does, and what his responsibilities are.”[523] As long as the general public understood the specific place engineers held in society, they could retain their status apart from the everyday laborer.

Engineers of the 1950s rehashed the almost-omnipresent problem of engineers' “detachment” from normal society. Like in previous eras, engineers in the 1950s periodically called for a greater engineering presence in government and policymaking. Their preoccupation with producing physically engineered items was, to some, a distraction and engineers had a great opportunity to serve their country in Cold War need through greater application of their knowledge to social purposes. In the words of one commentator, “We have hidden behind our slide rules when we should have been taking our essential place in the world of public affairs.” From their dialogue, until all global and domestic tensions had been treated with the engineer's touch, one could not hope to live in a truly open and free society. In the tradition of engineers, these commentators also knew that the existence of any of the above problems proved that they had not yet “finished our job.”[524]

Without a doubt, challenges lie ahead, but the 1950s were perhaps the most inappropriate moment in which to air those fears. For a profession that had never been more in demand, visible, and highly paid, their complaints and problem-seeking impulses within their own camps reflect nothing more than overreaction. From 1940 to 1955, the membership in the ASCE grew every year, without fail, even during the war.[525] The drop in graduating engineers after 1950 was

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[523] Louis Butz, Arthur Gooch, Thomas Woolton, and James O'Brien, “Is Our Professional Status Threatened?” *Civil Engineering*, Vol. 25, no 4, (April, 1955): 66.
[524] Finch, *Civil Engineering*, 37
[525] Wilbur, *Civil Engineering*, 67.

real, but not a harbinger of things to come. The graduating class of 1950 became the largest in American history to date due to many war veterans graduating in that year after returning from war. The demand for engineers remained high as the military industrial complex emerged under wartime mobilization in Korea.[526] Over the course of the following years graduation rates increased year-over-year and recovered with a more-healthy gradual trend in the latter 1950s.[527]

To relieve engineering anxieties in the 1950s, the profession unequivocally carried higher status than it ever had before. Employment trends through the 1950s reflect that engineers held consistently rising importance in American society. The field had expanded to approximately 400,000 practitioners by 1950, a number that was around ten times greater than in 1900. Wages had also steadily increased since the end of the war, and the Bureau of Labor Statistics occupational outlook for the field consistently reported positive futures for engineers each and every year through the 1950s. The expanding economy and demand for consumer goods also drove demand for technicians through the 1950s. Recent graduates had more choices for specialization than ever before, filling new specific subfields like formalized biomedical engineering and food engineering fields. By the end of the decade, engineering ranks had more than doubled again to approximately 850,000.

The decade also saw engineering education take nominal steps toward reforming how students earned their degrees. College programs began co-op relationships with employers on an increasing basis in the 1950s as an immovable part of an engineering degree course. By the measure of the U.S. Bureau of Labor Statistics, there existed about 35 such programs in the country by 1959. While these more practice-focused co-ops were being increased in the field, engineering programs at places like RPI were dropping their written thesis requirements for B.S.

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526 U.S. Department of Labor, "House Document 230: Effect of Defense Program on Employment Outlook in Engineering," August 1951.

527 U.S. Department of Labor, Occupational Outlook Handbook, 1959),100.

degrees. And just as important, women made their first significant gains in the field in the 1950s as well.

The speedy increase of engineering demand was no doubt supported by state spending, but engineers found high demand in private firms as well. Development engineers were often contracted by the U.S. government rather than brought on government payrolls, which could blur the line between private and public engineering service. Even so, innovations in the private sector in the aerospace, consumer goods, and automotive and construction industries all demanded engineers in increasing numbers.

By the end of 1952, engineers had abetted the explosion of development work in the U.S., contributed to spreading their craft abroad through literature and education, and ingrained themselves into domestic public life through agencies like the National Science Foundation. Across the board, to be an American engineer in the early 1950s was rewarding to say the least. Few occupations had ever enjoyed such dramatic increases on all fronts. Without a doubt, engineering in the 1950s can be viewed as the high-water mark of the profession's Golden Age.

Yet even when engineers were doing well, they still exhibited a great deal of angst, which brought out their problem solving mentalities in force. And, when the problems they encountered in the technological world proved manageable, they turned their criticism on themselves, and found challenges and issues within the field that distracted them from real problems that loomed over them. The engineering mentality had served technicians through world wars, and enabled development policies that only they could fulfill. If their commentaries are any indication, this was a trait impossible to turn off for individual technicians. In the best of times, engineers found ways to turn their rather heady operation into a kind of paranoid basket case. Problems in the

field became convenient ways to continue exercising their skills when real detrimental problems were unavailable or being solved in the moment.

Reviewing Engineering in Early 1950s Foreign Policy

All things considered, the early 1950s had cemented engineers as partners in American foreign policy, enabling American Cold War moves to previously ignored parts of the globe. Just the same, the U.S. government enabled technicians and their problem solving skills, which had the dual effect of raising their stature and reputations, while giving way to new anxieties amongst practitioners. Combined with various developmental programs from U.N.E.S.C.O. and other U.N. arms, engineers were now involved in both U.S. and U.N. agencies used to promote "improvement" of all types around the world. As a group, technicians experienced a renaissance in their profession due in large part to their expansive work abroad in the name of American security and development.

In their own way, individual engineers like Pat Gifford and Jack Killalee had ridden the crest of that wave, serving as experimental subjects for Truman's melding of engineering with foreign policy. Gifford's job educating Turks on the Maintainer amounted to a minor role on the larger scale of development work, but came to symbolize one of the central aspects of U.S. foreign policy in the Third World. As he departed for home just before Christmas 1950, Gifford had traveled on nearly 2,000 miles of Turkey's roadways, making it as far as Elazig in the east. As it stood, the roads project still had plenty of work to be done, but the pace of progress remained rather consistent for the duration of the program.

American manufacturing as a whole began forming itself into a modern enterprise between World War II and 1952. Companies big and small made the transition to full road

machine manufacturing, often leaving behind the last vestiges of their agricultural pasts. Huber continued to produce its Maintainer tractor, but increasingly marketed it for road maintenance purposes instead of its farming uses. It also began using its foreign experience as proof of the company's machines' global applicability. Huber profiled unique overseas uses for its machines in its corporate literature, especially when those machines found use near sites like ancient Rome's aqueducts.[528] Huber expanded its manufacturing operations with a new state-of-the art foundry building on the company's Marion campus, stretching 88,000 square feet. Out of that foundry came in-house grayiron, a type of heavy metal with elements of cast iron and pig iron, relieving the firm from contracting out its metal supply needs. All the while, the company continued to deploy its distinctive "Huber Orange" paint on its world famous machines.

Other companies flourished as well by making the full switch to road machinery. Caterpillar realized its future lay in the earthmoving business, and focused its efforts on that segment of the market instead of the crawler farm tractors that brought the company its fame. Both International Harvester and Allis-Chalmers followed suit, just as their machines continued to turn over earth for new roads in Turkey, Iran, and Liberia.[529] On top of these global developments, American road machine companies and their engineers stood poised to tackle bigger projects back home like the Interstate Highway program that lie just around the corner. With their overseas development work, American equipment makers and their engineers now had enormous international experience to support their wide application. Like the engineering field more broadly, the 1950s was good to road machine builders.

But, to see the end of American involvement in Turkish roads would take the full extent of the 1950s. Getting there revealed a new wrinkle in American development policy, one that fell

[528] The Huber-Warco News, February, 1955, 7.
[529] Haycraft, 141-142.

in line with bigger engineering tendencies regarding their craft. If the State Department's stated goal regarding big development projects included "helping Turks help themselves," the realities on the ground suggested that American policymakers stood just as willing to extend their commitments there at engineers' recommendation. To that end, technicians' problem finding mentalities would play a key role in ensuring that American engineers in development, and other technical foreign policy programs, could regularly find reasons to keep working just a bit longer.

Chapter Six: Expanding Foreign Policy's Engineering Scope

Pat Gifford's return to Ohio from Turkey on Christmas Eve night 1950 seemed to garner more attention than his departure. Everyone from Marion-area civic groups to the Huber corporate magazine asked him to recount his experience overseas. Even Gifford's upstate New York hometown newspaper, the *Troy Record*, reported that he had returned safely from his travels. When addressing crowds about his experience like the one that assembled that afternoon at the Hotel Harding, he was sure to mention the political climate of the places he visited. Gifford consistently mentioned the "violent anti-Russian sentiment" of the Turkish people he encountered during his travels, underlining a linkage between Turkish citizens and the personally anti-communist Marion Republican.[530]

Beyond the publicity surrounding his return, life back in Ohio greeted him with a cold shoulder. Four days after his arrival, Gifford was involved in a car crash involving two commercial vehicles. All the vehicles involved sustained considerable damage. To make matters worse, Gifford caused the accident, and he committed the infraction while driving his son Glenn's vehicle. All things considered, the incident cost Gifford $300 out of pocket.[531] More seriously, his wife of over three decades, Florence, passed away suddenly later in 1951. The loss struck Pat deeply, and he was charged with running his household for the first time by himself. As if his year had not proceeded badly enough, in December 1951, his house caught fire. At around 3AM on December 16th, his refrigerator short-circuited, lighting his kitchen walls aflame. Glenn and daughter-in-law Madeline had been visiting at that time for Christmas, and Glenn

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[530] "Conditions in Turkey, Africa Described in Lions Club Talk," *Marion Star*, Gifford Papers.
[531] The Troy Record, Jan 6, 1951, 10; J.C.A. Arter to Gifford, January 8, 1951, Gifford Papers.

used quick thinking to break an upstairs window to release the stifling smoke. The Marion Fire Department thankfully saved Gifford's house, but the damages totaled $3,000.[532]

Gifford found solace in engineering, and doubled down on his work over the following years. He continued to travel for Huber both domestically and internationally after the death of his wife. He visited industry conventions on Huber's behalf, and dropped by the company's satellite distributors, a network that by 1952 stretched from Seattle to Miami. In the summer of 1952, Gifford again traveled abroad to Turkey, this time teaching Turks how to use the Huber tandem road rollers in addition to the Maintainer. That specific trip later took him to Ethiopia and Liberia, where Huber machines were seeing great use after being purchased for other U.S. Bureau of Public Roads programs funded through Point Four. In Ethiopia, King Haile Selassie inspected the Imperial Highway Authority's Maintainers personally, something President Bayar had done the previous year in Turkey.

Gifford also threw himself into more design work. He filed a patent for the Huber Maintainer's road grader attachment in 1953. In practice, the implement did not operate as a grader, but rather a device that could maneuver under guard rails to clean and smooth pavement otherwise out of reach of a normal grading blade. With the attachment secured, the Maintainer could run parallel to a guardrail while the implement extended off of the side to clear debris as the Maintainer moved along. It was later marketed as a "side dozer" attachment, which more appropriately described its function. The project marked Gifford's eighth patent since he began inventing in the 1920s.

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[532] "Five Marion Fires Cause $5000 Loss," *The Marion Star,* December 17, 1951, 19; Glenn was Pat Gifford oldest son. He followed in his father's footsteps by training as an engineer in the 1940s. By most accounts, Glenn was the true brilliant mind in the family. He achieved high marks and praise from instructors as a student at Ohio State's abbreviated chemical engineering program due to WorldWar II. He ended his career as a chief engineer at Standard Oil, running the company's refineries in Whiting, Indiana and then the Saint Louis area.

By 1955, Gifford's full retirement lie a long way off, but his days globe-trotting in the name of engineering were over. The latter half of the 1950s saw Gifford draw down his travels and labors. Still working as Huber's head engineer, he settled in for a final home-bound phase of his career. He advised other firms on machinery design and appeared in a 1954 edition of *Who's Who in the Midwest*. [533] He later earned an elected position as Engineer Director of the Marion chapter of the Ohio Society of Professional Engineers.[534] Through all this, he continued his membership in the American Society of Automotive Engineers, which he belonged to for over 35 years by the end of his career. Until the end of his life, he still tinkered in his basement workshop, designing little implements for personal use, like a soup can crusher.

Other members of the engineering generation slowly faded from public view in the 1950s. Jack Killalee remained on staff in the Republic through 1950, continuing to evaluate the needs of Turkish infrastructure, while also filling in as division engineer when Jesse Williams took time off. He returned to Burlingame to serve in the Bureau offices in San Francisco until mandatory Bureau retirement in 1955. Later events, however, would take the exacting Killalee back overseas in a significant way.

Vannevar Bush continued to comment on American science and technology research through the 1950s. He expressed distaste for Eisenhower's less-interested stance toward Bush's expertise on technology policy matters. Bush felt strongly about maintaining a cutting-edge conventional defense force, a notion that pushed against the more nuclear heavy defense policy of Eisenhower and John Foster Dulles' "New Look" military program.[535] Even as his role advising American technology policy dwindled, he continued to comment publicly on the

[533] Marquis, *Who's Who in the Midwest 1954,* (St. Louis: Von Hoffman Press, 1954), 287.
[534] "Professional Engineers Elect Walter R. Warne," *The Marion Star*, March 10, 1959, 12.
[535] Zachary, *Endless Frontier*. 366-369

importance of defense while serving as the president of the Carnegie Institution for Science Research. Not to mention, he continued to tinker and invent in his spare time.

As the engineering generation stepped back from the most work-intensive stages of their careers, the Turkish roads program still operated in full swing, and would remain so until the end of the decade. The size of the American mission in Turkey gradually shrank over the course of the 1950s, signaling that American engineers were becoming less needed on the project. New Bureau placements were usually reassigned to Turkey for shorter lengths of time, or moved to other assignments in the growing catalog of international Bureau projects. Turkish experts had finally begun to take their roads project more fully under their own control.

The End of the Roads Program

Through all the tweaks made to development funding and structure under Eisenhower, road building in Turkey continued on without any real change to its operations. The program had incorporated 4,500 miles of roadways into its mechanized maintenance program by 1950, a number that would jump to 11,580 miles by 1954. By the time Eisenhower's administration ended, there were over 20,000 miles of all-weather roads built or improved upon, a vast increase from around 7,800 miles in 1947.[536] Turkey had seen an immense jump in automobile usage in the 1950s, and between 1946 and 1952 alone, total automobile registrations increased almost three-fold. On the economic front, by one measure, improvements on some roads leading to of Ankara by 1955 brought freight prices down to one-quarter of their 1949 prices.[537]

The partnership between the Bureau and Turkish Public Works (now the Directorate of Highways) over the roads program ended in 1959, with the last Bureau officials leaving the

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[536] Annual Report: Bureau of Public Roads, 1960, 44.
[537] Turkish Foreign Trade by Year, Turkstat; "Turkey Advances Her highway Net," *The New York Times*, May 1, 1955, 28.

country in June of that year. The mission left at least partially satisfied that the Turkish Directorate of Highways was ready to administer the road system by itself after more than a decade of American help, and more than $40 million of dollars of aid.[538] Considering that the size of the Turkish project exceeded by far larger than any previous cooperative project the Bureau had attempted with a single foreign government, the Bureau's withdrawal may have seemed triumphant and final. But, the timing of the American withdrawal reveals a final reality about the nature of development work not only in Turkey, but around the globe.

American experts involved in development work abroad exhibited resistance to leaving their work in the hands of foreigners, regardless of the training or length of time Americans invested. As so many individual engineers had made clear during their time in Turkey, more problems could be found in perpetuity to legitimate extension of their commitments. This phenomenon was not limited to road building and engineering, but emerged in a variety of projects in Turkey and beyond.

Pulling the timeline back, in 1947 the Bureau and Turkish Public Works officials projected that construction on the roads program would last nine years. When 1956 approached, the Bureau erased and extended that deadline, first for one year, then two.[539] American engineers contributed to the extensions, adamant that their work in Turkey had not been completed, and that Turks were not ready to handle the project on their own. In 1955, the ICA determined that on the basis of progress reports from the Bureau mission in Turkey, technical aid could not be discontinued on the originally scheduled timeline. In the words of one official, "[W]hile considerable competence on the highway field has been developed we do not believe that it would be prudent at this time to entrust the care and operation of the considerable amount of

[538] Ibid, 28.
[539] Annual Report: Bureau of Public Roads, 1955-1959.

equipment which the United States has places in the hands of Turkey to the Directorate of Highways without some further technical assistance and advice." The problems stemmed from fears from American engineers that Turks had not yet mastered equipment maintenance and repair to a "sufficient" level since the mission began. The "receiving, assembling, and controlling" of incoming equipment orders was itself a large enough project that American officials felt only U.S. personnel capable of overseeing. The solution was to leave a set of American engineers in place "for a period of at least two more years" in order to oversee such matters.[540]

The procurement of equipment had constituted the largest segment of American funding to Turkey, and the maintenance of that equipment held a high priority. But it was the fear or relinquishing all control of the project that kept American hands on the program, despite years of intensive training efforts both in Turkey and in the United States. There existed little evidence that Turkish engineers were unable or unwilling to incorporate what they learned from Americans regarding machinery. There had been countless hours of cooperative work to wean Turks off of American help, but the Americans in the end perpetually found reasons to stay on despite assurances by Turks. Rather than a real mistrust of Turkish abilities, the hesitance can be best attributed to a general discomfort with detaching themselves from a project they had invested so heavily in. U.S. engineers with the Bureau ultimately remained in Turkey well beyond both initial estimates, and those proposed midstream. Turkish lack, in this case of proper maintenance skills, was the problem to be remedied by more American engineering, a problem that would only end when Congress stopped funding it.

[540] Gage to Turner, November 21, 1955, NARA, RG30 1955-1959, Box 1060.

Contributing to American hesitation was a conception of technological universalism which posited that the Turks must run their equipment program just as Americans would. In fact, this was nothing new in the roads program. There had been a variety of spaces in which Americans intended to precisely replicate their road management methods onto the Turkish landscape, including the promotion of systematic progress reports and organizing their highway personnel along similar lines to the Bureau of Public Roads.[541] But, in American minds, satisfying notions of universalism could only happen with Americans on board directly, not as simple observers. This urge to prolong American engagement with development programs became a pattern found frequently in American reports of foreign assistance projects.

Ultimately, the withdrawal of American engineers in 1959 from Turkey proved temporary. The general Turkish highway program came under the full autonomous control of the Turkish Directorate of Highways, but new projects emerged that brought American engineers back to Turkey time and again. Engineers from the Bureau were back in Turkey beginning in 1960 on a contract basis to complete a traffic survey and to provide assistance implementing a computer system for the Turkish directorate's use just a couple of years later. In the middle of the 1960s, even more American engineers came to Turkey to assist in the procurement of equipment for a new forestry road system in Turkey financed by the Import-Export Bank.[542]

Critiques Emerge

With all of the expensive projects with indeterminate end points in operation, political backlash naturally came as a result. The rolling supply of American aid funneled to countries like Turkey under Eisenhower began to raise suspicion from U.S. policymaking corners other than

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541 Teaf, *Hands across Frontiers*, 382-384.
542 Annual report: Bureau of Public Roads, 1960-1964.

congressional isolationists in the late 1950s. Policymakers and journalists started asking questions about the purposes of these billion dollar programs when it became clear that the aid did not producing desired results within estimated timelines and budgets. These commentators began to produce critiques of development that for the first time questioned the wisdom of attempting to change the landscapes and ways of life of entire populations.

Until the late 1950s, the only truly visible opponents to development programming were the gadfly congressional isolationists, who were steamrolled in the late 1940s by the rising internationalist wave that enacted Truman development programs. But as these programs entered their second decade, more critical voices emerged in Congress and the media that shed light on the realities of large-scale aid programs. In Washington, the critiques of American development escalated in earnest with a scathing February 1958 letter from the House Committee of Foreign Affairs to James H. Smith, Director of the ICA. The Committee submitted a series of criticisms to the ICA with the expectation that Smith respond to each in front of the group in March. The criticisms of the program were wide-ranging; some were levied against projects in specific countries, while others addressed more general concerns. For instance, the Committee suggested that "ICA redtape in contract negotiations discourages private organizations" from participating in aid programs. In another example, the Committee found that "In 1948, 450 people were employed to distribute foreign aid. Now…the staff of our global paymasters has grown to 21,000, all of whom battle to perpetuate and enlarge the giving and to preserve their inflated and overstuffed bureaucracy." Regarding a specific program in Pakistan to deliver aviation radio equipment, the committee cited that approximately $3 million in gear was "wasted" and put away in storage rather than used for its intended purpose to improve Pakistan's aviation ground facilities.

