

The Myths of Mars: Why We're Not There Yet, and How to Get There*

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- *The opinions in this paper are my own and do not reflect the views of NASA, the Jet Propulsion Laboratory, or the University of Oklahoma*

Myth / 'mith / n 2a: a popular belief or tradition that has grown up around something or someone; esp: one embodying the ideals and institutions of a society or segment of society.

Our Cherished Myths – Some Examples:

- 1. All it takes is guts and leadership:**
 - a. If a President would just declare ...**
 - b. If astronauts were willing to take risks ...**

Our Cherished Myths – Some Examples:

2. NASA knows best:

- a. Werner was right.**
- b. Apollo is the right model.**
- c. Only NASA and its contractors can do the job.**
- d. NASA is HEDS (Human Exploration and Development of Space).**

Our Cherished Myths – Some Examples:

3. If we tell the truth, it won't sell:

- a. The Shuttle**
- b. The Station**
- c. Mars Observer**
- d. The Synthesis Group**
- e. Mars Sample Return**

Our Cherished Myths – Some Examples:

- 4. Only astronauts are interesting: (e.g.)**
 - a. The Meatball eats all other NASA logos (except astronaut mission patches).**
 - b. NASA TV covers every minute of shuttle missions, even when nothing is happening.**

Our Cherished Myths – Some Examples:

5. Scientists know best.

- a. Alan Binder's House Science Subcommittee testimony – “just put an experienced PI in charge and all will be well.”**
- b. Scientists staff most leadership positions at Code S.**
- c. Sometimes science payload selection committees ignore engineering inputs (e.g., MO, Surveyor 2001).**

Our Cherished Myths – Some Examples:

6. Engineers know best.

- a. Reviews by armies of experienced engineers after a failure will solve the problems for the next mission.**
- b. “Just put an experienced engineer who has delivered flight hardware in charge and all will be well.”**

Our Cherished Myths – Some Examples:

- 7. We can't risk astronauts' lives.**
- 8. International participation saves money.**
 - a. Space Station**
 - b. Mars Sample Return**

Myths for the Future

What are some new paradigms / myths that might serve us better in formulating the future Mars exploration program?

New Myths: Some Examples

- 1. Tell the truth.**
 - a. About costs**
 - b. About capabilities**
 - c. About risk**

The Truth Myth 1: We keep our promises!

- **Like George Washington and the cherry tree -- about a project which did what it promised and didn't overrun.**
- **Engineers and managers who delivered (e.g. Tony Spear and Gene Kranz) are heroes.**
- **No “managing by fear”.**
- **No “buying in and getting well”.**

The Truth Myth 2: Margins are us!

- **Reserve 10% of integrated Mars Exploration Program for planning future missions.**
- **Reserve 10% for solving problems in the program's projects.**

The Truth Myth 3: The Mars Exploration Team!

- **Each element of the program is a fundamental part of the whole, not a separate fiefdom.**
- **Incentivize project managers to cooperate with other project managers.**
- **Seek synergy.**
- **Make payload selection process so payloads fit overall program strategy.**

2. Follow the money

- a. Mars jobs programs (a la Station), but don't overdo it.**
- b. Nurture commercial and international efforts, but don't oversell them.**
- c. Recycle International Space Station components.**

The Money Myth 1:

- **Find “heroes” who have made/may make money in space.**
- **Help media create Mars myths about them.**
- **Examples: John Carmack of Armadillo Aerospace or John Copple of Space Imaging.**

The Money Myth 2:

- **Promote Mars commercial partnerships and publicize them.**
- **Examples: Kennedy Space Center and Florida, NASA and Dreamtime (?), Oklahoma and Small Commercial Launch Companies, Takeoff Technologies and Frederick, Oklahoma.**

3. Keep it interesting

- a. Educate the customer (the public), then ask what it wants.**
- b. Do fun robotic missions.**
- c. Do more with MGS and Odyssey pictures of Mars.**
- d. Let other people play (e.g. University student payloads, space tourists, commercial launch companies).**
- e. Make NASA interesting again.**

The Open NASA Myth 1: NASA wants YOUR input!

- **A Customer Engagement Plan**
- **Deliberative Polling**
- **Student Input (e.g. “NASA Means Business”)**
- **Partnerships, Not Competition with Private Companies**

The Open NASA Myth 2: NASA wants YOUR participation!

- **A Mars Exploration USRA Center.**
- **Mars USRA Center partners with public and private organizations (e.g. Planetary Society, National Space Society, Mars Society, Oklahoma Space Industry Development Authority).**
- **X-prize style award for the first team demonstrating some key piece of technology for Mars exploration.**
- **Create Mars program office focused on public participation.**

The Open NASA Myth 3: NASA is the happening place!