The ICA responded to these allegations of waste and bloat one by one. Regarding the Pakistani radio equipment, the ICA argued that the program had not yet finished, and that that equipment in storage would be utilized in due time. In response to the allegation of ballooning staffs, the ICA noted that the program in actuality employed over *23,000* individuals across all aid programs rather than the cited number of 21,000, further raising the ire of Committee members. In relation to the allegation of excessive "redtape" the ICA stated that examples of private companies unable to participate in aid programs were exceptions rather than the rule. Specifically, the ICA wrote its own damming clarification, stating that non-participating firms refused involvement on the grounds that they were unwilling to "furnish financial and other information which ICA required to support proposed fees, overhead rates and per diem rates."[543] Apparently, "redtape" had different meanings to these private companies and the ICA.

The Committee conspicuously excluded Turkey from the bulk of its criticisms, but the Republic came up in these discussions in another sense. Turkey emerged as a counterexample for ICA officials who wanted to illustrate development "success." Throughout its interrogation, the ICA proudly advertised that all work in Turkey came in the successful pursuit of securing a "free world" and that American aid in Turkey contributed greatly to that status. Officials singled out the roads program there as a marker of worthwhile development programming given the massive jump in all-weather mileage the program achieved.

One of the most notable examples of media critiques of development came in the spring of 1959 in a series run by the *Chicago Daily Tribune*. Penned by Chesly Manly, the series made clear that the guise of "limited" and "temporary" aid espoused at the beginning of the Truman Doctrine by State Department officials was truly "history." Aid had been "institutionalized" by

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[543] U.S. Senate, House of Representatives, Committee on Foreign Affairs, *Criticisms of the Foreign Aid Program*, 86th Congress, first session, 1959, 40-44, 78-79.

1959, and Manly remarked that American assistance begat more, not less, aid into the world.[544] Using the Turkish context, the author found evidence of animosity in the U.S.-Turkish relationship based on the basic principle that the two countries had built a debtor-creditor relationship. Turkey's economic situation in recent years had been anything but stable, and at times required further American aid to alleviate. In a foreshadowing of future critiques of aid programs, Manly noted that the Turkish people were not more free under aid. He cited the incarceration of dissenting press members in the Republic as evidence of increased authoritarian rule under Prime Minister Adnan Menderes, and argued that aid money was enabling those policies.[545] Furthermore, Manly argued that the introduction of new technologies, such as modern tractors, created new problems that required more funding. Modern tractors from American manufacturers produced higher demand for gasoline and spare parts, most of which the Turks would have to import.

Manly ultimately concluded that American grants to Turkey should stop altogether, and should be dramatically reduced for the rest of the world. He oddly set apart "technical assistance" programming by suggesting that such funding should continue because of its less traumatic effects. He justified that logic by stating "Technical assistance helps the Turks help themselves, without corrupting them or disrupting their economy. The number of American technicians required is small and there is no friction with the Turkish population." [546]

Manly's critiques seemed appropriate, but for a couple of oversights. As noted in the roads project, friction between the Turkish population and Americans was simply unavoidable

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[544] Chesly Manly, "Tribune Reporter Takes a Look at U. S. Foreign Aid: What Is It? Who Gets It? Does It Help Recipient?," *Chicago Daily Tribune*, March 15, 1959, section one.
[545] Chesly Manly, "Tyranny Stifles Press, Judiciary in 'Free' Turkey," *Chicago Daily Tribune*, March 29, 1959, section one.
[546] Chesly Manly, "Manly Concludes U. S. Should Stop Grant Aid to Turkey: Reporter Also Urges Reduction in Military Assistance Under Mutual Security Program," *Chicago Daily Tribune (1923-1963)*, April 5, 1959, 1.

because the two groups had little to no previous contact. Additionally, the nature of technical assistance often had the result of extending American stays in certain countries, rather than sticking to agreed-upon time limits and truly empowering local populations. This usually also meant more money would be spent to sustain that time extension, which could add greater strain to countries that were already swimming in debt.

Still, in most instances, Manly had a point. Aid programs seemed to only create more demand for greater aid and technical help in the Republic. Ten years after the first Turkish aid bill passed through Congress, the Republic still imported American experts, and not just for road purposes. Americans were brought in to help with things like economic reforms, seeing as previous attempts to jump start the Turkish economy had not provided long-term gains.[547] In 1959, there were forty-one total projects being undertaken through the ICA in the Republic, a marked increase since the program began there. [548]

Critiques of aid in the late 1950s also came from literary corners of American society. The most notable of these critiques was William Lederer and Eugene Burdick's 1959 book *The Ugly American*. Set in the fictional Third World Asian state of Sarkhan, *The Ugly American* illustrated an American development enterprise headed by obtuse leadership more concerned with holding posh social gatherings than improving life for normal Sarkhanese. Americans trying to woo Sarkhanese toward the West were routinely outwitted by more culturally-sensitive Soviets in Sarkhan who spoke the local language and embedded themselves in the population to earn trust. The result was a developmental battle in which the Soviet Union held the upper hand.

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547 Drew Pearson, "He's Talking Turkey to the Turks," *The Washington Post and Times Herald*, September 22, 1957, E7.

548 U.S. Congress, Senate, Committee on Appropriations, *Mutual Security Appropriations 1959*, 85th Congress, second session, 457.

The book received a sensational response upon its release. The *Chicago Daily Tribune* published excerpts from the book, and movie studios immediately vied for the novel's film rights. American public officials viewed the book's charges as an indictment of American foreign policy. Congress members even included claims from the book in their questioning of aid program management.

In some cases, the book revealed real flaws in the American development apparatus. Americans hired for development employment often lacked previous experience in the countries they moved to. Language remained a common obstacle to mutual understanding, and Americans did indeed hold extravagant balls in many Third World locations. In fact, the Bureau held such social events in Ankara's high-end Yüksel Palace Hotel, complete with full dinner menus and an open bar. But, the notion that Americans remained aloof of local culture, at least in Turkey, did not always reflect reality. If Jack Killalee's experiences were any indication, Americans took time with their Turkish counterparts to build relationships. Certainly, Bureau officials did not move into Ankara's low-rent neighborhoods, but the suggestion that Americans worked hard to insulate themselves from Turkish life did not occur as depicted in *The Ugly American.*

However, one of the book's claims very accurately depicted reality. In one episode, an American engineer named Homer Atkins came to Sarkhan with his wife to work on farm irrigation issues. Like broader engineering stereotypes, Atkins seemed continuously preoccupied with technology and solving problems, and readily deployed those skills in the Sarkhan context.

In the Sarkhanese villages, Atkins' true problem presented itself. The country's crop fields laid in paddies on steep hillsides. Far below the hills ran a river, but local irrigation methods included an inefficient "dip lift" to bring water to the paddies. While his wife occupied herself with domestic matters, Atkins flung himself into designing an appropriate water pump

that the villagers could claim as their own without imported materials. His tinkering habits drove his design which ultimately took advantage of local bamboo supplies, discarded Jeep parts, and readily-available bicycles. When put together, these components crated an efficient and productive water pump for Sarkhanese paddies.

The pump's implementation, however, required the knowledge of a local mechanical mind. Atkins hired a Sarkhanese mechanic to help him produce the pump, but the mechanic noted that the design had a flaw. Requiring the use of a bicycle meant that farming families would need to dedicate their valuable bicycle to full-time pumping. With the help of the local engineer, the two found a solution that did not limit the bicycle's function, which brought rural villagers a life-improving technology, celebrated by all.[549]

Atkins' profile revealed some realities about the state of development work in the late 1950s. The illustration of the engineer and his mentality fit right into longer trends regarding engineers in society. Like Gifford, Killalee, and Bush, Atkins proved to be most at home fixing practical problems. Problem solving became his identity in Sarkhan, and he reached his solution through tinkering with designs in a creative but measured way. Through this process, Atkins provided one of the few American success stories in Sarkhan. While well-groomed U.S. mission officials concerned themselves with politics, the rough-hewn Atkins stood out to represent the best of America in Sarkhan thorough his objective and rational design processes. As the true "ugly American" in the story, Atkins continued a tradition spreading triumphant engineering practices around the globe.

[549] Eugene Burdick and William J. Lederer, *The Ugly American* (New York: W. W. Norton & Company, 1959). 214-231.

Evaluating American Development in Turkey and a Stubborn Dichotomy

Events on the ground of the Turkish roads program bear out the reality that its execution was complicated and expensive. As a result, like American development policy writ large, the long-term effects of the Turkish roads program are mixed. The new roads increased exports and provided considerable aid to farmers in rural areas, especially once the rural roads program, of which American aid was minimal, was established. Turkish GDP rose at nearly 5½ % on average from 1950-1969, spurred on by a healthy and growing industrial sector.[550] But, as much as exports increased, so did imports after the roads program completed, which contributed to a rising trade imbalance. As a central part of Truman's Point Four program, private investment was to follow American technical expertise in Turkey and elsewhere. Training knowledgeable experts in these places locally was meant to give rise to new enterprises that American private investment would be attracted to. By one estimate, U.S. private investment in Turkey totaled only $8 million between 1954 and 1959, a gross imbalance to the $48 million the U.S. invested on the roads alone.[551].

Culturally, the Republic experienced change, particularly regarding automobiles and their influence on society. With the new roadways, cars and trucks populated Turkish landscapes in both urban and rural settings. Roads and automobiles made greater contact with neighboring towns and regions possible more often, and trucks that now travelled more cheaply and efficiently brought goods more easily to previously disconnected populations. Modern roads also introduced a new *flexible* means of transit for Turkish citizens. With speedy motor transit reaching new spaces, Turks no longer only relied on the rigid timetables and limited reach of

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[550] Turkstat, *Statistical Indicators 1923-2005;* Central Bank of the Republic of Turkey, Electronic Data Delivery System, as quoted in Nas, 11.

[551] *Criticisms of the Foreign Aid Program*, 1959, 111; *Hearings before a subcommittee of the Committee on Government Operations: Development Loan Fund*, 166.

railways. Automobiles made possible "volitional" travel for Turks who previously enjoyed little of that freedom.[552]

Of course, the political aspects of road building brought change as well. The laying of new infrastructure brought more of Turkey under the government's view, with roads serving as extensions of Ankara's reach into its less inhabited regions. Roads served as a central organizing feature for governmental administration. On Highway Directorate maps, Turkish towns became associated with nearby routes through their distance from Ankara, as the central organizing element in the country. Changes to federal traffic laws brought standardized signage and legal structures that governed how people could utilize the roadways. The days of Turkey's lawless road experience had been subsumed by orderly and enforceable guidelines, most of which came under the watch of the U.S. Bureau of Public Roads.

Engineers continued to apply their craft to the Turkish setting, but critiques of American work there remained. In one telling trend, American accounts of Turkish progress continued to adhere to a vision of Turkey as a not-yet-modern place. Most American observers saw Turkey through the old dichotomy that existed before aid began in the 1940s. Regardless of the years of assistance and billions of dollars in aid, reviewers of Turkish progress adhered to earlier interpretations of Turkey as a nation in-between modern and traditional. A full eleven years after military aid and training programs began, and over a billion dollars of dedicated military aid granted, State Department memoranda was peppered with extant concern for deficient "technical training" of Turkish military personnel in using modern weaponry.[553] American journalists at the

[552] Adalet, "Mirrors of Modernization," 221-222.
[553] *FRUS* 1958-1960, Vol. X, Eastern Europe; Finland; Greece; Turkey (1993), 775.

end of the decade noticed similar lingering deficiencies. Specifically, soldiers seemed to still carry outdated bolt-action rifles, and Turkish farmers did much of their harvesting by hand.[554]

American documentary films as late as 1962 still referred to Turkey as a place that possessed "extreme contrasts" throughout the country between old and new. Such films fixated on the enduring images of manual labor showcasing individuals using wells and buckets to retrieve water rather than indoor plumbing. The fact that livestock plowing and subsistence farming still existed in the country suggested that life had not changed for rural Turks "in any significant way." As one documentary put it, "it is the traditional society that is slowest to change," underlining what appeared to outside observers as more of the same when it came to everyday Turkish life.[555]

Even more broadly, the success or failure of Turkish road building and aid are tied to the general condition of American-Turkish diplomacy through the 1950s. Certainly the extension of American development into Turkey came as a result of Cold War concerns regarding Turkish defense and stability, a concern shared by policymakers in both countries. While the United States stood at the ready to involve itself in the steeling of Turkish economy and defense, Turkey clearly desired American help. In this way, the Turks partly contributed to extended American stays in their country. Evidence exists that Turkish leaders became more interested in American aid money and expertise as the 1950s progressed. Sometimes Turkish officials called for aid on the grounds of military weakness, while at other times they did so because of internal economic weakness. Soviet advances in ballistic missile technology (of which more will be said later) brought just as much clamor over more aid as internal economic struggles. On their own, Turks found more justification for continual American aid with pleas for grants for projects like a

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[554] Manly, "Tribune Reporter Takes a Look at U. S. Foreign Aid,"; [554] Chesly Manly, "U. S. Aid Dollars Back Turk Army of Doubtful Value," *Chicago Daily Tribune*, March 22, 1959, 1.
[555] *Turkey, I*nternational Film Foundation, (1962), film, http://archive.org/details/gov.archives.arc.654135.

Turkish-Iranian rail line extension, large-scale chemical plant projects, the aforementioned Zonguldak and Sariyar projects, and the ubiquitous military aid that jump-started the American development process to begin with.[556]

Given the long-term American concern with stability in the Third World, the domestic politics of Turkey in the 1950s, and their implications for aid, deserve mention. The 1950 election of Bayar's Democrat Party brought a period of economic liberalization that helped stabilize the economy. But that stability was short-lived, and greater market controls and authoritarian governance came about by the middle of the decade. That shift brought about an increase in borrowing for big development projects that did not immediately pay off economically. Given that the Eisenhower moved much of the nonmilitary development budget from grants to loans, most of Turkey's development aid added to their already-heavy financial obligations. Beginning in 1956, Turkey stood in default on its loan obligations of approximately $73 million.[557]

Those struggles continued to weigh on the minds of Turkish officials throughout the 1950s. Reflecting the still-troubled state of the Turkish economy in 1958, a joint venture by the U.S. government, IMF, and Organization for European Economic Cooperation pooled a massive $359 million package in grants and loans to establish "stability" in Turkey's economy. Not only was this amount nearly four times the total initial investment made by the U.S. when aid started in 1947 with the Truman Doctrine, it encompassed aid for more purposes than any of the Truman Doctrine architects would have envisioned. Issues of Turkish stability clearly remained present

[556] Mutual Security Appropriations for 1959, pt. 1, 35; Report to Congress on the Mutual Security Program for the first half of Fiscal Year 1960, 20-21.
[557] Hearings, Mutual Security Act of 1959 , pt. 1, 120.

in greater quantity after a decade of American help, challenging the notion that American development interventions gave poor nations a leg up.[558]

Financial strain and domestic social unrest brought the ouster of Prime Minister Adnan Menderes in 1960. A military coup removed Menderes from power, and put the military in control of the country, and ultimately executing the Prime Minister the following year. Menderes' opponents viewed his economic policies as self-serving to his legacy as a provider of change, and ultimately detrimental to the Turkish economy's long-term health. His large spending plans led the nation into a debt-ridden recession, partly in the pursuit of big-ticket development projects that he hoped to pin his name to. Critics stated that the $359 million aid package only added to that debt, which had the dual effect of a loss of sovereignty, drawing Turkey into relationships with the great powers that resembled dependency rather than burgeoning power.

Additionally, the Menderes government presided over damaging social unrest during his tenure. Tensions from the Greek, Turkish, and British negotiations over the future of Cyprus in 1955 brought on riots in Istanbul in September of that year. The demonstrations broke out after an explosion around the Turkish consulate in Salonika, the birthplace of Mustafa Kemal. Upon hearing this news, Istanbul Turks rioted, attacking Greek storefronts, smashing windows, flipping cars, and injuring around 300 people. Similar demonstrations took place in Izmir. The anti-Greek demonstrations brought scorn from many corners of the American populace, pressuring the administration to take action against the Turkish government, including the

558 International Monetary Fund, *Annual Report 1959*, Washington D.C.. http://www.imf.org/external/pubs/ft/ar/archive/pdf/ar1959.pdf, 21; "Turkey to Get $359 Million Aid From U.S., World Fund, Europe to 'Restore Stability," *The Wall Street Journal,* August 4, 1958, 2.

Greek-American community.[559] The event later known as the Istanbul Pogrom or "Eylül Olayları," (literally "September Events") brought strain among the broader NATO community, since the violence had to do with two members of the alliance. In a NATO hearing on the matter, Turkish officials claimed initially that "communists" were behind the attack, a notion shot down by the Greek representatives, who wondered how Turkey could blame the event on a political group that the country had long claimed had not activity in.[560] In the end the Eisenhower administration condemned the violence, but not after significant debate among members of the administration, and application of martial law in Istanbul, Izmir, and Ankara to quell any further demonstrations.[561] Menderes himself was later implicated in the riots, another black mark against his tenure at the head of the Turkish government.

Overall, the 1950s brought plenty of unrest and political instability to Turkey. Perpetual pleas for aid, economic debt, social unrest, and the Menderes coup revealed a stark reality that the large-scale development programs and aid packages did not bring about uniform positive change to society. Even in the face of astronomical aid packages, Turkey seemed more unstable in 1960 than it did in 1947 when American aid began. After the coup, the Eisenhower administration hoped for a smooth transition of power in Turkey, while lamenting the loss of the ally Menderes. After working so closely with that government on financial aid and mutual security, the White House viewed Menderes as a flawed but known quantity.

The instability in the 1950s did not mean that American-Turkish relations had frayed by any measure. In fact, it can be said that under Eisenhower, Turkish-American diplomatic

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[559] Harlow to Friedel, October 24, 1955, Eisenhower Library, Central File, General File, Box 832; The Associated Press, "ANTI-GREEK RIOTS FLARE IN TURKEY: Istanbul Mobs Wreck Shops, Threaten Church," *New York Times*, September 7, 1955.
[560] Henry Ginigers, "Anti-Greek Riots in Turkey Studied by NATO Council: ANTI-GREEK RIOTS STUDIED BY NATO," *New York Times*, September 9, 1955.
[561] "TURKEY CLAMPS MARTIAL LAW ON THREE CITIES: 300 Persons Injured in Anti-Greek Riots," *Chicago Daily Tribune,* September 8, 1955, Part 3.

relations grew closer than they ever had since the founding of the Republic in 1923. Their alignment on most foreign policy issues had borne themselves out over the decade in unprecedented ways. President Bayar and Menderes visited the U.S. on separate occasions in 1954, itself a significant moment since neither Ismet İnönü nor Mustafa Kemal before him traveled to the White House. Eisenhower invited Celâl Bayar to the White house in January 1954, welcomed with a state dinner and a toast from Eisenhower himself. In the toast, Eisenhower articulated Turkey as a partner in preserving the free world and progressive modernity: "Today we recognize [Turkey] as a modern, progressive country, one that we are proud to call ally in the great problems that face the free world today."[562] The two heads of state also conducted substantive diplomatic discussions regarding NATO, the Central Treaty Organization (CENTO), and Turkey's role in the recently quelled Korean conflict. Bayar deftly inserted a pitch for American aid to Turkey, noting that continued American support economically provided a key to Turkey's ability to contribute to the stability of the region. Bayar then received assurances from Eisenhower that the United States would continue its trend of economic aid. In a show of consensus over America's general development policy in the Third World, both leaders noted that "increasing the standard of living of the less developed countries" was of central importance to global stability.[563]

Menderes was invited later that year to discuss economic development and military aid to Turkey with Eisenhower and Dulles. [564] In those discussions, Menderes shared the ever-present concern of Turkey's "strain" in supporting its own military. Dulles assured Menderes that NATO and the U.S. would continue to relieve the Turkish forces, while lending more aid for military

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[562] Toasts of the President and the President of Turkey, Celâl Bayar, January 27, 1954, Eisenhower Library, White House Central File, Official File, Box 733.
[563] Telegram from Ankara to Washington, December 7, 1959, Eisenhower White House Central File, Confidential File 1953-1961, Subject Series, Box 54.
[564] "Menderes Due in U. S. to Survey Aid Plans," *New York Times*, May 25, 1954, 9.

and economic purposes.[565] Menderes and his advisers asserted their commitment to northern tier stability and mediation of disputes between regional countries like Pakistan and Afghanistan. Menderes noted that the loss of Asia to the Soviets would be a serious "blow" to security, and that they believed the Soviets on a grand scale, hoped to achieve that goal. [566] Upon leaving the U.S., Menderes addressed the press, stating that vigilance and cooperation between the U.S. and Turkey was key to avoiding another "Munich"-like revolution in the poor sections of the world.[567] Clearly, both Menderes and Bayar carried no qualms about aligning with Americans on Third World policy, as long as they received financial and rhetorical assurance from the U.S.

Even more significant, Eisenhower visited Turkey in 1959, the first sitting president to do so, and the last until George H.W. Bush. The president's stop in Turkey lasted less than 24 hours as a part of a larger Asian tour in which he also visited Iran and Afghanistan. Still, the visit served as a symbolic gesture of unity that had deep implications for Turkish policymakers who continued to desire reassurance from the West that Turkey remained a foreign policy focus. The notable moments of the event included a visit to Mustafa Kemal's mausoleum and an honorary degree awarded to Eisenhower from Ankara University.[568] Eisenhower's departure message to the Turks on the morning of December 7 was meant to continue the impression of diplomatic good will and warmth. He reminded listeners that, "Our two countries have been friends for a long time," and that Turkey and the U.S., "Stand together on the major issues of the world that divide the world." When Eisenhower signed off, he took another unprecedented step for a sitting

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[565] *FRUS,* 1952-1954, Vol. VIII, Easter Europe; Soviet Union; Eastern Mediterranean (1988), 949.
[566] Ibid, 946.
[567] "Menderes Off Home; Warns of a 'Munich,'" *New York Times*, June 7, 1954, 29.
[568] Stephens to Ankara - Presidential Visit, November 25, 1959, Eisenhower White House Central File, Confidential File, Subject Series, Box 54.

American president by speaking Turkish to a Turkish audience, using a formal Turkish goodbye, “Allahismarladik,” as he departed.[569]

Eisenhower and Dulles presided over a mid-century high-water mark in Turkish-American diplomacy, enabled by genuinely willing Turkish counterparts. Throughout the Eisenhower administration, Turks and Americans displayed a mutual worldview concerning foreign policy and communism. Ankara regularly praised American addresses regarding Middle Eastern stability and security. Menderes expressed respect for Dulles’ “farsighted statesmanship,” while fighting vigilantly against communism within Turkey. [570] Turkey steadfastly adhered to a pro-Western orientation ever since Menderes’ clam to make Turkey into a “little America” upon his election in 1950. Turkey subsequently joined NATO and attempted to stabilize the Middle East through its own efforts in CENTO. Turkish disdain for communism at this time remained consistent, even as Turkish officials leveraged Soviet aid offers when financially expedient. The Soviets exerted little effort to mobilize actual revolution in Turkey at this time, likely because the Communist Party there remained relatively small, and outside the bounds of normal Turkish politics. Menderes and Bayar actively suppressed communist figures in the country by revoking citizenship of dissenting leftists.[571] Although this suppression fueled suspicions that Turkey had become less free in the 1950s, it proved that Turkey remained out of full Soviet orbit. If American development programs were not to credit for keeping Turkey aligned toward the West, at the very least, those projects did not push Turkey *toward* communism. Would Turkey have been as anti-communist without American aid? Did strengthening Turkey have any bearing on Soviet designs in the region? Or, did the USSR

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[569] Telegram from Wells, December 7, 1959, Eisenhower library, Central File, Confidential File, Subject Series, Box 54.

[570] Dulles to Eisenhower, October 25, 1957; Menderes to Dulles, October 22, 1957, Eisenhower Library, JFD White House Memoranda, Box 5.

[571] Bulent Gokay, *Soviet Eastern Policy and Turkey,1920-1991*,(Routledge, 2006), 76.

actually avoid further entanglement in Turkey because of American retaliatory power? Regardless of how Turkey arrived in the Western camp, American policymakers in 1960-61 seemed content with the outcome, and remained vigilant about maintaining it.

The story of American engineers in Turkey may have started with road, dam, and coal mine modernization, but development programming only comprised a part of the narrative. All of the work engineers engaged in the in the Republic since 1947, and the subsequent locking of Turkey's orientation toward the West, did little to quell American concerns regarding the future of Turkish relations with the USSR. Continued investment in Turkey became a way to ensure that the U.S. remained in a position of power in the Republic.[572]

One site for such expansion came in the kingdom of Yemen, a nation on the southern end of the Arabian Peninsula that garnered almost no attention from the State Department until the Cold War. However, by 1960, Yemen became nearly as common a subject for State Department discussions as Turkey. Like in Turkey, American road building aid in Yemen became one way to counterbalance possible communist incursion there, a real concern given the homegrown communist movement at work at the time.

Also like in Turkey, Yemen leveraged the concurrent aid offerings of multiple powers to fit their own interests. In this context, the communists of the People's Republic of China (PRC) had extended aid offerings to Yemen for road construction. In response, the Eisenhower government deployed the U.S. Bureau of Public Roads to build a 270-mile gravel road connecting the coastal port of Mocah with Taiz and Sana'a. Considering the active Yemeni engagement with both the Soviet Union and PRC, American extension of aid to Yemen came as no surprise. The State Department clearly viewed Yemen as a yet another contested space for Cold War politics, evident in the agency's promotion of American road building there. One State

[572] Dept. of State, Report to Congress on the Mutual Security Program for fiscal year 1960, January 1961, 59.

Department cable stated, “Such an advance commitment is essential if we are to maintain the [Operations Coordinating Board]-approved United States objectives in Yemen, viz (a) denial of the area to Soviet domination, and (b) countering and reduction of Communist influence in the area.” When the Chinese proposed to pave their road project in Yemen with asphalt, the State Department immediately steeled itself for impending Yemeni leveraging, noting that the Yemeni Imam “may yet ask” for the American gravel road project to be paved with asphalt as well.[573]

Through an ICA loan, the Yemen road project got underway in 1959. Over the course of the next seven years, the Bureau deployed as many as 46 staff members to Yemen to oversee implementation of the road design, auxiliary facility construction, and the training of Yemeni nationals. Between 1959 and 1966, a number of Yemenis even participated in the foreign study program in the U.S. as a part of their development program. And like so many other American engineering projects in the era, completion of the Yemeni road did not necessarily mean that American engineers left the scene. After the road construction ended in 1966, Bureau staff unsurprisingly remained on site for years afterward.[574]

Beyond development work, American policymakers continued to find ways to invest money and human engineering capital in to foreign policy. Under Eisenhower, ballistic missile technology put new demands on engineers that opened the way for new endeavors in defense and, later, space exploration. Missiles may have had military purposes, but they represented engineering, through and through. The growth of that arm of the Eisenhower administration’s foreign policy reached Turkey in 1960, when the U.S. placed Jupiter missiles near Izmir. To understand the background of that decision requires grounding in the longer history of American

[573] *FRUS*, 1958-1960, Near East Region (1993), 819.
[574] Annual Report: Bureau of Public Roads, 1959-1966.

defense research under Eisenhower, revealing that the president's relationship with engineering has a whole other history apart from development.

Beyond Development

Regarding state science policy, historian Stuart Leslie argued that President Dwight Eisenhower, "presided over much of the Cold War buildup and so better than most of his contemporaries appreciated 'its grave implications'."[575] Eisenhower used his administration to further ingrain engineering into federal policymaking, continuing Truman's development programming and instituting other visible programs that used engineers. Throughout his tenure, Eisenhower assembled committees and built new agencies populated by scientists and engineers, with purposes closely tied to technology. As a part of his "New Look" foreign policy, scientists and engineers weighed in to advise the administration on the issues tied to a leaner and more advanced defense program.[576] As a means to counter the rising influence of the military over budgets and policymaking, Eisenhower found that increasing nuclear armaments, rather than conventional defense measures, would cut costs and the rising power of the Department of Defense. Eisenhower's investment in technology, then, did not come as a product of his appreciation for technology and wonder at the change it could bring. Rather, his research programs emerged against the backdrop of the broader geopolitical climate of the Cold War. The Eisenhower White House possessed a still-deep suspicion of Soviet Union's own advances in science and technology, which drove his interest in matters related to engineering.

[575] Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford*, (New York: Columbia University Press, 1994). 2.
[576] The New Look defense policy sought to institute a defense program geared toward a longer and sustainable defense budget for deterrence.

Another of Eisenhower's similarities with Truman came in an early personal experience with roads. As a young Lieutenant Colonel fresh from World War I, Dwight Eisenhower took part in the Army's First Transcontinental Motor Convoy in 1919. In an effort both to survey the condition of American roadways, and publically to promote the military's motorized units, the convoy left for San Francisco from Washington D.C. on July 7, 1919. Eisenhower joined simply as an observer, but saw first-hand the infrastructure-related obstacles that would mire American travel and defense mobilization. The unpaved highways provided dangerous travel arteries in bad weather, and the group lost at least one vehicle off of the side of a mountain. Bridges proved unsafe for motor travel, and vehicles themselves unceasingly experienced breakdowns. At some points, travel moved so slowly that the convoy covered only 62 miles in ten hours, a testament that unpaved roads made up over half of the entire infrastructure traveled.

The group reached San Francisco on September 6 to much fanfare, but the event left a negative impression on Eisenhower. The experience cemented in his mind the importance of adequate infrastructure for military purposes, and the hazards of navigating them even in the most modern vehicles. Eisenhower carried that experience with him to the Oval Office decades later. The expertise and funding needed for road building in the U.S. would become a priority in his own administration, leading to the Interstate Highway program and countless foreign road building programs his administration supported.[577]

Beyond Turkey, the Bureau of Public Roads expanded its project range under Eisenhower, as seen in the profile of Yemen. Through International Cooperation Administration (ICA) funding, a successor agency to Point Four's Technical Cooperation Administration, the Bureau engaged in new highway work in Laos, Nepal, and Sudan, and nearly finished its

[577] Kevin L. Cook, "Ike's Road Trip," *MHQ: The Quarterly Journal of Military History,* vol. 13, no 3 (Spring 2001): 68.

assistance to the Inter-American highway through Central America.[578] Of course, all of this went on against the background of Eisenhower's most massive roads project, the 41,000 mile National System of Interstate and Defense Highways in the U.S., launched in 1956.[579]

More generally, engineers took on even greater importance to American national security goals under Eisenhower. Through the 1950s, engineers found themselves contributing more directly to combating Soviet gains in technology in new programs through the CIA, Department of Defense, and most visibly, the National Aeronautics and Space Administration (NASA). As will be discussed in the next chapter, by the end of the Eisenhower administration, engineers would occupy a new place in the state administration that they never relinquished.

Engineering for Cold War Defense

The story of engineering in development stands as an important example of American deployment of their skills for foreign policy aims. When reviewing Eisenhower's general foreign policy, engineers emerge just as prominently in his dedicated nuclear energy, ballistics, and space exploration programming. Researchers have unearthed a wealth of information regarding the Eisenhower administration's relationship with technology. Many of these studies have focused specifically on the military's appropriation of technology, making it clear that the White House first viewed technology as a means to a security end, and an important end at that.

The administration pooled engineering expertise for more general purposes as well. Along with the immediate security implications of engineering, the administration looked to the future of the nation's engineering workforce, and assigned committees to study issues relating to American and Soviet manpower levels. In either situation, whenever technology became a state

578 Department of Commerce, *Annual Report: Bureau of Public Roads,* (Washington D.C: GPO,1960) 64-68.
579 Ibid, 2-53.

issue, Eisenhower assembled a new cadre of advisers to evaluate the status of the field in a given context. These studies had nothing to do with engineers in development, but everything to do with engineers in aeronautical, nuclear, and mechanical fields who could contribute to defense and keep pace with the Soviet advances in those same areas.

Gregg Herken's *Cardinal Choices* remains the most direct assessment of science and technology decision making across presidencies. His discussion of the Eisenhower administration reveals an early engaged presidency on technological issues beginning with nuclear power and, later, ballistic missiles. Through it all, the administration employed the expertise of leaders in science and engineering, which was anything but a token move; the Eisenhower administration took the opinions of these committees seriously, and included them into their foreign policy choices on a regular basis. Members of specific committees held influence in the directions of U.S. technology policies regarding technology like nuclear power, ballistic missile programming, and eventually, space exploration.[580]

In fact, Eisenhower's commitment to engineering and science became most visible through the impressive number of agencies and committees he commissioned to deal with those topics. He established, inherited, or consulted a number of committees and study groups employing engineers throughout his administration; the Atomic Energy Commission (AEC), Office of Defense Mobilization (ODM), Science Advisory Council (SAC) and its subcommittees including the Technical Capabilities Panel (TCP) and the Federal Council for Science and Technology (FCST). Additionally, the administration consulted the National Committee for the Development of Scientists and Engineers (later the President's Committee or (PCDSE), and the Strategic Missiles Evaluation Committee (SMEC). These committees were housed in branches of the military, or as independent agencies within the executive branch, comprised of a mixture

[580] Herken, *Cardinal Choices*, 101-104.

of engineers, scientists, business, and legal minds. Over Eisenhower's administration, each agency took on fluctuating significance, while others faded in importance depending on the technological issue of the day. The numerous new agencies sometimes left even those in the White House confused over the positions and titles associated with each group. One internal memo to Eisenhower secretary Thomas Stephens regarded an appointment seeker with urgent news: "…if it develops that it is impossible to set anything up with the President in the near future, he may want to ask to see the President's Scientific Adviser. Who would that be?"[581] Without a doubt, the Eisenhower administration brought engineering even closer to federal administration at the risk of growing his own technology bureaucracy. As historian Richard Damms writes, the effort was in line with Eisenhower's interest countering the pull of the military industrial complex with his own "scientific-technological elite."[582]

Engineers and Tension over Nuclear Policy

The Atomic Energy Commission (AEC) provides an early example of the influence of science and engineering expertise influencing Eisenhower policy. Signed into law through Truman's 1946 Atomic Energy Act, the AEC had been initially chaired by the TVAs David Lilienthal. The AEC sought to bring the nation's nuclear programming under a consolidated federal agency, manned by civilians, and meant to measure the dissemination and development of atomic energy.[583] With U.S. intelligence confirming knowledge of the USSR's increasing efforts to create their own nuclear program, the AEC stood to keep America's nuclear program more coordinated and one step ahead of the USSR. With the realization of the first positive

[581] Memo to Stephens, November 5, 1957, Eisenhower Library, White House Central Files, Official Files, Box 274.
[582] Richard V. Damms, "James Killian, the Technological Capabilities Panel, and the Emergency of President Eisenhower' 'Scientific-Technological Elite,'" *Diplomatic History* 24, no. 1 (January 1, 2000): 57–78.
[583] Richard G. Hewlett, *A History of the United States Atomic Energy Commission vol. 1* (University Park, PA: Penn State Press, 1962), 533-535.

Soviet nuclear test in 1949, Truman and the AEC collaborated with gusto to face the challenge of sharing the news of the Soviet bomb with the American public.[584]

The AEC came into greater importance again under Eisenhower. Now headed by Lewis Strauss, an early member of the Commission and prominent businessman, the AEC also called engineers like Yale graduate Thomas E. Murray and Vannevar Bush as members. Motivated by Strauss' arguments for a more open nuclear relationship with the Soviets, and urged on by John Foster Dulles, the administration developed the "Atoms for Peace" program in 1953 as a cooperative effort to share nuclear technology between the USSR and U.S.[585] Eisenhower viewed the proliferation of nuclear technology as a chance to collaborate with the Soviets, at least publically, on a central technological issue.

In front of the United National General Assembly in December 1953, Eisenhower announced his plan to contribute some American and Soviet nuclear technology to an International Atomic Energy Agency (IAEA) that would find ways to incorporate the technology for peaceful purposes. Eisenhower was careful not to commit the bulk of America's nuclear program to such endeavors, while also laying a foundation for further cooperation with the Soviets on the issue. After consideration, Soviet foreign minister Molotov dismissed the program out of hand, but the moment symbolized at least one example of softer diplomatic efforts on the part of Eisenhower surrounding technology. Conversely, Molotov's dismissal of the program reflected badly on the Russians in an international forum at a moment of global nuclear tension.

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[584] Richard G. Hewlett, *A History of the United States Atomic Energy Commission vol. 2* (University Park, PA: Penn State Press, 1972), 366.
[585] Herken, *Cardinal Choices*. 74-77.

It also revealed the first large influence of scientists and engineers on the administration's policymaking.[586]

These technology committees incidentally produced some of the most prominent anti-proliferation voices, often from the ranks of engineers. Thomas Murray served long and well on the AEC through its transition across the Truman and Eisenhower administrations, but emerged as perhaps the most outspoken national voice against nuclear proliferation in thermonuclear testing. He penned articles outlining the importance of non-expert leadership of the atomic program. In a February 1954 issue of the *Bulletin of Atomic Scientists,* Murray argued that expert leadership serves to keep politicians out of the fold, thus treating atomic power as "none of their business." The greater danger is the echo chamber that expert guidance can produce, which was why Americans should "not succumb to the narcotic effect of placing bling faith in the experts."[587] Coming from the pen of a leading engineer and inventor (he had two hundred patents to his name), the caution against technocracy was surprising given the broader effort from engineers to be *more* involved in state policy. But, his other traits, like "hard headed practicality" as an engineer drove him alone to make this big claim in the context of a AEC hostile to the notion of total non-proliferation and congressional oversight.[588]

When Murray proposed a moratorium on general testing in 1954, Eisenhower initially seemed intrigued, but his intrigue ultimately gave way to Dulles and Strauss' opinion that envisioned a more actively experimental nuclear program. The Eisenhower administration did not actually institute a test ban until October 1958, but Murray's voice no doubt played a role in

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[586] S. Dockrill, *Eisenhower's New-Look National Security Policy, 1953-61*, (New York: Palgrave Macmillan, 1996) 132-133.
[587] Educational Foundation for Nuclear Science Inc, *Bulletin of the Atomic Scientists* (Educational Foundation for Nuclear Science, Inc., 1954), 48-50.
[588] Richard Hewlett and Jack Hall, *Atoms for Peace and War 1953-1961: Eisenhower and the Atomic Enrgy Commission* (Berkely, CA: University of California Press, 1989), P 13.

planning the seed of nonproliferation in the minds of policymakers. He continued to campaign for a moratorium for years afterward as a public voice on the subject.[589]

Another committee convened to deal with a specific type of technology under Eisenhower came in the 1954 Technical Capabilities Panel (TCP), a subcommittee of the President's Science Advisory Council (SAC). The TCP's mandate, to investigate American vulnerability to Soviet attack, had been in the works for at least a year by the time it was first convened. The group was headed by SAC chair and president of MIT James Killian, who became one of the president's closest technology advisers over his administration. Killian had the President's ear as a special science advisor over a number of projects including the TCP.