- **Interesting NASA TV – Work with George Lucas?**
- **Help sell an “engineer” TV show like cop shows.**
- **Support companies like Takeoff Technologies.**
- **Scientists make results interesting (shades of Carl Sagan?) (e.g. Ken Edgett, Matt Golombek).**
- **Science research grants for “really cool” videos (for example) of analysis results.**
- **Really do comparative planetology (well, where DID all that water go and could that happen to us?).**

4. Be Flexible

- a. Set aside some budget for targets of opportunity.
- b. Take advantage of demonstrated new technology.
- c. Use a “decision tree” program strategy.

The Flexible Mars Program Myth 1: We adapt!

- **Budget for quick analysis of science and engineering data to revise program.**
- **Make room for private and student payloads.**

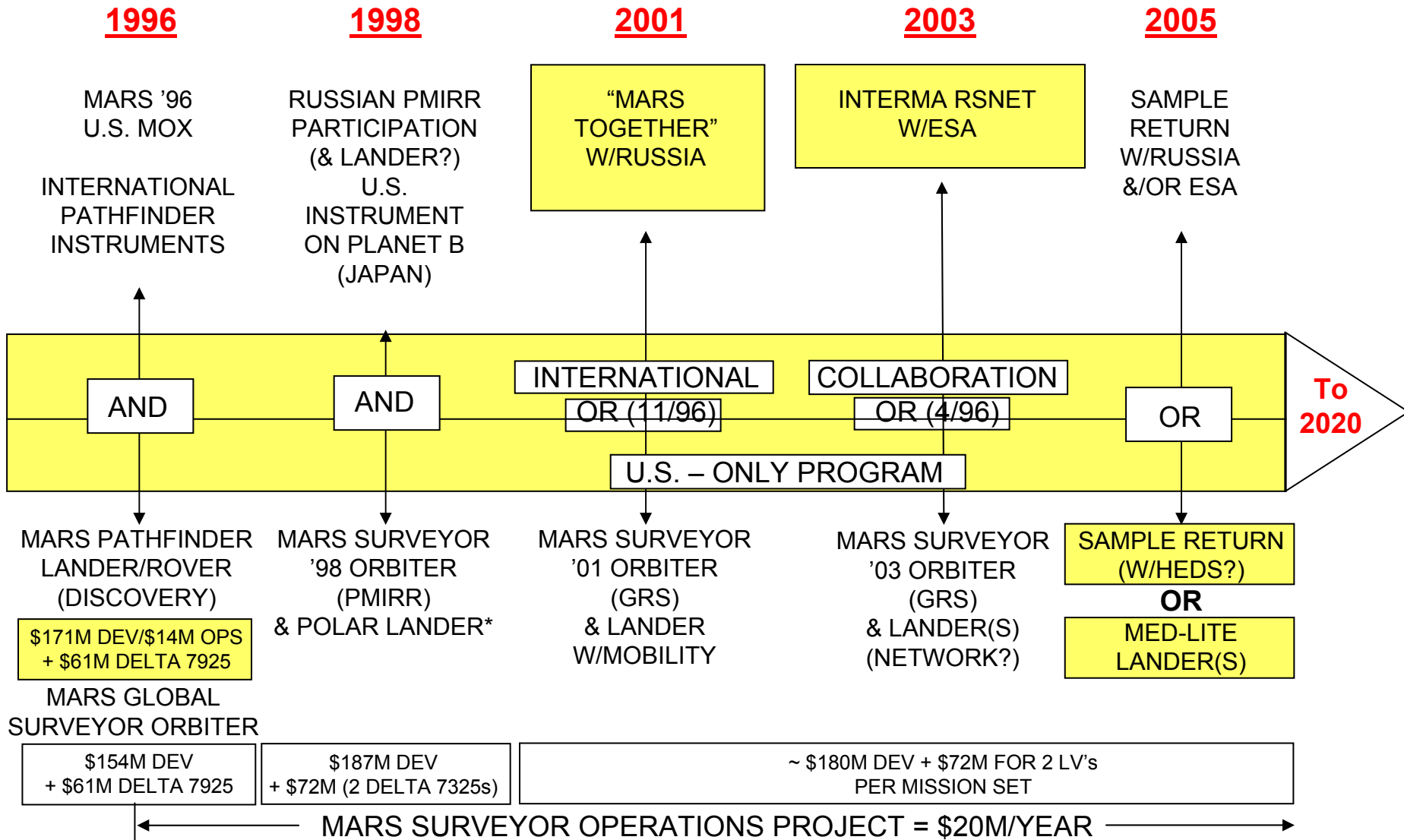
The Flexible Mars Program Myth 2: We are technology leaders!