Under Killian's leadership, the TCP resolved to investigate the issue of Soviet attack, and employed forty two scientists and engineers from across the country to do so. The panel's work entailed interviews and in-person visits to America's centers of defense and manufacturing to gauge production and Soviet detection capacity.[590] In early 1955, the TCP presented its findings to Eisenhower. The report noted that America possessed advantages in air and nuclear power over the Soviets, but that the U.S. still stood "vulnerable to surprise attack." Projecting the possibility of both the U.S. and Soviets obtaining multimegaton (a category of the most potent nuclear weapons at the time) nuclear weaponry, the TCP suggested that a better American defense system would prove a "deterrent" to Soviet attack which would undoubtedly "result in mutual destruction." Across the report, it became evident that the TCP believed that pressing greater technological advances in weaponry and detection served as a key for maintaining a favorable balance of power with the USSR, including greater attention to an intercontinental

[589] Herken, *Cardinal Choices*. 83.; Dockrill, *Eisenhower's New-Look National Security Policy, 1953-61*. 252.
[590] Ibid, 68.

ballistic missile (ICBM) program. The TCP also suggested greater investment in radar defense and data transmission technology. [591]

After paring down the initial State Department budget estimate to fit his "New Look" framework, Eisenhower ultimately enacted a number of suggestions from the TCP Report.[592] Eisenhower advanced ballistic missile programs to top priority status, assigning their development to the Air Force, Navy, and Army. The Army was charged with building the intermediate range (IRBM) Jupiter rocket, while the Navy would develop the submarine launched Polaris rocket. The Air Force received responsibility for Atlas and Titan ICBM, and Thor IRBM programs.[593]

The TCP report catalyzed a manned surveillance aircraft development program as well. With Eisenhower's increased attention toward intelligence gathering, a new TCP-inspired research program enveloped engineering into the intelligence world. Since the CIA stood as the only reasonably reliable channel for intelligence on Soviet armaments, new high altitude surveillance aircraft could enable greater intelligence gathering over the USSR. Eisenhower approved a program to develop the U-2 spy plane program in 1955 [codenamed AQUATONE]. The aircraft would change the frequency and scope of the gathering of technological information and Soviet technological progress.[594]

Engineers helped develop the policy for the U-2 program through the TCP. But, the project required engineers on a basic design level as well. Like the road building machines designed by technicians like Gifford, aircraft like the U-2 had individuals behind them with expertise inspired by tinkering and problem solving habits. The AQUATONE program was

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[591] *FRUS* 1955-1957, Vol. XIX, National Security Policy (1990), 44-55.
[592] Damms, 72.
[593] Herken, *Cardinal Choices*. 89.
[594] David, *Spies and Shuttles*. 18-21.

headed by Clarence L "Kelly" Johnson, a Lockheed aircraft engineer who led the company's venerable "Skunk Works" program for advanced projects.[595] Born to Swedish immigrant parents in 1910, Johnson seemed destined for a career in engineering from an early age. Like his predecessors in the field, Johnson read and fantasized about mechanized technology. As a child, he eagerly read Tom Swift books like *Tom Swift and His Aeroplane*, admiring Swift's aptitude for problem solving on the fly with mechanized devices. His carpenter father contributed to his engineering impulses as well, teaching Johnson to "respect tools and machinery," going as far as building his son a wagon with a "remote control" brake. Johnson also learned to tinker with mechanical devices like Swift. In one instance, he tinkered with the air intake manifold on a teacher's car in order to increase gas mileage.[596]

Johnson graduated from the University of Michigan with a M.S. in engineering in 1932, specializing in the supercharging of engines and aerodynamics. Afterward, he immediately began a career with Lockheed in California.[597] His brazen style became immediately evident to his Lockheed coworkers. One of Johnson's first notable moments as a young engineer came shortly after arriving in California. Lockheed's most senior engineering personnel had designed a new aircraft before Johnson's arrival, at which point Johnson warned his superiors that the plane design was "unstable." Taken aback by the criticism at first, the designers ultimately heeded young Johnson's advice, a move that precipitated a quick, Gifford-like ascent through the Lockheed ranks.[598] Within only 5 years, Johnson advanced to Chief Research Engineer, and earned another promotion in 1952. His sometimes ambitious design habits were rewarded as he

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[595] Warren G. Bennis and Patricia Ward Biederman, *Organizing Genius: The Secrets of Creative Collaboration* (New York: Basic Books, 1997) 13.
[596] Daniel Alef, *Clarence L. "Kelly" Johnson: From Skunk Works to the Edge of Space* (Titans of Fortune Publishing, 2010); Johnson and Smith, *Kelly*. 6-7, 19.
[597] "Alumni News," *The Michigan Technic*, December 1933, 17.
[598] Johnson and Smith, *Kelly*. 22-23.

contributed helpfully to aircraft stabilization experiments and power increasing measures that ended up on commercial aircraft for companies like Pan American Airways. By the mid-1950s, Johnson had undoubtedly become an engineering superstar. Besides his commercial aircraft innovations, he designed the popular P38 and P-80 fighters for the U.S. effort in World War II.[599] By the end of his career, Johnson patented a number of designs for military and commercial aircraft and aircraft improvements, many of which came while contracted under the U.S. government. As one commentator suggested, Johnson's legacy stands plainly as a "legendary contributor to national security."[600]

As a part of that contribution, his work on the U-2 proved vital for Eisenhower's intelligence program.[601] After the president approved the program, Johnson delivered a U-2 prototype for testing just months later. The plane's equipment could take 60,000 miles worth of terrain photographs in one mission, dwarfing all previous attempts at expansive air reconnaissance.[602] But, the detail with which the U-2 could capture Soviet intelligence became the greater aid for intelligence gathering. From its high altitude (supposedly a range of 80,000 feet) the aircraft's camera could read the license-plate of a car on the ground.[603] Its high-altitude capability supposedly would to protect the U-2 from Soviet ground detection and anti-aircraft weapons. Although the U-2's missions proved useful, they did not turn out as covertly as Americans would have liked, and the flights were detected by Soviet equipment from the start.[604] Still, Johnson's development of the plane, and the TCPs suggestions toward its implementation, were important examples of engineering's influence on policy under Eisenhower.

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599 "Varied Program Planned for IAS National Summer Meeting," *Aeronautical Engineering Review*, May, 1957, 52.
600 Johnson and Smith, *Kelly*. 149
601 Paul Lashmar, *Spy Flights of the Cold War*, 3
602 Dockrill, *Eisenhower's New-Look National Security Policy, 1953-61*., 152
603 Walter LaFeber, *The American Age: United States Foreign Policy at Home and Abroad, 1750 to the Present*, (New York: W. W. Norton & Company, 1994). 542.
604 Damms, 77.

The TCP disbanded in 1955, but its end did not signal the end of Eisenhower's connection with engineers, or the end of SAC activities.[605] The President continued to find ways to incorporate Killian's leadership in other projects. On March 13, 1959, the president approved Executive Order 10807 for a "Federal Council for Science and Technology" to be headed by Killian, the latest attempt by an American president to streamline and create a cooperative relationship across science and engineering activities in the government. Not unlike the failed effort by Truman to consolidate federal research through the National Science Foundation in 1950, the Council came as a result of a report published by Killian earlier that year that noted the redundancies in federally-funded research arms. Concerned with the fields of science and technology research broadly, the order mandated that the Council "consider problems and developments in the fields of science and technology and related activities affecting more than one Federal agency…" With support from a typically eclectic crowd of business leaders and university intellectuals,[606] the Council's work ran into many of the same obstacles Truman's efforts did, leaving the military research arms largely unwilling to lose sovereignty over its research programs. Military and civilian research arms saw little to gain from consolidating or cooperating, especially with sensitive projects, but the effort was notable for its continued pursuit of a streamlining and disempowering the military-industrial complex.

Dealing with American Manpower and Sputnik

Certainly, the most notable engineering contributions to Eisenhower foreign policy came in designing defense and surveillance tools. Yet, engineering concerns pervaded the

[605] The SAC would later be redubbed the President's Science Advisory Committee (PSAC) after Sputnik's launch. The change placed a full time science adviser in the White House, placing the committee even closer to the president.
[606] Executive Order: Federal Council for Science and Technology, January 22, 1959; Press Release, March 13, 1959, Eisenhower Library, White House Central File, Official File, 1953-1961, Box 774.

administration on a different level as well. Eisenhower regularly received reports regarding Soviet technology and engineering manpower levels, as a way to monitor the USSR's progress in specific technologies, and to compare them with America's own programs. Those reports spurred forth greater emphasis on America's own engineering manpower concerns to deal with the challenges from the USSR. When technological competition with the USSR expanded into new fields and types of war materiel into 1953-54, Eisenhower pled for more intelligence regarding Soviet capabilities.

Eisenhower attempted to address the top levels of engineering in the United States by enabling military research programs that led to the U-2 and ballistic missile. His administration also empowered the field from the bottom up through new initiatives to fund engineering and scientific education. For years, Eisenhower's advisors (and Truman's before him) warned of a perceived dearth of engineering manpower to fill positions in technological research and development, especially as reports of Soviet manpower levels indicated Soviet engineering abundance. A coordinated effort to address engineering manpower levels began in 1954 through the Office of Defense Mobilization. The ODM's "Special Interdepartmental Committee on Training of Scientists and Engineers" found that greater math and science instruction was needed at the secondary school level to feed the future supply of engineers in the United States.[607] The committee further recommended a more diverse National Committee on the Development of Scientists and Engineers (NCDSE) made up of leaders in business and education, along with scientists and engineers. In 1955, Eisenhower's cabinet endorsed this program to the president, and work began assembling the NCDSE.[608]

[607] Summary of Meeting no. 1, July 21, 1954, Eisenhower Library Staff Files, Presidents Committee on Scientists and Engineers, Box 1

[608] National Committee on the Development of Scientists and Engineers, May 19, 1955, Eisenhower Library, Staff Files, President's Committee on Scientists and Engineers, Box 1.

Initial suggestions for membership included a both professionally and racially diverse set of organizations. That initial list included groups like the Association of Negro Land Grant Colleges, whose inclusion would have been a notable departure for such committees, as few blacks were given positions in national engineering councils at the time. In the end, however, the list condensed to exclude the Negro Land Grant Colleges, while keeping engineering voices like the Engineers' Joint Council and the American Society for Engineering Education.[609]

The NCDSE received added pressure to deal with the manpower issue after a CIA report on the Soviet Five-Year Plan of 1956. The report specifically emphasized the Soviet goal of graduating millions of new scientists and engineers, who would be able to buttress the Soviet economy, while also entering into, "Industrial competition with the West and to strengthen its military capabilities." As a part of that effort, the Kremlin aimed to increased "specialized advanced training" for technicians and scientists.[610]

The Eisenhower administration also got word of Soviet manpower imbalances from private engineers, adding pressure to the administration for more support to keep pace. Some reports noted greater consistent enrollments in Soviet engineering programs, and a general long-term focused effort from the Kremlin on down to "beat us at the very game in which we pride ourselves on leading the world."[611] Upon learning of the news of the Soviet ICBM launch in August 1957, U.S. technicians pleaded to Eisenhower for some kind of action to address what was already to them a drastic situation in manpower.[612] Some said the reforms should begin at the college level, specifically through eliminating "distracting elements" of the arts and

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609 Ibid; Membership List and Affiliations, October 1958, Eisenhower Library, President's Committee on Scientists and Engineers, Box 1.

610 Intelligence Memorandum, The Soviet Sixth Five Year Plan (1956-1960), March 16, 1956, https://www.cia.gov/library/readingroom/docs/DOC_0000497777.pdf, 22.

611 The Cleveland Engineering Society, "Engineering, Scientific, and Industrial Development in the USSR: The Kremlin's Potent Educational Weapon," April 29, 1955; Comparison of Scientific Manpower in the USA and the USSR, undated, Eisenhower Library, Staff Files, Presidents Committee on Scientists and Engineers, Box 25.

612 Jones to Eisenhower, August 29, 1957, Eisenhower Library, White House Central File, Official File , Box 529.

humanities from engineering programs: "In Russia, the engineering college program extends over a 5 ½ year period and contains very little study in the humanities or liberal arts field. Because of this specialization, the Russian graduate obtains more training in his field and, consequently, gets an education equivalent to that obtained by a master's degree student in this country." The author continued to emphasize engineers' place of importance in the new world order: "We must keep our technology strong because it is technology and not diplomacy or statesmanship that is preventing World War III."[613]

Another engineer wrote that in light of the ICBM breakthroughs in the USSR, the American response required more engineering. "I know of a defense - more engineers. The engineer shortage in American is dangerous. The shortage can be eliminated if the government would offer to send qualified people to college to become engineers."[614] As noted earlier, under Truman in 1950, American engineering experienced its greatest number of new graduates, but struggled to match that high-water mark for the rest of the decade, a challenge that the NCDSE would try to rise and meet.

The NCDSE was charged with stimulating "non-federal" approaches to increasing manpower rates, and brought in leaders in science, technology, and education to research those ideas. Eisenhower appointed former Ohio State University President Howard Bevis as the chair of the committee, and embarked on an investigation of issues related to increasing technological and scientific personnel. The committee tackled the problem on two fronts. The first front investigated ways to increase the quality and number of practitioners of these fields. The second front focused on encouraging the "long range improvement of science and mathematics

[613] John T. Rettaliata: Two Factors Which endanger the nation's technological superiority, September 27,1954, Eisenhower Library, Eisenhower Staff Files, Presidents Committee on Scientists and Engineers Program Material, Box 25.
[614] Jones to Eisenhower, August 29, 1957, Eisenhower Library, White House Central Files Official File, Box 529.

programs" in primary and secondary schools. Manned by an engineering-specific working group composed of the heads of the Engineers Joint Council and American Society for engineering Education, the committee immediately found cause for greater availability for scholarships to support study in these fields in colleges.[615]

Despite its early suggestions, real urgency in the NCDSE mandate came over a year later with the USSR's launch of Sputnik I in the fall of 1957. American intelligence gathered the previous year made it clear that the Soviet Union had gained the capability to hold space operations, and Sputnik's launch did not come as a surprise to those high in the Eisenhower administration. Still, the event changed the pace of the administration's reforms regarding manpower. Despite the eight years that had passed since the USSR gained nuclear capability, thus entering the two powers into a long-run struggle over technological superiority, the Sputnik launch intensified the administration's technology efforts. The event struck many American engineering leaders as definitive proof that the USSR had finally displaced American superiority in engineering quality, which seemed to some a double win for the Soviets and communist models of education. In response to Sputnik, NCDSE chairman Howard Bevis noted "The Soviet Union has already given us unmistakable evidence that it is making an all-out effort to profit from the scientific revolution. There are ample signs that the same goal motivates the leaders of Communist China."[616]

The American public reaction to Sputnik's launch revealed new awareness of Soviet power, and an acknowledgement that, at the very least, the communists shared world dominance

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[615] First Interim Report of the National Committee for the Development of Scientists and Engineers, July 18, 1956, Eisenhower Library Staff Files, Presidents Committee on Scientists and Engineers, Box 35.
[616] Bevis to Eisenhower, December 17, 1958, Eisenhower Library, Eisenhower Staff Files, President's Committee on Scientists and Engineers, Box 35.

in the area of technological advancement.[617] Polls conducted in the launch's aftermath reflected a diminished American reputation globally, while spurring on curriculum changes in American schools. In an October 20th poll, a majority of participants in India, Canada, France, Norway, and Finland reported that Sputnik's launch was a "blow to U.S. Prestige" while respondents in the U.S. maintained a certain level of optimism; 43% of people said Sputnik damaged American status in the world, while 46% did not, and 11% did not know.[618]

At the lower levels of American education, Sputnik seemed to spur on changes in instruction indirectly. After Sputnik, there emerged a greater willingness for American schools to alter curriculum to face the challenge in science and technology posed by the Soviets. In a 1958 Gallup poll, of a sampling of 1100 high school leaders across the country, one in four stated that they had made "some changes" in instruction since Sputnik. Respondents claimed that much of their emphasis centered on increased science and mathematics coursework, and in some cases leaders added an entire year of those subjects to their curricula. Other's noted that their tried to pool their highest performers in those subjects together in a group of "fast learners."[619]

After Sputnik, the field increased its pleas for federal investment in engineering. Manning H. Dandrige of New York, a Grumman Aerospace engineer, wrote Eisenhower on October 15th with a decidedly triumphalist tone. Dandrige claimed big things for his field including general human progress: "In one way or another technology is responsible for every major achievement in history, with of course…the grace of God to guide us all." Although he admitted to being spurred on by Sputnik's launch, he argued that Eisenhower's administration would be well

[617] Columba Peoples, "Sputnik and 'skill Thinking' Revisited: Technological Determinism in American Responses to the Soviet Missile Threat," *Cold War History* 8, no. 1 (February 1, 2008): 55–75.
[618] George Gallup, "SPUTNIK HURT U.S., GALLUP POLL FINDS: Surprised Expressed in World Centers That Russia Beat America on Satellite Project," *Los Angeles Times*, October 21, 1957, 1-2.
[619] George Gallup, "SPUTNIK CALLED SPUR TO EDUCATION: Gallup Poll Finds School Principals Feel It Sparked Curriculum Changes GALLUP POLL," *Los Angeles Times*, April 13, 1958, 7.

served by the installation of a cabinet level positon for a Secretary of Technology to "forestall any further recurrence of that type" and be "responsible for the technological development in the country…" and should be unsurprisingly, manned by an engineer.[620]

However, not all engineers agreed with the notion of a manpower crisis. Even after Sputnik, engineer J.M. Hill claimed that his area of Southern California was covered with "restless" engineers. Rather than agreeing with the administration's position that a dearth of U.S. engineers caused the country to trail the USSR in technology, Hill wrote, "It certainly seems incongruous to me that our military technical failures are being blamed on a shortage of scientists and engineers when there are probably over 1000 of them unemployed, and another 5000 under-employed, in Los Angeles County alone."[621] The revolving crisis of engineering manpower had been iterated before by engineers and policymakers, and may have been of dubious validity even around the time of Sputnik. Even so, voices questioning the reality of a manpower crisis were ultimately marginalized by the administration which still favored engineering increases

Eisenhower's policy responses to Sputnik looked similar to what most engineers desired. The post-Sputnik urgency thus contributed to a shift away from Eisenhower's earlier non-federal engineering manpower policy. He may have struck out intending to find non-federal solutions to American manpower levels, but the reality of Sputnik meant the president would take matters into his own hands. Indeed, the NCDSE suggested in a post-Sputnik report that "Federal Government at the white House level assume the responsibility for coordinating and stimulating the nation's efforts in the development and utilization of highly trained manpower."[622]At this

[620] Dandrige to Eisenhower, October 15, 1957, Eisenhower Library, Central File, General File, Box 1154.
[621] Hill to Adams, December 8, 1957, Eisenhower Library, Central File, General File, Box 1154.
[622] Final Report of the President's Committee on Scientists and Engineers, December 17, 1958, Eisenhower Library; Eisenhower Library Staff Files, President's Committee on Scientists and Engineers, Box 35.

suggestion, Eisenhower explored ways to stimulate manpower through federal means. New avenues of research opened up, and new agencies started that made plenty of space for technicians and their skills to gain attention and use.

To review, engineers' response to Sputnik's launch suggested that the technological challenge from the Soviet Union could only be remedied by more engineering at home. Soviet development of ballistic missiles and the Sputnik had to be met with greater levels of American engineering, or America would fall behind irreparably in the contest for the skies. The NCDSE's findings gave the administration both a blueprint for identifying areas that required greater federal attention, while also reifying the crisis of manpower.

The NCDSEs contributed to the ultimate passage of Public Law 85-864, also known as the National Defense Education Act of 1958. Signed by Eisenhower on September 2, the law dedicated millions of dollars of low-interest loans for college scholarships. The scholarships were to be funneled toward students intending to teach primary or secondary school, or those with "a superior academic background…whose academic background indicates a superior capacity or preparation in science, mathematics, engineering, or a modern foreign language."[623] Essentially, the Act expanded science and engineering funding as seed capital for future technicians. Although the government sought to support technically-oriented students though the NSF in 1950, the 1958 Act expanded that funding pool considerably. The Act did not impose any changes on curricula in secondary schools or below, but ensured that the federal government and post-secondary education would be wedded indefinitely for the good of American engineering, and by consequence, national security.[624]

[623] Public Law 85-864, Sept 2, 1958, (Washington D.C.,: GPO, 1958), https://www.gpo.gov/fdsys/pkg/STATUTE-72/pdf/STATUTE-72-Pg1580.pdf, 1584.
[624] Wayne J. Urban, *More Than Science and Sputnik: The National Defense Education Act of 1958* (University of Alabama Press, 2010, 170.

Deploying IRBMs to Turkey

The Eisenhower's administration's maneuvering over ballistics had later implications for Turkey. The most notable American deployment of this technology in Turkey came in the 1960 delivery of Jupiter missiles near Izmir. So often remembered as the shadowy bargaining chip buttressing President John Kennedy's successful Cuban Missile Crisis blockade, the Jupiter missiles carried their own diplomatic significance before October 1962. The Jupiter placement had been triggered by two main forces. First, the launch of Sputnik sparked a new desire to share U.S. technological might with NATO allies to counter the negative psychological effects of the launch. Second, Eisenhower carried a commitment to nuclear deterrence and NATO defense. By deploying a batch of fifteen Jupiter missiles to Turkey's Çiğli Air Base, the administration addressed both of these concerns, while simultaneously directly tying American engineering to the Republic's internal developments and diplomacy again.

The Jupiters' journey to Turkey had roots in a 1957 NATO conference that approved a change granting NATO the power to deploy ballistic missiles as a part of its broader security mandate. John Foster Dulles argued that American allies needed to make the U.S. nuclear arsenal "available" to allies in NATO, especially in light of the Soviet ballistics statement Sputnik made so powerfully.[625] Even among NATO members, Eisenhower and Dulles struggled to find willing takers of the missiles. After shopping the missiles around European allies, Turkey and Italy stood as the only remaining candidates for the arsenal willing to concede the required controls to Americans, and to deal with implications of housing a nuclear arsenal in the broader context of

[625] Report to the President by the Technological Capabilities Panel, February, 14, 1955, in Marc Trachtenberg, ed., *The Development of American Strategic Thought: Writings on Strategy, 1945-1951* (New York: Taylor & Francis, 1988,.370, 405-406; Philip Nash, *The Other Missiles of October*, (Chapel Hill, NC: University of North Carolina Press, 1997) 83-85.

Cold War tension. The Turkish military and Prime Minister Menderes were willing to concede equal control over the missiles as long as Turkish forces would be eventually be able to take control of the missiles after they completed training by stationed Americans. Indeed, the U.S. had found its willing partner.

As Philip Nash writes, the choice to send the Jupiters to Turkey received criticism from foreign policy voices like George Kennan, who argued that placement of the missiles symbolized nothing less than nuclear proliferation and a danger to the greater globe.[626] However, the missiles served an important purpose in the Republic. In Turkish eyes, the Jupiters symbolized a vote of confidence in Turkey's alliance with NATO, a show of good faith that the U.S. intended to protect the Republic with its nuclear arsenal. Turkish press announced the nuclear coup proudly on the covers of newspapers, while Turkish leaders assured American officials that their country was the right choice for the Jupiter arsenal.

Another point of debate regarding the missiles came in the term "obsolescence." American congressional officials and foreign policy advisers noted that the second-generation Jupiters were essentially "junk" as one voice put it, and paled in comparison to the capabilities of newer ballistic missiles. Yet, in a later State Department cable, the Jupiters' obsolescence in American eyes did not seem to register to the Turks. To Turks, the usefulness of the weapons was not important, rather it was their mere presence that filled Turks with peace of mind:

"Turkish PermRep here has consistently made it clear that Turks set great store in Jupiters placed in Turkey. He makes very clear that Turkey regards these Jupiters as symbol of Alliance's determination to use atomic weapons against Russian attack on Turkey whether by large conventional or nuclear forces, although Turks have been most reluctant admit

[626] Nash, The Other Missiles of October, 83-85.

presence IRBM's publicly. Fact that Jupiters are obsolescent and vulnerable does not apparently affect present Turkish thinking. My impression is that symbolic importance represents a fixed GOT view, although of course Hare can comment much better than I on this point."[627]

As a part of U.S. diplomatic history's master narrative, the "obsolete" Jupiter missile tagline has become a fact. As the story goes, the missiles served as convenient currency for President John Kennedy during the Cuban Missile Crisis precisely because they were too old to be useful. Removing them in exchange for the USSR's removal of its ICBMs in Cuba stood as an overwhelmingly favorable trade off in American eyes, and has become the accepted view in the minds of many historians. In reality, the notion of obsolescence has been overplayed by historians, and not just because of their diplomatic significance in Turkey. Engineers, or lack thereof, actually played a role in the proliferation of the idea of obsolete Jupiters.

The missiles' obsolescence became a common policy topic after a 1960 investigation by a congressional Joint Committee on Atomic Energy. The committee personally visited the Çiğli launch site as a part of a larger journey across many NATO countries, and came away with the impression that the missiles in Turkey (which had not yet been rendered fully operational) were "obsolete." The committee found that the missiles seemed immobile in the event of attack and easily tampered with by saboteurs. Because the Jupiters were liquid fueled, their fueling time upon activation alert was higher than solid fuel missiles by an order of minutes.[628] Additionally, the Jupiters were thought to be less accurate, and thus less effective, than newer Polaris submarine Launched missiles (SLBMs) developed by the Navy.

It is important to note that the criticism of the Jupiters did not come from engineers, but from the mouths of Congress members and foreign policy experts in the Eisenhower

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[627] *FRUS* 1961–63, Vol XI, Cuban Missile Crisis and Aftermath (1996), 213.
[628] Executive Session: The Joint Committee on Atomic Energy, August 23, 1961, 7.

administration. Congressional figures with law and business backgrounds, along with Eisenhower's foreign policy minds, all seemed to agree with the committee that the missiles' obsolescence was real based off of those observations regarding their vulnerability and deployment.[629] But a slew of technically minded individuals in the Department of Defense disagreed. Certainly the Jupiters' largely unprotected placement and long fueling times were a liability, but did not render them obsolete. It became the position of the Department of Defense that the Jupiter missiles were *not* obsolete, but admitted that as new innovations in ballistic technology emerged, modernization of the arsenal should follow.[630]

In the Joint Committee on Atomic Energy's questioning of military personnel after their overseas visit, it becomes clear that the obsolete terminology came from unreasonable expectations by committee members regarding the pace of innovation. When one congressional committee member asked why the Jupiters could not simply be replaced by the newer Polaris SLBM, West Point and MIT graduate General Austin Betts stated that such an expectation placed unreasonable pressure on technological development. The current technology would not allow for the submarine-based Polaris to be launched on land, and certain innovations would need to be completed before the military could swap out Jupiter missiles for Polaris missiles. Republican Representative from California Chester Craig Hosmer embodied the impatient committee member by suggesting that the military chose not to engineer the needed adaptations for Polaris land deployment more quickly. Implying that the military engineers selectively took a slower route to adapting Polaris to land use, Hosmer claimed, "There is a hard way and an easy

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[629] The Joint Committee on Atomic Energy's only real trained engineer, John T. Conway, did not choose to even engage the notion of obsolescence, and instead focused his questions toward the department on security and surveillance practices.
[630] Ibid, 68; It was stated that "the Department if Defense does not consider that the NATO forces have been preferentially equipped with obsolescent weapons."

way [to engineer].” Betts responded with in-kind rebuke, “And a right way and a wrong way. We are trying to do it the right way.”[631]

In this way, labeling Jupiters obsolete came as a result of a fundamental misunderstanding of the capabilities for newer missile groups, and perhaps a misunderstanding of the term “obsolete.” Committee members believed that the military had developed interchangeable missiles in its various development programs, when in fact, engineers posited each device served a specific purpose, and could only be constructed in a specific setting. The Polaris may have been a better missile, but its functions were specifically designed for maritime launches, a truth congressional figures seemed to not grasp. The charges regarding the Jupiter’s long fueling times did not actually have to do with obsolescence at all, but rather general vulnerability, a problem remedied only through more engineering innovation. In the end, the Jupiters may have been older than the Polaris, but engineers argued that the Jupiters remained functional, dangerous, and significant for their utility as a defensive armament, and to put nervous Turkish minds to rest.

Engineering a Space Launch

The development of ballistic missiles and new legislation like the National Defense Education Act certainly carried significance for the field of engineering. They provided proof that engineers’ concerns and skills remained aligned with those of the administration, and that the future of the nation’s security depended on the skills of scientists and engineers. Like engineers generally, the Eisenhower administration seemed to agree that the way out of a challenge to American technological superiority was more engineering.

[631] Ibid, 9.

The greatest testament to that ideological alignment between engineers and Eisenhower came in the concerted effort to launch a space satellite in late-1957-58. Although it served as the administration's final policy response to Sputnik, NASA did not signal the actual start of the nation's space research activities, nor was the agency in existence when that first launch took place. Both the military and civilian technicians had been engaged in pseudo-space research since at least 1955. The military's ballistics programs always had a space-exploration facet to them, usually as a prospective avenue to counter Soviet space weaponry or reconnaissance. Much of the early American work on ballistics came from Wernher Von Braun. The German-born technician had been trained as a mechanical engineer in Berlin, and worked as a mind behind the German V-2 rocket during World War II. He came to the U.S. after surrendering to American forces and offering his services to the United States military, requesting to be taken to "Ike" himself. Having been identified as an engineering expert by American and British officials, von Braun signed a working contract with the U.S. War Department shortly thereafter, and set off assisting Americans in developing their own missiles similar to the V-2.[632] As a part of the Army's ballistics program, he helped produce the first U.S. rocket system, the Redstone short range ballistic missile (SRBM), in the early 1950s.

But, ballistic missiles became only a part of the technology needed to get a space program up and running. The next step was developing orbiting satellites like Sputnik. As early as 1955, Eisenhower's defense leaders suggested that a reconnaissance satellite be developed for preempting "surprise attack," while research for a civilian satellite program was suggested as a part of the cooperative International Geophysical Year Program (IGY). [633] The first U.S. satellite

[632] Michael J. Neufeld, *Von Braun: Dreamer of Space, Engineer of War* (New York: Vintage Books, 2008) 200-211.
[633] Roger D. Launius, *NASA: A History of the U.S. Civil Space Program*, (Malabar, Fla: Krieger Publishing Company, 1994), 19-23.

would be dubbed “Explorer I” and took the combined efforts of engineers from multiple agencies. As a part of the IGY program, engineers developed most of the Explorer’s features at Caltech’s Jet Propulsion Laboratory under Dr. William Pickering’s watch. The New Zealand-born Pickering obtained graduate degrees in electrical engineering, and dedicated much of his early career to developing Caltech’s propulsion facilities and testing missiles and projectiles. His work on the Explorer came as a collaborative effort with physicists like James Van Allen of the University of Iowa, who specialized in the implementation of detection and collection devices on the satellite.[634]

When the post-Sputnik research surge laid new emphasis on speeding an American space response, the Explorer project took on new significance for American technological prestige. Together with Von Braun’s Army Ballistic Missile Agency (ABMA) team, the satellite designers devised a method to put the device into orbit for the first time. Specifically, the engineers adapted the Army’s older Redstone SRBM technology to serve as the delivery device for the Explorer. Called the “Jupiter-C” rocket, the adapted missile came as a product of long, hard experimentation by von Braun and the ABRA. By itself, the Redstone could not carry enough long-burning propellant to reach outer space. The rocket’s range depended on the amount of fuel available inside. With more length, the rocket could store more propellant and thus go further. To achieve this, the Army lengthened the Redstone to accommodate more fuel and the satellite itself. Combined with a lightweight but more powerful Rocketdyne-branded engine, the Jupiter-C provided just the thing to get America’s response to Sputnik off the ground.[635]

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[634] “Explorer-I and Jupiter –C Data Sheet,” Department of Astronautics, National Air and Space Museum, Smithsonian Institution. http://history.nasa.gov/sputnik/expinfo.html.
[635] Neufeld, *Von Braun*, 302.

Following the launch of Sputnik II in November and the failed deployment of the Vanguard satellite in early December 1957, Explorer I successfully launched on January 31st, 1958 to great acclaim in the U.S. The *New York Times* identified the rocket's launch as a "Tense 15 ¾ seconds" but that the 80-inch satellite's liftoff brought "cheers" from the in-person observers near Cape Canaveral, Florida. Other news reports noted the broader significance to the Cold War: "[Explorer] will help revitalize the sorely buffeted self-confidence of the free peoples."[636] Still, the launch did not change the position of the U.S. in the growing space race by itself. Wernher Von Braun stated that Explorer I was a "rival only in spirit" to the larger and more impressive Soviet satellites. It seemed to Von Braun that even with the engineering skill at the Americans' disposal, the Soviets were still at least "five years" ahead in the race.[637]

The methods used by American engineers to launch Explorer I fell in line with general engineering practices emphasizing creativity and conservative experimentation in equal measure. Certainly the development of both the rocket and satellite took considerable time and calculation to get right, utilizing the expertise of scientists and engineers of different specializations. Their skills in measurement, math, and physical science all needed to be employed to make the rocket and satellite a reality. But, the combination of the modified Redstone and Explorer technologies took creativity and problem solving, the other crucial aspects to the engineering mentality. The launching of a satellite may have been accomplished before by the Soviets, but that launch occurred behind a shroud of secrecy. American technicians had to treat their launch as the first of its kind, using no precedent knowledge to get the satellite aloft. Combining the already-existent Redstone rocket with the Explorer was never a *fait accompli,* yet the marriage of these two devices provided the correct balance of thrust, weight, and stability to get the first American

[636] "Hail the Explorer!," *The Washington Post and Times Herald* , February 2, 1958, E4.
[637] "Red Still Ahead, Von Braun Warns," *Daily Boston Globe*, February 2, 1958.

satellite to space. Like the engineers who decided to place a Rolls Royce engine into a P-51 Mustang in World War II, the adventurous and curious sides to America's early space engineers proved important for making the program operational.

NASA is Born

With a successful launch behind it, the Eisenhower administration proceeded to explore the consolidation of the nation's space activities under a new agency. Once again, James Killian's SAC led a study into the building of a space agency. The group recommended that a new agency be formed, essentially an expanded form of the National Advisory Council for Aeronautics (NACA) to oversee the direction of a space program, a recommendation Eisenhower approved of. But, then-Texas Senator Lyndon Johnson suggested an even more powerful and ambitious agency, one that could slice through red tape without committee approvals. Noting that the current expanded NACA framework lacked centralized authority, Johnson was wary of building an agency without the authority to navigate internal disputes across multiple military agencies, civilian engineers, and scientists.[638] The existing ballistics program had been spread across the Army, Navy, and Air Force, while private engineers had been developing satellite technology as a part of the IGY program. As usual, military officials feared the results of losing their sovereignty over research to civilian administration. The heads of American military's ballistic programs cited fear of "disastrous" developmental delays if the military program transferred it duties to a civilian research arm created specifically to pull the U.S. further along the space race.[639]

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[638] Launius, *NASA*,. 30-31.
[639] Charles W. Corddry, "Quarles Is Undisturbed By Army-Space Rivalry," *The Washington Post and Times Herald* , October 25, 1958.

In the executive discussions leading up to NSC 5814, which laid the foundation for NASA, Eisenhower and his advisors noted that a potential space program would serve simultaneous defense and scientific purposes. He felt both needed to be deftly separated to pursue both interests without conflict between the military and civilian research interests. Eisenhower personally stated that the new space agency needed to preserve the authority of scientists by not conflating the scientific aims of the program with defense goals. The resultant plan separated powers relating to the space program; NASA would pursue the scientific aspects of space while the Department of Defense would research its military and defense implications in their own program.[640]

Bringing all the existing projects under a single head would require a careful touch to avoid replicating the hated interdepartmental squabbles the president encountered as the Supreme Allied Commander in World War II. The result of the NASA negotiations was a compromise of sorts between Eisenhower and Johnson's plans. NASA would be nominally chaired by the president to achieve the dispute resolution aims of Johnson, while allowing Eisenhower to pass duties onto a head administrator at the very top of the program.

The first head administrator of NASA was T. Keith Glennan, an electrical engineer and president of the Case Institute of Technology. Glennan served as an Atomic Energy commissioner under Truman and later as a member of the National Science Board.[641] Under his administration, Case became a leading national engineering school, and established itself as Ohio's preeminent technical institution. As the NASA head, Glennan successfully integrated the

[640] David, *Spies and Shuttles*, 2; Launius, *NASA*, 30-34.
[641] National Aeronautics and Space Administration and John E. Naugle, *First Among Equals: The Selection of NASA Space Science Experiments* (CreateSpace Independent Publishing Platform, 2014). 42-43; NSF Bulletin vol. I, no. 2, April 6, 1956.

military research programs into the civilian agency. Importantly, Glennan successfully drew Wehner von Braun into NASA work from his ARBA position, a position he held until 1970.[642]

NASA's initial stated purposes had a clear Cold War undertone. The NSC 5814/1 introductory note made clear the administration's positon that the Soviets had indeed taken over the title as world's technological leader at the statement's outset: "The USSR has surpassed the United States and the Free World in scientific and technological accomplishments in outer space...if it maintains its present superiority in the exploitation of outer space, [the USSR] will be able to use that superiority as a means of undermining the prestige and leadership of the United States and of threatening U.S. security." Even more directly, the statement acknowledged a central truth of technology in the Cold War in stating "the beginning stages of man's conquest of space have been focused on technology and have been characterized by national competition. The result has been a tendency to equate achievement in outer space with leadership in science, military capability, industrial technology, and with leadership in general."[643] Like in his attempt at a cooperative atomic policy through Atoms for Peace, Eisenhower similarly viewed the space race as an opportunity for decreasing international tensions. The world needed unity rather than rivalry with the Soviets, and he felt space exploration, like nuclear energy before it, could be a rallying point for such cooperation. But, despite the motions from Eisenhower and the security council to reduce the role of "national rivalries" in pursuit of space exploration, public opinion and other advisory voices made clear that American technology, as delivered by scientists and engineers, would be a way to assert power in the Cold War rather than diminish it.

To underline the linkages between space exploration and national security, NASA established an ongoing relationship with the nation's main intelligence agency under

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[642] David Binder, "T. Keith Glennan, 89, First Chief of Space Agency," *The New York Times*, April 12, 1995.
[643] *FRUS*, 1958-1960, Vol. II, United Nations and General International Matters (1991), 844-846.

Eisenhower. Not only were the heads of NASA and the CIA in direct communication over helping each other out, there were vested intelligence interests in the development of specific technology for use against the USSR. The space race thus took on greater significance as a geopolitical competition, and became more tied to the status of American might in technology rather than a cooperative endeavor. In the end, the space race increased rivalry between the U.S. and USSR, all the while pressing engineering closer to the center of American foreign policy.[644]

Engineers Reflect on the Space Race

If the end of World War II turned America's foreign policy and engineering focus abroad, the end of the 1950s turned the profession's gaze toward the cosmos. Generally, engineering journals and professional gatherings noted the effects of space travel on the field after Sputnik and Explorer I. But, it can be safely said that the field had been peeking toward the heavens for years before their launch and the establishment of NASA. With the rise in government research for ballistic missiles and participation in the IGY program, technicians had plenty of reason to discuss outer space throughout the 1950s. Engineers held entire professional conferences on space exploration well before the launch of Sputnik, and freely shared ideas about the direction of such programming. Engineering journals came peppered with pieces addressing military developments regarding relevant space technology advances. In many cases before Sputnik, engineering articles espoused a clear understanding that the development of high end ballistics and satellite technology came tied directly to broader competition with the USSR. Some engineers confidently claimed that American space technology stood "in every respect,

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644 David, *Spies and Shuttles*.

superior to the Soviets," reflecting a general belief among technicians that American engineering was the best engineering.[645]

For this reason, the launch of Sputnik took many in the engineering field by surprise. Some admitted that Russian technicians had "outsmarted" Americans at their own technological "game." But, the issue of Sputnik did not turn American engineers inward as previous challenges had. The field seemed generally disinterested in placing blame for not beating the USSR to space. After all, such finger-pointing was best left to the "politicians." Instead, engineers focused on the immediate benefits that the field would gain after Sputnik's launch. Engineers seemed aware that they would now receive even greater state funding for research, all in an effort to assert distinctly American engineering power over the new space race. Engineers rallied around a consensus that the field needed to "get to work" in order to keep from falling further behind the Soviets. In the words of one technician, "We can't afford to dawdle."[646]

The effects of engineering's late-1950s preoccupation with space became most visible amongst the ranks of aeronautical engineers. At the time, the notion of a "rocket scientist" was more than a punchline in a sarcastic quip; it meant an achievable position worth striving for. The relatively young specialization experienced increases in practitioners and professional membership due to attention toward space in the latter half of the 1950s. Between 1954 and 1958 alone, the Institute of Aeronautical Sciences grew its membership by nearly 50%, supported by a wave of young student members excited about the possibilities of flight and space exploration.[647] The Institute's magazine *Aero/Space Engineering* turned its attention toward space flight as a result. While in 1957 the magazine covered mostly jet fighter and radar technology, by February

[645] Lt. Thomas S. Power, "Air Force Research and Development in Space Technology," *Aeronautical Engineering Review*, vol. 15, no. 9 (September 1957): 36-37.
[646] "Zero to Infinity," *Aeronautical Engineering Review*, Vol. 16, no 12 (December 1957): 24-25.
[647] "The Five Year Look," *Aero/Space Engineering* Vol. 18, no. 1 (January 1959): 22-25.

1959 the publication's feature articles almost exclusively covered space-related engineering developments. Going forward into the 1960s, the publication continued to dedicate the bulk of its features to developing spacecraft, the dynamics of gravity on structures, and the unlimited potential of manned space flight.[648]

Pursuing space flight while also pursuing American foreign policy aims overtly added weight to the field of aeronautical engineering. The space program contributed to evolution of aeronautical engineering into a more inclusive "aerospace engineering" to account for the new realm of space applications. One writer appropriately noted that the space race turned the field of aeronautical engineering completely, "on its head."[649] University aeronautical programs adapted to the shift by adding new courses in "rocket propulsion" and "space vehicles," and often usually changed the department name to incorporate the wider aerospace focus.[650]

Engineers were right to turn their attention toward the space program, and not just because Eisenhower needed their expertise to make such a program a reality. The establishment of NASA came with the added benefit of science and engineering research funding, in amounts above and beyond previous channels for engineering research like the NSF. The single year budget for the ballistic missile programs alone exceeded $1 billion in 1958.[651] In 1960, the NASA Budget appropriated over $500 million, over half of which was to go to research and development operations. By 1965, NASA's budget ballooned to over $5 billion, nearly $4 billion of which came earmarked for research.[652] The results of that funding could be seen on television reports and newspapers; grand, expensive machinery launched beyond the stratosphere, pushed

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648 The magazine was called Aeronautical Engineering Review, then Aero/Space Engineering,

649 John D. Anderson Jr, "Riding the Crest: A History of Michigan's Aerospace Engineering Department," *AIAA Journal* vol. 53, no. 4 (2015):. 814

650 Ibid, 814.

651 Robert A. Divine, *The Sputnik Challenge*, First Edition edition (New York: Oxford University Press, 1993). 29.

652 Jane Van Nimmen, Leonard Bruno, and Robert L. Rosholt, *NASA Historical Data Book, 1958-1968*, Vol. 1, (1976), 6-7.

America's reach further into the universe, while bringing back data, samples, and measurements regarding the last human frontier to keep pace with Soviets.

The results of that funding could also be seen in the mass of patents granted through the space program's funding. The National Aeronautics and Space Act of 1958 made detailed provisions for the technology that NASA produced through its research appropriations. Much like private manufacturing firms that were assigned the rights to the patents developed by their engineers, NASA stipulated that any patent granted under contracts for the Administration AND those not granted under the contract, but still relevant to the contract, would become "the exclusive property of the United States." Those restrictions on marketing NASA-backed innovations seemed to have little effect on the rate of technological advance. By 1965, NASA reported 6,500 patents, most of which came from outside contractors.[653] The NASA Administrator was granted the patent on behalf of the United States. The policy did provide for financial awards for "any scientific of technical contribution to the Administration which is determined by the Administrator to have significant value in the conduct of aeronautical and space activities" at the discretion of the Administrator.[654] The result was a rash of new inventions under Glennan's name, of which he had no actual role in developing.

The space race produced other changes in American engineering culture. Much like the large-scale American building projects of the late-1800s and early-1900s that attracted the engineering generation to the field, the space race created its own magnetic effect for young people. The era led space engineers to become increasingly attractive models for successful professionals in the United States. Figures like Von Braun reached the level of the heroic

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[653] Sylvia Katharine Kraemer, "Federal Intellectual Property Policy and the History of Technology: The Case of NASA Patents," *History and Technology* , vol. 17, no. 3 (January, 2001): 195.
[654] National Aeronautics and Space Act of 1958, Public Law 85-568, 72, July 29, 1958, Record Group 255, National Archives and Records Administration, Washington, D.C; available in NASA Historical Reference Collection, History Office, NASA Headquarters, Washington, D.C.

engineer, thrust into Americans' living rooms and newspaper stands as his celebrity grew. As would-be NASA engineer Homer H. Hickam wrote in his bestselling memoir about his coming of age during the space race, the lure and exoticism of working on highly technical rocketry entranced him: "At night before I went to sleep, I thought about what Dr. Von Braun might be doing at that very moment down at the Cape. I could just imagine him high on a gantry, lying on his back like Michelangelo, working with a wrench on the fuel lines of one of his rockets. I started to think about what an adventure it would be to work for him, helping him to build rockets and launching them into space"

As a child, Hickam already shared traits of burgeoning American engineers. He avidly read of *Tom Swift* novels, putting him in league with technicians born five decades before him. He found motivation in the practicality of engineering to utilize academic subject matter that he had previously neglected. In high school, Hickam's urge to create rockets proved influential enough not only to conquer his academic nemesis, algebra, but to study calculus independently. Hickam's motivations may have lacked clear direction, but his desires to emulate America's great engineers would drive him nonetheless: "I knew to do that I'd have to prepare myself in some way, get some skill of some kind or special knowledge about something. I was kind of vague on what it would be, but I could at least see I would need to be like the heroes in my books- brave and knowing more than the next man."[655]

For significant numbers of Americans growing up at the same time as Hickam, the space race drew their attention to engineering as an attractive avenue for their lives. Becoming an aerospace engineer carried high status and prestige, along with a public visibility that outpaced even the most prominent of the engineering generation's technicians. Shortly after the establishment NASA, the Mercury program would turn the nation's attention to the first

[655] Homer H. Hickam, *Rocket Boys: A Memoir* (New York: Delta, 1998) 11-30.

astronauts, bringing yet another set of technically-trained professionals into public view with unprecedented celebrity. As their status continued to rise, avenues for technicians opened wider to accommodate higher numbers of engineering students. The emphasis on science and technology in schools made it clear that those with such skills would be valued in society, and have plenty of outlets for their talents.

The field of engineering, and American society in general, would continue to be influenced by the space race for years to come. And rightly, many of the shifts caused by the space race are credited to Eisenhower, who alternately continued the increasingly intense science and engineering-focused presidency of Truman, while blazing his own trail regarding the directions of those subjects in American policy. In that process, Eisenhower found still more ways to deploy engineering to further foreign policy aims.

Engineering Writing

Beyond defense initiatives, NASA, and Turkish development, U.S. foreign policy under Eisenhower utilized engineering in other geographic contexts and situations. Besides their participation in development and defense work, perhaps the most subtle deployment of engineering expertise in American Cold War foreign policy came in the form of engineering writing. Under Truman, American science and engineering publications spread internationally through U.S.-run libraries and reading rooms in foreign countries. The Office of War Information had established American libraries in places like Mexico City and Berlin in the mid-1940s to spread a more positive image of the U.S. abroad. Eisenhower expanded engineering writing to more foreign audiences by combining it with a wider intelligence and propaganda

campaign into poor parts of the world. Those earlier libraries (or "Information Centers") set a precedent for what would eventually become a part of Eisenhower's United States Information Agency (USIA) in August 1953. Combining various propaganda arms of the American government under the auspices of the State Department, the USIA established a broader network of global libraries stocked with American literature and other pro-U.S. materials often translated into local languages. Historian Kenneth Osgood writes in his book *Total Cold War*, "The Eisenhower administration found itself embroiled in an intense political and psychological competition for the loyalties of the newly emerging states…" To underline the perceived importance of spreading a positive image of the U.S. through literature, the libraries numbered 58 at its most robust year in Asia alone.[656]

Specific inventories varied from location to location, but USIA libraries typically carried around 13,000 books, magazines, and newspapers. Engineers and technology had something to offer this propaganda enterprise. The libraries often stocked technical manuals on a range of technology subjects like atomic energy, *Engineering News-Record,* and chemistry journals like *Chemical Abstracts.*[657] Books on civil, chemical, and electrical engineering, not to mention materials-specific textbooks also appeared to aid locals in designing and administrating building projects in their homelands.[658]

The notion of educating foreigners on the merits of American thought and ingenuity aligned closely with the purposes of development programming. The more positively foreigners viewed American technology, the less likely they would be to feel sympathy toward Soviet

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[656] Kenneth Osgood, *Total Cold War: Eisenhower's Secret Propaganda Battle at Home and Abroad* (Lawrence, KS: University Press of Kansas, 2006) , 113, 121.
[657] Marc Frey, "Tools of Empire: Persuasion and the United States' Modernizing Mission in Southeast Asia," *Diplomatic History* , vol. 27, no 4 (August 2003): 550-567.
[658] International Cooperation Administration, *An Industrial Technical Library for a Tropical Country.* (Washington, D.C.: GPO, 1957), 25.

collectivist ideals. To think like an American engineer meant solving measured, practical problems, not seeking impractical revolution.[659] In other words, in addition to attacking, education, hunger, economic, and infrastructure problems, the Eisenhower ad sought to use science and technology *writing* to serve its own containment purposes.

Engineers certainly asserted themselves in their participation in development, defense, space programs, and the dissemination of literature, but they also contributed in large part to other Cold War events that defy simple categorization. Engineers guided the clearing of sunken vessels in the Suez Canal after the Suez Crisis of 1956, and built the facilities that supported American personnel and families of the U.S. Army European Command.[660] Technicians implemented the global Voice of America (VOA) radio network, which spread American news and propaganda over the previously untapped-airwaves. All the while, engineers continued to innovate and problem solve, further integrating themselves into American foreign policy for decades to come. That integration proved more lasting than perhaps even engineers expected at the time, but the process looms large over the field to this day.

Without a doubt, engineers intensified their partnership with the government under Eisenhower. Toward the end of the Eisenhower administration, the opportunities for engineers grew more visible, especially in the space program. As the engineering generation began to step away from their foreign policy roles in the late 1950s, new technicians stepped in to take their places. The people taking up these new projects in aerospace engineering and related fields increasingly belonged to a new generation than the one populated by Gifford, Killalee, and Bush.

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[659] Jody Sussman, "United States Information Service Libraries," Occasional Papers, University of Illinois Urbana Graduate School of Library Science, 1973.

[660] Amy L. Sayward, *The Birth of Development: How the World Bank, Food and Agriculture Organization, and World Health Organization Changed the World, 1945-1965* (Kent State University Press, 2006). 61; Center of Military History and United States Army Corps of Engineers, *Building for Peace: U.S. Army Engineers in Europe, 1945-1991* (Government Printing Office, 2005). 149-150.

People like Homer Hickam grew up viewing the greater globe as an American engineer's drafting board, whose ideas could influence and reshape how people lived. They could pursue these ideals because of American foreign policy decisions took engineers along as necessary associates to reaching a security end. But, what mattered most to these younger engineers remained consistent between their era and that of the engineering generation. As long as they could find and fix problems using technology, they could be satisfied fulfilling their professional purposes in service the United States government.

Conclusion: The Engineering Generation's End

Pat Gifford did not know much about the bigger development process he participated in when he went to Turkey in the 1950s. He paid attention to world events and politics, but gave his own position as a part of those events little mind. He went to Turkey largely unaware that his skills (ever so slightly) contributed to furthering American Cold War foreign policy. To his mind, Gifford traveled abroad simply in the engineering service of the greater good. Above all, Gifford fancied himself an engineer. He found much of his identity in designing implements to solve practical problems, and no amount of professional trauma could change that.

Already years removed from his globetrotting for Huber, Gifford contentiously left his employer in 1958 after nearly forty years in the company's drafting room. He stood to gain a sizeable pension upon his impending retirement, a pension Huber angled to avoid dispersing as the company's financial position weakened. Excluding Gifford and a few other fellow long-tenured employees from their pensions meant partial financial relief from non-revenue producing obligations, at least temporarily. The move shocked Gifford and his family, a hurtful and disloyal development from a company whose very plunge into the road construction industry in the 1920s was due to Gifford's work. So, later that year, Gifford quit and started in on the final phase of his long and dynamic career.

Gifford's engineering mentality never stopped working even after his departure from Huber. Free from his obligations at the company, Gifford emerged ready to design whatever he could to fill a need. It turned out that his practical problem to solve came in the form of smaller scale road equipment. The equipment market in the late 1950s was saturated with large road rollers, graders, and excavators for highway work. Eisenhower's Interstate Highway project

brought larger and more powerful machines out of American manufacturers' drafting rooms, as makers hustled for a position in the huge construction program. Yet, plenty of people still needed rollers for jobs like driveway or parking lot paving, for which purchasing or renting a six-ton roller would have been overkill. Gifford responded with his latest machine, the 'Gifford' one-ton roller, a smaller-scale device that provided asphalt-rolling technology to consumers for smaller projects. Gearless and clutch-less, he designed the Gifford specifically for simple operation for smoothing driveways, sidewalks, and parking lots. To market the machine, the sixty-five year-old Gifford incorporated his own company, and unimaginatively dubbed it 'Gifford Industries.' He rented an office on the north side of Marion to work out of, and brought his second wife, Lois, on board as the company president who would handle his financial dealings- a project he had spent his whole life avoiding.[661]

Gifford slowly built his brand widely enough to gain a reputation in the region and on the east coast. In 1961, he placed bids for District of Columbia municipal equipment contracts. The lifelong Republican hoped to win those contracts, if only for the simple fact that his machines could be used to "roll Kennedy out flat."[662] Mostly, Gifford sold his machines to Ohio clients and buyers from neighboring states. His greatly scaled-down operation in comparison to Huber liberated him from designing anything he did not want to. He typically only produced two or three total machines at once, all of which found application for smaller projects like the one-ton roller. Gifford often machined specific parts for other companies' equipment, and completed ad-hoc work whenever he could find it.[663] When he needed help on a project in his shop, he hired sparingly, and kept the operation as lean as he could. At different points, Gifford employed his

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[661] Gifford Industries Inc., Gifford One-ton roller advertisement; Gifford Industries Inc., Articles of Incorporation, December 23, 1958, Gifford Papers.
[662] Pat Gifford to Glenn Gifford, January 30, 1961, Gifford Papers.
[663] Pat Gifford to Glenn Gifford, July 1, 1961, Gifford Papers.

adult children, and even included them on the company board. From top to bottom, Gifford Industries oriented itself as a family operation, which suited Gifford just fine. Only a few years after leaving Huber, it seemed that Gifford Industries represented his most personally rewarding career stage.

What happened next came as a surprising twist to cap Gifford's long engineering career. In 1968, detecting a new avenue for the company's future, a new-look Huber Manufacturing Company offered to buy Gifford Industries and its smaller scale road rollers and asphalt sealers. Now 73 years old, the buyout offer came at the right time for Gifford, who hoped to scale back operations at his company. Not only did providing the engineering muscle for Gifford Industries wear him down, but the business of operating his own enterprise became too much of a headache. By his own admission, "[I've] had almost as much government regulation as someone in the military." Gifford ultimately accepted the Huber offer, closed operations, and transferred the rights to market, manufacture, and sell his asphalt sealers and one-ton roller to the his old firm. As an added bonus, Huber brought Gifford back on an advisory basis for design work, but his days as a full-on engineer had come to an end.[664]

Gifford's late career shift from Huber to Gifford Industries reflected much of the uncertainty experienced by many engineers employed in the heavy equipment-manufacturing segment in the 1960s and 1970s. Mergers and general economic instability in the U.S. changed the complexion of the industry, putting company engineers and general staff into career jeopardy. The heavy equipment segment experienced greater costs consistently in this era, which weighed on company profit margins. Under the Johnson and Nixon administrations, the construction equipment Producer Price Index increased 54%, caused by the Vietnam War, the recession of 1970-71, and price and wage freezes following the elimination of the gold

[664] Pat Gifford to Private Marc Gifford, March 24, 1968, Gifford Papers.

standard.[665] Major manufacturers like Case and Allis-Chalmers dealt with takeover attempts, and the price of doing business in the segment became more difficult due to overseas competitors. Industry engineers continued to innovate with new machines like the hydraulic excavator, but the pace of innovation of three decades earlier had slowed.[666]

Equipment engineers made up only a small percentage of the technicians involved in postwar U.S. foreign policy. Engineers in many specializations came to benefit from their changed relationship to the federal government in the postwar era in different ways. Started under Truman, and continued under Eisenhower, engineering for foreign policy partly came to define the mid-century engineering experience at multiple levels.

The first wave of technicians to experience the changing relationship between engineering and foreign policy came in the engineering generation. For these technicians, engineering unlocked a literal world of work of which their predecessors could only have dreamed. Although technology had long been viewed by Americans as a sort of magic problem-solving wand, the postwar world tested the field's capability to push boundaries, and solve new problems with their skills. The engineering generation rose to meet those challenges, and as a result, extended American power out into the world.

Closing a Chapter

Between World War II and the end of the Eisenhower administration, engineers emerged near the top of the American government, research agencies, universities, and private enterprise. They developed implements and processes used to further American policy aims in a variety of contexts. Engineers like Ben Moreell and Lewis Coombs formed the Seabees, facilitating the

[665] Haycraft, Yellow Steel, 189.
[666] Ibid, 194-212, 241.

successful execution of a logistically complicated land and sea war. Other technicians headed government research agencies, or invented important Cold War defense and surveillance technologies. Some invented the heavy machinery used to build roads at home and abroad, or planned and managed large dam and highway programs in far off lands. These members of the engineering generation had faded from view beginning in the mid-1950s, a result of natural processes of aging, and movement out of the public eye. Officials charged as leaders in American engineering endeavors retired, changed positions, or passed away. These technicians set a tone for the field that would influence the career paths of a great number of future engineers.

Pat Gifford passed away in Marion in 1979, leaving behind twenty-six grandchildren and a handful of great-grandchildren. Like many of his colleagues in the engineering generation, he also left behind a long legacy of innovation and contribution to technology. The road building industry took off with his Huber gas powered road roller, and his experiences abroad serve as a useful lens into the roles of engineers in postwar development. Like other technicians, Gifford shared a consistent worldview and habits regarding the craft of engineering. Problem finding, problem solving, and the triumphant application of technology bound these figures across geographic and engineering contexts.

Vannevar Bush, perhaps the most visible and powerful of the engineering generation, began to fade from his public work by the mid-1950s. Bush had largely removed himself from government and academic service by 1955, and turned his attention to writing commentaries about the roles of technology in American society. He became a megaphone of sorts for the interplay between the military, scientific research, and democracy, urging more caution regarding increased armaments and military control. His loud opinions on these matters turned

his writing more political as time went on. Naturally, his politicism grew a certain separation between Bush and the American scientific and engineering communities who still adhered to notions of an "objective" engineering craft that operated above petty political maneuvering.

Even so, Bush continued tinkering and innovating into his last years. Like some of his earlier innovations, Bush's work late in life contained ambitious visions for pushing technology to new heights. His patents and designs in the 1960s brought forth a new type of heat transfer method for gasoline combustion engines, and a special space-age hydrofoil boat, among other implements.[667] Although these may have been useful innovations, Bush could not convince less-adventurous buyers in the automobile industry and Navy Department of their merits. He noted in the late 1960s that, due to ill health and failing eyesight, his time as a tinkerer was over. Ultimately, Bush succumbed to a cerebral hemorrhage in 1974, leaving behind great contributions to both American foreign policy and his field generally.[668]

Like Bush, Jack Killalee exhibited a continuous drive to serve the greater good through engineering late in his career. After leaving his role in Turkey in 1950, Killalee worked in the San Francisco Bureau offices until his retirement in 1955. Shortly thereafter, he unretired thanks to a consulting contract offer for the Lebanese government under the employ of the American firm Tippets-Abbett–McCarthy-Stratton. In that capacity, he helped design the first-ever divided highway in Lebanon, and surveyed for the future Damascus-Beirut highway.[669] With an engineer's exactness, he pointed out deficiencies in Lebanese materials testing equipment and

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[667] Bush, Vannevar, Hydrofoil craft, U.S. Patent 3270699 A, filed March 4, 1965, and issued September 6, 1966; Bush Vannevar, Hot gas engines method and apparatus, U.S. Patent 3457722 A, filed April 5, 1966, and issued July 29, 1969.

[668] Zachary, *Endless Frontier,*. 381-383, 403-406; Robert Reinhold, "Dr. Vannevar Bush Is Dead at 84," *The New York Times*, June 30, 1974.

[669] Memoir No. 2223, American Society of Civil Engineers, "Jack Aldabert Killalee," Killalee Papers, Burlingame Historical Society.

facilities, along with the needed machinery to improve engineering practices in the country.[670] Upon the completion of his contract in Lebanon, he received a proposition by the United Nations to consult on road building for its proprietary technical assistance programs (which he declined).[671] Instead, Killalee retired to Burlingame once again.

Just three weeks after his second retirement as a highway engineer, Killalee suddenly passed away of a heart attack at his home in November 1957.[672] Only 58 years old at the time, news of his passing rippled through the engineering field. The Director General of Turkish highways wrote upon his death, "Killalee was one of the most popular members of the BPR groups who came to Turkey, and it was a real pleasure to work with him for the Turkish Engineers who adored him. All the members of the Turkish Highways who knew Jack Killalee were deeply sorry when we heard of his passing away."[673] Officials in the ASCE and the ICA wrote personal letters of sympathy after Killalee's death, and the Seventh Annual Highway Planning Conference resolved to honor Killalee at their 1958 convention.[674]

Even seven years after leaving Turkey, the Republic continued to hold a place in Killalee's heart. Upon his passing, his engineering material and reference manuals were donated to Turkish engineers in the Ankara office of the Directorate of Highways.[675] His family's experience in the Republic remained an important part of their lives, and his wife readily advertised their years there as some of their most fondly remembered.

The next generation of technicians inherited an engineering world with far greater possibilities than what their predecessors experienced in their first years on the job market.

[670] Killalee to Khatib, March 14, 1956, Killalee Papers, Hoover Institute Archives, Box 3.
[671] Sivasankar to Killalee, October 8, 1957, Killalee Papers, Burlingame Historical Society.
[672] "Jack A. Killalee," *San Francisco News*, November, 18, 1957.
[673] Ataç to Killalee, December 16, 1958, Killalee Papers, Burlingame Historical Society.
[674] Wisely to Killalee, November 27, 1957; Dorsey to Killalee, January 23, 1957; Resolution Number 2, April 10, 1958, Killalee Papers, Burlingame Historical Society.
[675] Turner to Killalee, June 6, 1958, Killalee Papers, Burlingame Historical Society.

Thanks to structures and trends started by the engineering generation, the next wave had more professional options, and more money to go with those options, than their predecessors. For the first time, a generation of engineers would be largely *required* to hold B.S. degrees in order to become professionals. As a result, the new generation emerged more formally educated than the engineering generation, following a trend nationally of increased college enrollments. Between 1917 and 1937, colleges in the U.S. experienced a general three-fold increase in enrollments, and conferred degrees in larger quantities than they did in Gifford's era.[676] Engineering colleges like MIT saw total enrollments rise 35% between 1916 and 1937, accompanied by facility betterments and faculty expansion to match.[677] New job opportunities in burgeoning fields like nuclear and aerospace engineering provided more specialized sectors of work for technicians, not to mention the increased funding opportunities provided through the federal government which made experimentation with any sort of scientific or engineering principle that much easier. The triumphalist overtones of engineers would thus thrive in the environment left behind by the engineering generation.

This new generation would be the first to contend with women in the labor market. Engineering colleges saw slowly rising female enrollments in the late 1940s, and more frequent hiring of female faculty members.[678] In April 1949, a group of women engineers representing eastern colleges assembled at the Drexel Society for Women Engineers at the first conference of

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[676] Martin Trow, "Reflections on the Transition from Mass to Universal Higher Education," *Daedalus*, vol. 99, no 1 (1970): 1-42

[677] Massachusetts Institute of Technology, *Massachusetts Institute of Technology: Report of the President*; vol. 75, no 1, 1939, 18; *Massachusetts Institute of Technology: Report of the President*, vol. 52, no 2, 1917, 37, https://libraries.mit.edu/mithistory/digital.

[678] Georgia Institute of Technology began hiring women faculty members regularly in 1960 to coincide with the rising female student population, Joshua Cueno, "Female faculty, staff offer professional perspectives," *Technique Focus*, April, 11, 2003, 1.

women engineering students. It was the first large (non-local) Society for Women Engineers in the U.S., setting in motion a slow shift toward greater organizing among engineering women.[679]

The Next Generation

As a window into the foreign policy world that greeted the next generation, second-wave development brought together younger technicians to take part in aid programs often unrelated to defense concerns. Many U.S. development programs executed under Point Four in the mid-to-late 1950s operated on scales larger than what came before them, involving multiple institutions, funding arms, and personnel, and often occupying longer lengths of time. The engineers in these projects largely came after the engineering generation, taking up the field's mantle in a position of advanced foreign policy status thanks to the work of their predecessors.

Delbert Byg typified the next generation of American engineers. Like Gifford and Killalee, Byg found himself inadvertently flung into the world of development work. Born in 1921 to a humble immigrant farming family in South Dakota, Byg broke with his surroundings by attending college. He earned his agricultural engineering degree from Iowa State College in 1947, before becoming a professor of agricultural engineering at The Ohio State University.[680] Iowa State became the first college to award a degree in agricultural engineering back in 1910, establishing a model used to create other similar degree programs in many Midwestern colleges in subsequent years. In the early years, the Iowa State program became so important to the agricultural field, that it attracted students from as far as California and Massachusetts to the

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[679] "Women Engineers Organize," *Engineering News-Record*, April 28, 1949, 38.
[680] U.S. Bureau of the Census. *Fifteenth Census of the United States, 1930*, Washington, D.C.: National Archives and Records Administration, *Hartford, Minnehaha, South Dakota*; Roll: *2228*; Page: *2B*; Enumeration District:*0014*; Image: *886.0*; FHL microfilm: *2341962*.

expansive fields of Ames to take degrees.[681] These programs became the training ground for future engineers who pioneered patents in energy measurement and labor-saving implements for modern farms over the first half of the 1900s. Americans, then, became some of the foremost experts in combining principles of engineering into farm operations.

As Point Four took off decades later, so did the knowledge sharing of these agricultural experts. Building on the foundations laid by the engineering generation, Byg caught the second wave of development work as an advisor to a new and expansive program connecting experts like him to agricultural colleges in India in the middle of the 1950s. Agricultural missions were nothing new to American development programmers. Perhaps more than any single type of technical assistance, agricultural aid programs had operated for decades intermittently before Truman's policies institutionalized that type of work for the long term. In the 1950s, American policymakers implemented a number of agricultural programs that sought to institute changes on bigger scales than simply teaching new fertilizing and harvesting methods.

Newly-independent India served as an increasingly common target for American development policy. Due to its enormous (and largely poor) population, India stood as a potential threat to stability in South Asia. In 1952, Point Four's Technical Assistance Program in agriculture began in India, which established working relationships between American Land Grant colleges and Indian higher-learning institutions. American professors received assignment to work at these Indian colleges for years at a time in order to design courses to modernize the Indian agricultural education system. Americans proceeded to translate approaches to agriculture

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681 "Jay Brownlee Davidson," Biographical Dictionary of Iowa, http://uipress.lib.uiowa.edu/bdi/DetailsPage.aspx?id=88; Elizabeth Shaw, "History of Agricultural Engineering at The Ohio State University, 1873-1970," The Ohio State University, 1970, 5. https://library.osu.edu/find/collections/the-ohio-state-university-archives/; Ag Engineering Database, Iowa State University, http://www.abe.iastate.edu/abe100/files/2013/06/AgEngrGraduatesFinal.pdf, 1-14.

education from U.S. to India. Ohio State built its working relationships with the Punjab Agricultural University in Ludhiana and the University of Udaipur in Rajasthan.[682] Eventually, Kansas State, Tennessee, Penn State, Illinois, Missouri, and The Ohio State Universities all built relationships with Indian colleges under the Technical Cooperation Mission to India.

Byg came to India as one of many Ohio State professors from the OSU College of Agriculture and Home Economics contracted to work at these Indian colleges for extended periods. He would take repeat stays in India between the mid-1950s and the 1970s, with some visits lasting as long as four consecutive years.[683] During their assignments, agricultural professionals contributed their expertise in specializations as wide ranging as veterinary surgery and soil analysis. Agricultural engineering professors like Byg made up a part of that group of experts. In India, Byg did what engineers do best; he found and fixed problems. He analyzed the condition of both Indian farming methods, and agricultural instruction methods in place at Punjab and Udaipur in the hopes of reforming the schools for the better. Byg penned articles and reports on his work with titles like "Problems facing Indian Agriculture" for the Technical Cooperation Mission, in an effort to show how more engineering might improve the fortunes of Indian farmers.[684] Byg specifically looked into issues surrounding Indian cotton production and the labor-saving techniques and technology that would be of use there.[685] Like in Turkey, would-be Indian agricultural engineers had opportunities to study abroad in the U.S. at American colleges. Participants earned full, and often advanced, degrees at these American colleges. For those who hoped to work as academic agricultural engineers, Indians could enroll in courses like

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682 Kathleen M. Propp, *The Establishment of Agricultural Universities in India: a Case Study of the Role of USAID-U.S. University Technical Assistance,* (Urbana, Illinoi: University of llinois, 1968), 5-31.

684 National Dairy Research Institute, *Report: Karnal, India* , 1954, 41.

685 International Commission of Agricultural Engineering, IX CIGR Congress Papers, 1979; *Agricultural Mechanization in Asia* (Farm Machinery Industrial Research Corporation, 1979).

“Agricultural Organization and Administration" which focused on the administration and purposes of land grant colleges.[686]

Ohio State’s partnership program ended in the 1970s after nearly two decades of active cooperation. Predictably, the program’s terminal reports cited hesitation in withdrawing from the country. Officials noted that “traditional” Indian ways of operating colleges inhibited progress toward a more perfect type of Indian agricultural college. The reports cited continued deficiencies in number of areas regarding agricultural college operations, but pointed to Indian culture as a main cause. Furthermore, the report suggested that the Indian colleges maintain relationships with American institutions after the program’s termination, echoing the hesitance to disengage fully from the project in the Turkish roads program.[687] Until a more precisely American type of educational system could be implemented, American officials seemed to think that Indian schools would fall short of their potential. Even after nearly twenty years of assistance, the educational ideal in India still lay just out of reach.

Engineering under Truman and Eisenhower

Byg’s India adventure provides a clear example of the unorthodox ways the government deployed engineers in foreign policy after the engineering generation. As a continuation of earlier relationships between the government and technicians, the India project proves that this relationship remained after Eisenhower left office, and arguably grew stronger. Engineers did not forge their place in foreign policy on their own. A connection emerged between engineering

[686] United States Agency for International Development (USAID), “Terminal Report, USAID Contract/Nesa-148, November 1, 1964 to September, 30 1972,” undated, 64; Shaw, “History of Agricultural Engineering at The Ohio State University, 1873-1970,” 37.
[687] USAID, “Terminal Report,” 67.

and American policymakers, a mutually reinforcing alliance that grew throughout the twentieth century. Policymakers identified engineers as a specialized group who, when integrated into American foreign policy, could extend American reach far further than ever before through development programs and defense measures. The ends may have been about American security interests, but the means were as visible as new military installations, and innocuous as new agricultural education programs.

Engineers appeared all over American postwar foreign policy, becoming a central component to policymaking for the duration of the Cold War. Engineering helped secure American security goals, a reality that brought both Truman and Eisenhower to keep engineers close to the state administration. In the process, engineering *became* foreign policy, a notion that has reiterated itself many times over during the past seven decades. The U.S. government used engineers of all shades: service academy-educated military men, Bureau of Public Roads staff, private contractors, and NASA technicians. Through these groups, policymakers used engineers to fulfill broader international goals, which deeply affected how technicians viewed themselves.

American society valued engineers before the engineering generation came of age, but the Cold War gradually switched that value from awe and wonder to necessity. Technicians internalized their growing partnership with the government over the twentieth century, becoming conscious of their value in waging Cold War as policymakers passed legislation to support engineering and science as a geopolitical expedient. When earlier national crises emerged, technicians called for greater roles in public policymaking to alleviate the effects of those crises. By the end of the 1950s, technicians knew that national security challenges required their services, and that their field would receive more attention and funding because of it.

The foreign policy of Harry Truman first institutionalized engineering into a permanent part of American policymaking. He fed the rising status of American engineers, flinging them into places of importance in development, defense, and research programs. His legacy comes tied to the effects of his choices on the field of engineering, along with the broader global developments propelled by his vision. Truman biographer Robert H. Ferrell rightly claims that Truman development policy came as a pragmatic response to a global crisis. Given the challenge brought by global communism, "The country no longer could follow the wisdom of President George Washington and remain apart from the world, intervening only to change the wicked ways of Europe…"[688] Doubtless, Ferrell's claim rings true in evaluating Truman's thought process in turning the U.S.'s attention outward after the war. Truman deeply believed that America that had something important and useful to give the world, and he used U.S. foreign policy to express that sentiment.

Engineering became one of the useful concepts Truman shared with the world. Whether they were described through the language of defense as in the Truman Doctrine, or through Point Four's language of technical "know-how," engineers emerged in some form in many of Truman's major policy initiatives. His inauguration of American development policy through the Truman Doctrine brought together engineers from the JAMMAT and Army Corps of Engineers. The Marshall Plan and Point Four programs brought more engineers into U.S. foreign policy programs for even more purposes like agricultural education and dam building. At home, Truman brought about engineering-supporting programs like the National Science Foundation, not to mention the defense research programs that produced ballistic missiles and a nuclear arsenal.

[688] Robert H. Ferrell, *Harry S. Truman and the Cold War Revisionists*, (Columbia, MO: University of Missouri Press, 2006), VIII.

Implementing these policies required certain conditions in the legislative and executive branches. Truman's disdain for the 80th Congress has been well documented, a sentiment best summed-up by his proclamation that the Republican-majority legislature was a "do-nothing" body filled with contrarian figures.[689] In retrospect, the 80th Congress proved to be Truman's key partner in activating what would remain the most long-lasting foreign policy act of his administration, and along with the atomic bomb, likely the most legacy defining. A number of engineers populated Congress who steadfastly supported aid programs and their positivist mission to use technology to solve big global problems. Dean Acheson once testified that the 80th Congress represented the, "Best congress in foreign policy we ever had."[690] Right or not, Truman's policies and their congressional supporters more tightly wedded engineering to broader American security goals in the late 1940s and early 1950s.

Eisenhower continued this trend throughout his terms in office. His support of development programming continually enabled engineers to apply their mentalities to large-scale foreign projects like Turkish road building, and more subtle projects like Indian university engineering education reforms. He expanded the available avenues for aid funding, and navigated diplomatic challenges as poor nations increasingly leveraged Soviet aid offers against those of the U.S. Eisenhower consulted engineers through councils like the Technical Capabilities Panel, which helped guide the president's decisions on Cold War policy. He enacted legislation to prioritize engineering as a matter of American security, providing college engineering students with scholarships through the National Defense Education Act. His signing of the National Aeronautics and Space Act of 1958 then exploded engineering research in the U.S. far beyond anything the field had seen from the government before.

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689 David McCullough, *Truman*, (New York: Simon & Schuster, 1993), 842.
690 Oral History Interview with Dean Acheson June 30, 1971, Truman Presidential Library, https://www.trumanlibrary.org/oralhist/acheson.htm#transcript, 13.

The changes made to American engineering policy through both administrations endured long after they left office. Perhaps the greatest testament to Truman and Eisenhower's endurance in today's foreign policy is that, even decades after the fall of the Iron Curtain, their Cold War foreign policy initiatives remain alive and well today. Development constitutes a significant part of America's reach in the world. After several bureaucratic name transitions, American development agencies experienced their final name change when the International Cooperation Administration reformed into a standalone agency, adopting the title "United States Agency for International Development" (USAID) in 1961. The purposes of the organization have remained as conveniently vague and broad as they were in Truman and Eisenhower's day. The notion of "technical assistance" under USAID has since come to mean anything and everything related to education, agriculture, transportation, human rights, and of course, engineering, in poor parts of the world. The reach of this development impulse stretches far beyond USAID. Non-Governmental Organizations, the United Nations, religious institutions, and even college spring breakers have come into the development fold as bringers of some kind of improving change to poor countries. Technicians continue to pursue both the ideals of their profession and American security interests by working on development aid projects, fulfilling their problem-solving impulse while also serving the greater good.

The well-known endurance of nuclear power and the massive delivery devices developed under Truman and Eisenhower need only minor elaboration here. Military and civilian contracting engineers continue to innovate with defense technology in the post-Cold War era at a feverish pace. The wider context of the Cold War taught American policymakers that, regardless of the enemy, huge investments in technology research and development have become a necessary part of annual budget discussions. The place occupied by NASA since the end of the

Cold War has changed, but the agency continues to exist partly as a cooperative arm to engage with foreign governments, and to conduct engineering and scientific research projects.

American engineering education still contends with the environment created by the Truman and Eisenhower administrations. The heavier emphasis on science and technology in American schools in the 1950s came about as a response to concerns with the nation's engineering manpower supply relative to the USSR. That emphasis never truly faded; American schools and universities still emphasize these subjects as a matter of national interest, most recently through programs bearing the STEM acronym (Science, Technology, Engineering, and Mathematics). Engineers still enjoy greater federal research funding than every other subject area but medicine. According to the American Academy of Arts and Sciences, funding for the humanities in 2012 amounted to 0.55% of the allocation dedicated to engineering research and development.[691]

The spread of engineering into so many phases of American policymaking proved what engineers had already realized about their profession for years. Technology brought change into the world, fixed problems, and improved life. But, engineers did more than fix problems; they found them to begin with. In the context of the Turkish roads project, engineers identified the deficiencies that inhibited a modern transportation system from functioning. They found the design flaws that limited the range of space-bound rocketry, and the instructional deficiencies that kept Indian college agricultural engineering programs from modernizing. In each context, the problems identified by engineers could only be fixed with more engineering, a process that created a cycle that sustained the status and centrality of engineering in American policymaking. In this way, just as engineers enabled American Cold War policymaking, the U.S. government enabled and supported engineers' triumphalist attitudes toward their craft.

[691] "The State of the Humanities: Funding 2014,"National Academy of Arts & Sciences, humanitiesindicators.org, 4.

Evaluating Engineers

Although technicians' effects on foreign policy remain visible through NASA, defense research, and myriad other endeavors, development programs provide a wide-ranging set of examples through which to evaluate the broader implications of deploying expert engineers to fix problems in poor parts of the world. Development has received scholarly attention through critiques and historical analyses that unveil more about the implications of deploying engineers to fix problems around the world.

Diplomatic historian Michael Latham has emerged as one of the leading historians of American development and foreign policy, His book, *The Right Kind of Revolution,* directly connects the larger Western impulse for "improvement" to postwar American foreign policy. The shift under Truman from isolationism to permanent internationalism, gave way to tweaks to that international engagement through Eisenhower, and, later, John F. Kennedy. Under Kennedy, Latham points out that American development took a distinctly liberal turn toward modernization theory laid out by social scientist Walt Rostow. Modernization imposed certain replicable and systematic structures on societies that emphasized democratic governance and market economies, in order to transition states from a problematic "traditional" to stable "modern" existence. Traditional societies operated within political and economic systems that supposedly inhibited their advancement. As a result, the Kennedy administration viewed those traditional systems as a problem to be solved through modernizing policies.

However, the deployment of modernization in poor countries did not produce the results Washington policymakers expected. Local populations and leadership contested and reformed modernization theory to fit their needs, emphasizing a flexible notion of modernity that

Americans understood rigidly. These policies produced unintended consequences in places like Ghana, where American loans for dam building were followed by an ideological "left turn" at the top of Ghanaian leadership. Rather than opening the country to greater market exposure, Ghana's officials imposed statist economic controls. Instead of peaceful and democratic transitions of power, a military junta ultimately removed Ghanaian Prime Minister Kwame Nkumrah from power via coup in 1966. Latham shows that modernization seemed to struggle in transitioning poor nations into the modern category.[692]

Development projects of all types seemed to trigger unforeseen consequences. Nick Cullather argues as much in *The Hungry World*, in which American policymakers pursue a solution to global hunger. The problem of hunger emerged in policy discussions because of its potential to cause disaffected populations to rise up in revolution, thus bringing about the dreaded destabilization that haunted American policymakers. Americans attempted to share advanced crop technology to raise crop yields in poor and highly populated places like India. The Green Revolution, and its associated efforts to raise crop yields, challenged traditional ways locals grew and ate food. Instead of solving the grain shortages there, the Green Revolution added new emphasis on American imports that formed a more dependent relationship between the U.S. and India.[693] In the end, India may have fended off communism, but they did not inherit greater prosperity or economic stability.

Similar trends emerged in the execution of Point Four programming in Ethiopia. As explained by Amanda McVety in *Enlightened Aid*, Point Four brought a variety of "modern" concepts to the East African nation that did not always end as American officials hoped. McVety describes how numerous efforts to reform Ethiopian agriculture and raise its economic viability

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[692] Latham, 83-89
[693] Cullather, 145, 172-180.

to outside capital investment fell flat, inhibited by Emperor Haile Selassie's prioritization of military expenditures and self-preservation. Like in Turkey, when Americans balked at activating aid renewals to Ethiopia, Selassie threatened to shop Soviet aid offers as a form of Cold War leveraging. Despite the long investment into a variety of Ethiopian programs, Ethiopia did not emerge from Point Four as a first world society, but rather a more authoritarian one.[694]

The criticisms levied by diplomatic historians toward American development programs resemble those shared by the bulk of development studies scholars who analyze present-day development enterprises. Taking the critique a bit further, development scholars have expressed the bolder claim that American and Western development interventions have replicated colonial inequalities around the world. As a result, scholars in the field generally agree that the work of mainstream development programs, like the U.N.'s Millennium Development Goals, have failed.

The most critical of development scholars has been William Easterly, an economist noted for his skeptical views on mainstream global development. Like many commentators, Easterly ropes engineers into a bigger cadre of experts and political leaders who have done little to alleviate issues tied to poverty since such programing began after World War II. One of his arguments in his recent book, *The Tyranny of Experts,* places technocrats at the center of the discussion about the issues that keep development from working on a bigger scale. "The conventional approach to economic development, to making poor countries rich, is based on a technocratic illusion: the belief that poverty is a purely technical problem amenable to such technical solutions as fertilizers, antibiotics, or nutritional supplements."[695] As Easterly states, the zeitgeist of "non-ideological evidence-based policies" is only the most recent manifestation of

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694 McVety, 140-151.
695 William Easterly, *The Tyranny of Experts: Economists, Dictators, and the Forgotten Rights of the Poor* (New York: Basic Books, 2014), 6.

using objectivity to veil broader complications that development projects inevitably produce in the Third World.

Easterly's assessment of development's effects seems correct- technical problems (the wheelhouse of development engineers) convey greater power to rulers in charge, regardless of the violations to individual freedoms that result simply because they practice an 'objective' craft. Engineers enable this sort of critique. Technology, as engineers understand it, is an objective way to fix problems that provides for, rather than detracts from, human advancement. To question development like Easterly does is to question the core of technology and engineering, and their role in the world

Common across these texts is the acknowledgement that at the root of development programs sits the conceptualization and identification of the "problem." That process, itself fraught with complication, has come to be fulfilled by special expertise in some form. Analyzing expert construction of the "problem" alone is nothing new. For example, Timothy Mitchell argued that expert cadastral surveys in Egypt reproduced British colonial control over the country by identifying ways to reform the tax system to extract more from landholders, and exert legal power over the domain.[696] In this construction, experts legitimately understand their roles as supporting features for colonial rule, and they consciously contribute to replicating the exertion of that rule in those places. In fact, a number of other scholars have adopted this construction in arguing that development has failed to improve the lives of its targets, while making conditions worse in many cases in order to prop up ruling groups.

Yet, responses to the construction of the consciously complicit expert have recently emerged. Historian Nicholas Danforth suggests that American experts discussed development publically in the same ways they discussed it privately. The rhetoric of improvement that

[696] Mitchell, *Rule of Experts,* 55, 84.

undergirded American development overtly in speeches and press releases resembled almost precisely how experts discussed it behind closed doors. When policymakers, economists, or other experts publically claimed that aid would bring uplift to poor countries, their words largely reflected a real belief in improvement rather than simple lip service. A different picture of expertise thus emerges when the expert actually believes that their work brings betterment of those it meant to serve.[697]

As one distinct type of expert, American engineers also seemed to "practice what they preached," consistently using their mentalities to improve conditions in whatever context they found themselves. In their professional discussions, engineers never wavered from their faith in technology to bring good, even as evidence of economic, political, and social instability in target nations mounted through the 1950s. Any such problems could be overcome with better or differently-applied engineering. Engineers like Killalee and Gifford in Turkey did not question their positions in the Republic and the broader development enterprise, or wonder why they were needed in the first place. Their positivist belief in their craft melded thought with practice, and when problems needed solving in Turkey, they naturally filed a gap. Problems needed solutions, and the geographic, cultural, or political contexts of those problems mattered less than the engineers' drive to provide fixes as they knew how.

Within this framework as true believers in technology, engineers did not simply serve as servants of the U.S. government. Certainly, engineers' development of new technologies served the American government's ends, and their patriotism and duty to country played a role in their initial willingness to embark on development work. Engineers knew that their work would further U.S. policy aims, but technicians still labored with an internal motivation to fix problems

[697] Nicholas Danforth, "Malleable Modernity: Rethinking the Role of Ideology in American Policy, Aid Programs, and Propaganda in Fifties' Turkey," *Diplomatic History* 39, no. 3 (June 1, 2015): 477–503, 491.

and serve the greater good. For many technicians, technology provided enough substance and purpose to serve as an end in itself, even when embarking on large-scale development projects abroad. Because of that internal, personal motivation, engineers cannot be viewed as cogs in an American policy machine, but rather a distinct body of professionals whose skills and mindsets proved to be useful allies for furthering state interests. If they served any single master, then, engineers were as likely in their minds to serve the greater good through technology as the American government.

However, given how they interpret and internalize their craft, engineers have become as critical of themselves in development as development scholars. As this text has attempted to show, engineers proffer their skills as beneficial for the greater good, but they have also found themselves to blame for national and international crises. With regard to development, engineers remain engaged and conscious of their roles in the process even today.

Engineers Dean Niesuma of RPI and Virginia Polytechnic Institute's and State University's Donna Riley recently penned an article in the journal *Engineering Studies* outlining shortcomings of 'engineering for development' (a catch-all phrase for programs that support engineering specific projects in the Third World). Echoing the findings of development historians like Cullather and Latham, Niesuma and Riley found that certain institutions and NGOs known for sponsoring engineering-specific development programming, such as Engineers Without Borders, fail to grapple with the full contexts of their environments as problem solvers, and often ignore issues relating to 'social justice' on local jobsites. Furthermore, engineers seem to "over-attend" to the technology being implemented in development programs, which causes a sort of technological myopia to wider effects of the technology on a new population.

But, like engineers of yesteryear, Niesuma and Riley prescribe an all-too-familiar formula to remedy these programs' shortcomings. They argue that a differently-implemented engineering, rather than a wholesale reduction of technology, could provide the correct balance needed to bring development projects to successful conclusions. The authors suggest that engineers embed themselves with other non-technical experts to cross disciplines, and reduce the negative effects siloed technology-focused projects produce.[698]

As engineering has blossomed into a ubiquitous force for good in modern society, engineers have often been among the first critics of their craft and its contribution to humanity. Just as engineers were quick to criticize their perceived contributions to crises like the Great Depression, they always found solutions in a different or altered type of engineering rather than a reduction of it. Niesuma and Riley's argument reveals only the most recent manifestation of the technician's tendency toward self-criticism regarding engineering and development, but will likely not be the last.

In today's hyper-specialized engineering world, generalizing for the entire field becomes a greater challenge than ever before. Still, similarities connect the engineering generation to technicians today. Problem finding, problem solving, and technological application remain constant driving themes in the field, binding the mentalities of that era's Pat Giffords with today's nuclear and biomedical engineers. That problem-finding impulse has pervaded development work at large, and come to sustain the enterprise that so many commentators have panned. Their influence in development appears throughout the development apparatus: in the modern harnessing of nature in projects like dam building; the application of technology, such as in the use of new seed varieties for crop yields; and the problem-seeking and problem-finding

[698] Dean Nieusma and Donna Riley, "Designs on Development: Engineering, Globalization, and Social Justice," *Engineering Studies* 2, no. 1 (April 1, 2010): 29–59

impulse that drives so many individuals and organizations to development work in the first place. In light of these trends, it seems that even when engineers are not directly involved with a development project, their mentalities created a framework through which development projects are understood.

Technology and Foreign Policy

Development provides one lens through which to understand how engineering pervaded U.S. foreign policy in the Cold War. However useful, that lens does not tell the whole story of engineering in foreign policy. This thesis attempted to corral their vast endeavors into a cohesive narrative, all to argue that engineering matters in foreign policy. However, engineering for foreign policy starts with the individual expert who, when conditioned over the course of their childhood and education, applied specific knowledge sets to a variety of contexts important for policymaking.

Technology's central role in American foreign policy history has become unarguable. Foreign policy historians like Walter Lefeber, Michael Hogan, and John Lewis Gaddis have always acknowledged the significant role technology played in the Cold War. The bigger story of the origins and early prosecution of the Cold War always brought with it discussions of ballistic missiles and atomic power as contributors to geopolitical competition with the Soviet Union. With the development of high tech weaponry, nuclear technology, radar, and surveillance equipment, America's relationship with the rest of the world changed in the twentieth century due to engineering. High-tech arms sharing agreements through NATO brought smaller nations into permanent alliances with the U.S., while the notion of a long-range "missile gap" gave rise to new tensions with the USSR. NASA's developments contributed new competitive energy with

the Soviets through the space race, all while utilizing engineers at a variety of research and development levels. International development programming brought an altogether different set of technologies to bear on all sorts of problems in poor countries, which also changed relationships between the U.S. and aid receiving nations.

Even with the vast scholarly attention to the early Cold War, the individuals behind these technological innovations have often remained anonymous. This project has attempted to identify the individuals behind those innovations, and to explain how they think, and why they ended up playing role in U.S. foreign policy. Most importantly, the project has attempted to show how Truman and Eisenhower deployed engineering to prosecute the early Cold War, and how those policies endured beyond their administrations.

For American engineers, the postwar era stands as the most significant turning point in the field's modern history. Partnerships with the government expanded the roles of engineers in furthering state policy aims, which produced new funding and employment opportunities that technicians continue to enjoy today. The engineering generation became the first group to experience that shifting relationship. Growing up, the engineering generation lived in a more insulated world than the one that greeted them during and after World War II. Their job options were less diverse, and their appearances as a part of American foreign policy more intermittent and unattached to larger global aims. The generation emerged out of a series of crises both authoritative in their expertise, and willing to share that knowledge in any context that might bring about a measure of improvement through service to the greater good. By the time they faded from view, the engineering generation found themselves in more places doing more diverse work than any of them could have foreseen as young men.

The next generation followed the same trails blazed by the engineering generation to places of foreign policy influence. Since Gifford, Killelee, and Bush played their roles in postwar foreign policy, thousands of technicians have contributed their expertise for governmental aims, a trend unlikely to end any time soon. Those individuals trace their lineage to the partnerships formed between engineers and the U.S. government under the Truman and Eisenhower administrations. U.S. foreign policy may have a fundamentally mixed record, partly enabled by the technological contributions of engineers. The rising tensions surrounding their defense innovations, and engineers' complicated deployment in development programming, produced myriad consequences for the U.S. and the global community at large during the twentieth century. Without a doubt, technology changed U.S. foreign policy in wide-ranging and significant ways.

Despite the mixed record of technology's effects on foreign policy, foreign policy served engineers very well. As a result, Truman and Eisenhower stand unequaled as the most important American presidents for engineers yet. Technicians who won NSF grants, earned government contracts to build heavy road graders, or participated in any number of other government-supported programs helped strengthen the engineering – state partnership. Like in Eisenhower and Truman's era, the positive feedback loop at work in that relationship still turns powerfully today. As engineers prove their indispensability for American policy aims, the government continues to support engineering as a national priority, which serves to build up engineers' self-important notions. The result has been a society still enamored with engineering's charms, honoring the engineering mentality as a powerful and objective change-agent with universal application. The path engineering took through the twentieth century elevated the field to

become the prototype for middle-class American professional achievement, and with the support of the federal government, it has unquestionably remained so.

A Dream Fulfilled?

As a part of their mentalities, engineers often revisited their roles in society, periodically rehashing old concerns that their field remained aloof of political and social events while they attended to their drafting boards. Whether in the context of economic boom in the 1920s, depression in the 1930s, global war, or Cold War geopolitical tension, engineers constantly clamored for greater engineering engagement with politics and policymaking. Philadelphia ASME member Morris L. Cooke wrote in September 1945, "In spite of the glamorous accomplishments of science, it is apparent that for the greater part of humanity we have the specter of dire and growing want in the midst of plenty. For fast-moving progress along a broad front, the active and comprehending co-operation of politicians is absolutely requisite. So if there is anything which engineers and scientists can do to woo and win the politicians, the doing of it will have tremendous social significance….Some common ground between the two areas must be found."[699]

As it turns out, the engineer's introspection remains one of the profession's most common traits, but one that has proven to perpetuate its own myopia. What seemed to engineers as a Sisyphean task of perpetually clamoring for political influence only to be ignored, actually resembled a dream being gradually realized at every juncture. Engineers and politicians found the common ground Cooke hoped for in national security and foreign policy, and built on it continuously well before (and well after) Cooke penned his *Mechanical Engineering* article.

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[699] Morris L. Cooke, "Science Knocks at the Door of American Politics," *Mechanical Engineering*, vol. 67, no. 9, Sept. 1945, 569

Engineers' angst about their place in American government, and their internalization of the roles they played, ignored the fact that the government actively pursued engineers consistently throughout the twentieth century. At the same time Cooke wrote, American engineers had just completed their service in World War II, and U.S. ballistic missile research programs were underway, programs that would balloon in size over the next decade. Truman and his advisers began contending with the postwar world, discussing war-torn economies and the role the U.S. would play in them.

Over the next decade and a half, the burgeoning partnership between the government and engineers tightened in precisely the ways engineers had clamored for during the previous four decades. And yet, commentaries like Cooke's continued to emerge well after the engineering generation left the scene. By the end of the Eisenhower administration, American engineers had achieved status, influence, and federal support in nearly every way possible for a single profession. As he prepared to leave office, Eisenhower famously warned of undue influence from the expensive "military-industrial complex," in his farewell address. But, more discreetly, he also warned his fellow Americans of the same potential coming from powerful technological expertise:

"Today the solitary inventor tinkering in his shop has been over shadowed by task forces of scientists…The prospect of domination of the nation's scholars by federal employment, project allocations, and the power of money is ever present, and is gravely to be regarded. Yet in holding scientific research and discovery in respect, as we should, we must also be alert to the equal and opposite danger that public policy could itself become the captive of a scientific and technological elite."[700]

[700] Final TV Talk, Eisenhower Library, DDE's Papers as President, Speech Series,; NAID #594599, Box 38.

The influence of engineers and scientists on public life, then, had become in the president's mind equal to that of the American military. Based on Eisenhower's dialogue, the days of engineers hoping in vain for a greater say in public policymaking would have seemed to most observers a distant memory. Still, engineers continued to plea for more influence as if they possessed none at all. In other words, over the course of the preceding six decades, American policymakers had obviously listened to engineers. But, had engineers been listening back?

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Epilogue

At the corner of Greenwood and Quarry Streets in Marion, Ohio lies an empty fenced-off field that extends for acres east. In that lot, the Huber Manufacturing Company once operated, its machines assembled piece-by-piece through its massive, but long-since demolished, twelve-building manufacturing center. Only a couple of long warehouse facilities lining the lot to the north stand as visible remnants of Huber's once-imposing footprint in the city's manufacturing center. Along the south end of the lot run two of the main freight railways in and out of the city. A rail spur once connected the Huber facilities in that field with the freight lines, which moved finished machinery out of the Huber factory, set for other distributors domestically, or the company's export office in New York City for foreign distribution. Upon arrival to their destinations, those machines reshaped the land, laid new infrastructure, and carried Turkey and many other countries into a new interconnected age. Today, no smokestacks remain in operation, no crates of finished goods flow out of the city, and no engineers flock to its drafting rooms. Things changed in Marion since Gifford's day, and not for the better.

Like in Gifford's day, rural landscapes surround Marion in all directions. The difference is that those fields are peppered with machines built by Case-International Harvester and John Deere, not Huber. Difficulties in Midwestern manufacturing were beginning to take hold of smaller firms by the late 1950s and 1960s, and many folded entirely in the 1970s. Unlike the often-cited forces of globalization that damaged American manufacturing in the automobile segment, by some accounts, Huber's decline was self-inflicted. The company remained a force in road building through the 1950s, but became too reliant on government contract work. The strength of Huber for generations had been its direct contact with its core consumer bases, the

farmers and construction workers that lived and worked in the region. Adjusting to buyers' desired improvements helped build and maintain loyalty to Huber machines, and form a product line that molded to fit customer needs. By 1960, Huber had become reliant on government contracts for sales volume. But, those contracts came with standards that became increasingly difficult to fulfill. They mandated that Huber source all of its parts from only certain suppliers, an added headache and profit-cutting measure that slowed the company's growth. Huber management's reliance on government contracts was meant to simplify the company's operations and provide a consistent revenue stream. Instead, it crippled the company from the inside. When management added in ill-advised acquisitions of smaller manufacturers, the world-renowned Huber name became a burdensome label.[701]

Huber finally failed in the 1970s after years of financial struggle, its assets sold off to a South Carolina firm leaving its once-thriving facilities empty.[702] The city's other large manufacturers also faded in the second half of the century. The Marion Power Shovel produced notable machinery through the 1980s, including NASA's space-shuttle crawler in Cape Canaveral. At the time the company was purchased by Dresser Industries in 1977, Marion Power Shovel still stood as the second-largest dragline shovel maker in the country, but its product offerings decreased, and the company slowly shrank its operations until completely folding in the 1990s.[703]

The cruel irony is that while Marion and Midwestern towns like it provided the world with the tools of technological advancement, they themselves became more susceptible to economic regression. Just as the dominant narrative of the Midwestern rust belt goes, the 1960s

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[701] Don Keil, Notes on Huber, Huber Machinery Museum.
[702] Incidentally, the Huber name and logo have been co-opted by another company currently using them for other products; The Huber Manufacturing Company, *The Huber Story 1863-1948*, p. 6
[703] Keith Haddock, *Extreme Mining Machine: stripping shovels and walking draglines*,(MBI: 2001), 122

and 70s damaged manufacturing in the region, and Marion felt its effects almost as badly as Detroit. When companies like Huber failed, the cities that housed them failed as well. Consequently, Marion is a shell today of what it once was. The birthplace of a president and one of Ohio's most robust small town economies, now possesses more problems than assets. There are fewer than 37,000 people there today, a number that reflects a decline since the 1970s.[704] In the early 1960s, the city had only 2 percent unemployment, driven by a still-large manufacturing base. Now, Marion struggles with a devastating heroin problem and consistently lags behind statewide employment rates.[705] The manufacturing that still exists in the city is minimal, and mainly limited to finished consumer goods.[706]

Discussions among locals and those who know Marion's vibrant past, often fall back on a common tragic and regretful metanarrative when describing their town. They reflect on a city once poised to grow boundlessly, its people and products bringing good into the world in the process. The home of a President, a Miss America, and a U.S. Treasurer, stood positioned to remain a bustling and important hub for Ohio's movers and shakers. Instead, Marion has been reduced to bylines about illicit drugs and abandoned buildings. The onetime potential of one of the Midwest's most active manufacturing hubs has been a total loss.

The tragic metanarrative applies directly to defunct Marion machinery firms as well. Huber's decline brought with it a host of regretful stories about what Huber could have become had certain events played out differently. Gifford himself often expressed regret that Huber's administration did not exercise more fiscal responsibility in the 1960s and 1970s. He felt that

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[704] 1970 Census of Population- Characteristics of the Population vol 1, part 37, Ohio section 1 , April 1973, US Dept. f Commerce, P. 37-36; 2010 census of Population and Housing, Ohio: 2010, Dept. of Commerce, October 2012, p44

[705] Bureau of Labor Statistics, Labor Force Data by County, Annual Averages 2010-2015, online database.

[706] "Earl Rinehard, "Kingpin arrested in Marion Heroin Bust," *Columbus Dispatch*, June 11, 2015; Jim Woods & Henri Gendreau, "11 Arrested as Fentanyl-laced heroin takes Heacy Tooll iun Marion County," May 29, 2015; Bobby D. Gibson, "Marion: Back to the Past?," *Ohio Business*, June 1, 1987.

Huber management, whose ranks Gifford adamantly refused to join when given the chance, lacked the vision of an Edward Huber or Shanck Barlow who led the firm through the boom times of the 1920s and 1930s. To his mind, if Huber management made better financial decisions, and employed a more robust legal department to protect the company's patents, Huber "could have" become the Caterpillar of today.[707] Other Marion commentators claim similar sentiments toward the city's other once-prosperous firms like Marion Power Shovel, who had absorbed local competitors like Osgood Shovel decades earlier, but still fell victim to its own outside takeovers.[708]

The regret is understandable, made even more tragic because these firms once manufactured globally-recognized machines. Their machines' dissemination to all corners of the map in the twentieth century reflected as much on the towns that produced them as the companies themselves. Especially for those hamlets usually unnoticed by typical foreign policy or historical research, the deployment of heavy American manufactured goods meant that these smaller firms and towns appeared on the proverbial "map" for the first time, recognized now by operators thousands of miles away who would have otherwise never known them. As a result, new vendors opened in Turkey and other countries for American machines, and their nameplates became recognized by locals in their foreign locations. The nameplates of Huber machines, emblazoned with "Marion, Ohio" on them, brought the American Midwest to the world. The town of Marion was likely more recognizable in the middle of the twentieth century to an Anatolian Turk, Ethiopian, or Liberian, than most Americans. Most of those employed by a Huber or Marion Power Shovel would never travel beyond Ohio, yet their machines reached populations around the world. Engineers busy in unassuming shops in Bedford, Ohio or

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[707] Glenn Gifford, Huber History, p. 16August 31, 1997
[708] Paul Huber, "Caterpillar to Acquire Bucyrus International, *EHMA Newsletter,* vol 22, no 1, Jan. 2011

Oshkosh, Wisconsin likely had little knowledge of the final destination or purposes of their innovations, but played a key role in foreign development nonetheless. Those engineers unable to travel like Gifford still contributed significantly to those postwar development processes, suggesting remarkably long reach for small town laborers.

The legacy of Marion's engineering past is more visible in the places its products served than the city itself. Huber products remain sought-after restoration projects for machinery hobbyists, but few non-hobbyists know the places abroad Huber and its competitors touched. The tools of modernization Huber built left a tangible legacy in the roads, dams, and buildings they helped erect at home and abroad. The roads in Turkey have since been repaved and repaired since Gifford, Killalee, and the engineering generation began remaking Turkish highways, but most still exist according to the master plan map laid out in the late 1940s.

In the time since these Marion firms closed, nothing significant has come to replace them. The Marion economy did not reorganize itself to accommodate a service-based workforce or any other new type of industry. Instead, people there continue to lament the loss of what the town once was. The city's most involved and vibrant citizens are those who lived to see the old days pass by. They remain the only voices preserving the memory of Huber and of Harding and the countless others who contributed to the city's high water mark. Historian of the American Midwest, Andrew Cayton, once wrote about Ohio's past-focused perspective: "[Ohioans] spend more time celebrating the past than imagining the future. Where in the early nineteenth century many people came to Ohio because they wanted to experiment, most Ohioans in the early twenty-first century are content with enjoying-and defending-the achievements of their

predecessors."[709] Although such a blanket statement might not be easily applied to the entire state, for Marion, Ohio, fewer words have rung as true.

[709] Andrew Cayton, "'While We are in the World, We must Converse with the World': The Significance of Ohio in World History," in Geoffrey Parker, Richard Sisson, William Coil eds, *Ohio and the World*: (Columbus, OH:Ohio State University Press, 2005), 17.

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