- **Follow and use commercial technology.**
- **Have a dedicated Mars technology program.**
- **Have a dedicated Mars instrument program.**
- **Fly technology-enabled missions (e.g. Mars airplane deploying penetrators to test “water” deposits).**

The Flexible Mars Program Myth 3: We have a flexible Mars exploration strategy!

- **Develop and manage a decision-focused Mars program.**
- **Develop a process to make decisions rapidly.**
- **“Slow and steady wins the race.”**
- **“Better” in *Better, Faster, Cheaper* needs to refer to results of the program, not of each project.**

Mars Exploration Program Strategy



* POSSIBLY W/NEW MILLENNIUM MICRO LANDER

ALTERNATIVES

DLS 1/27/96

Settlement Strategy – Decision Tree

1996-98

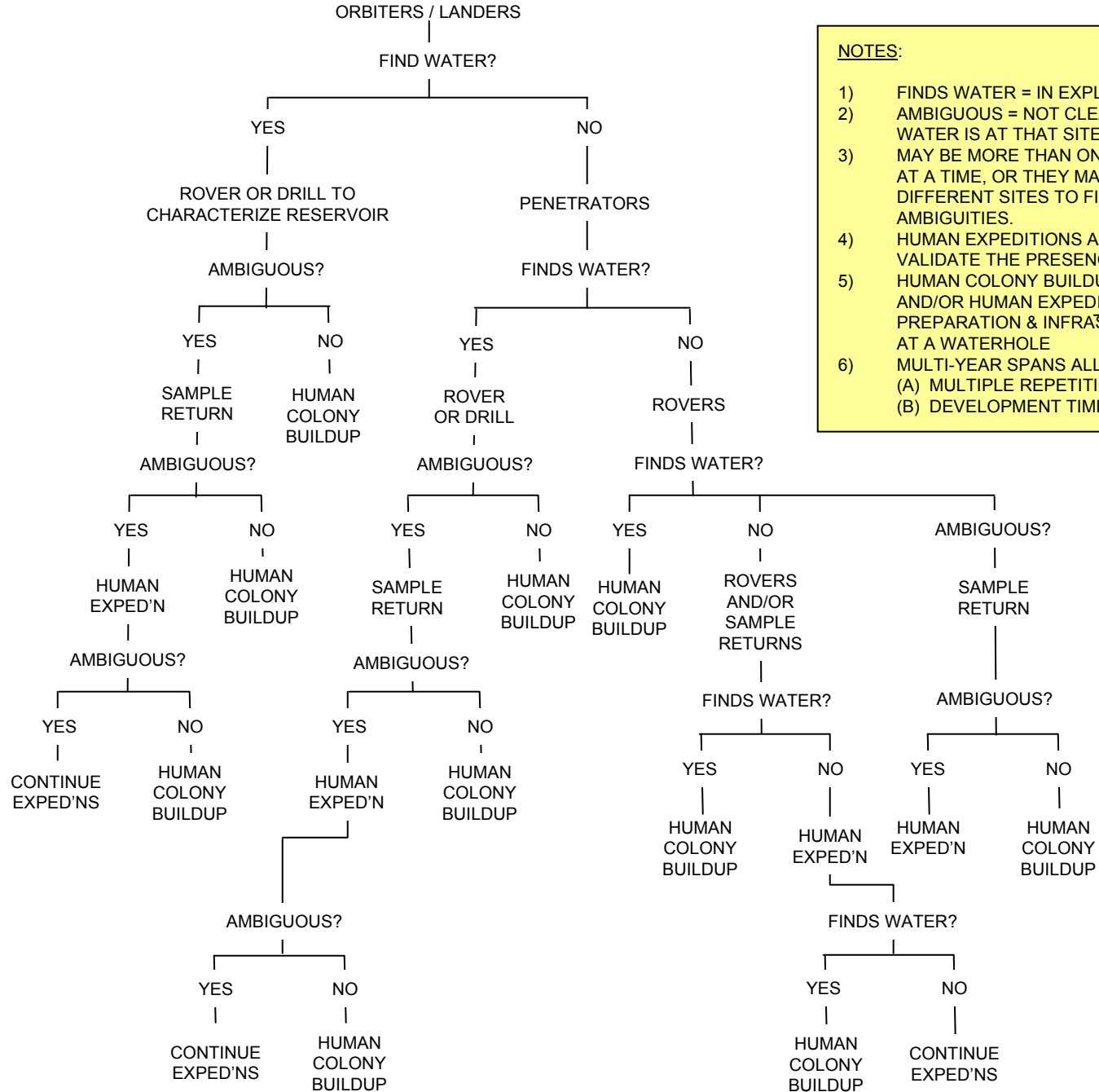
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2001-7

2003-13

2005-17

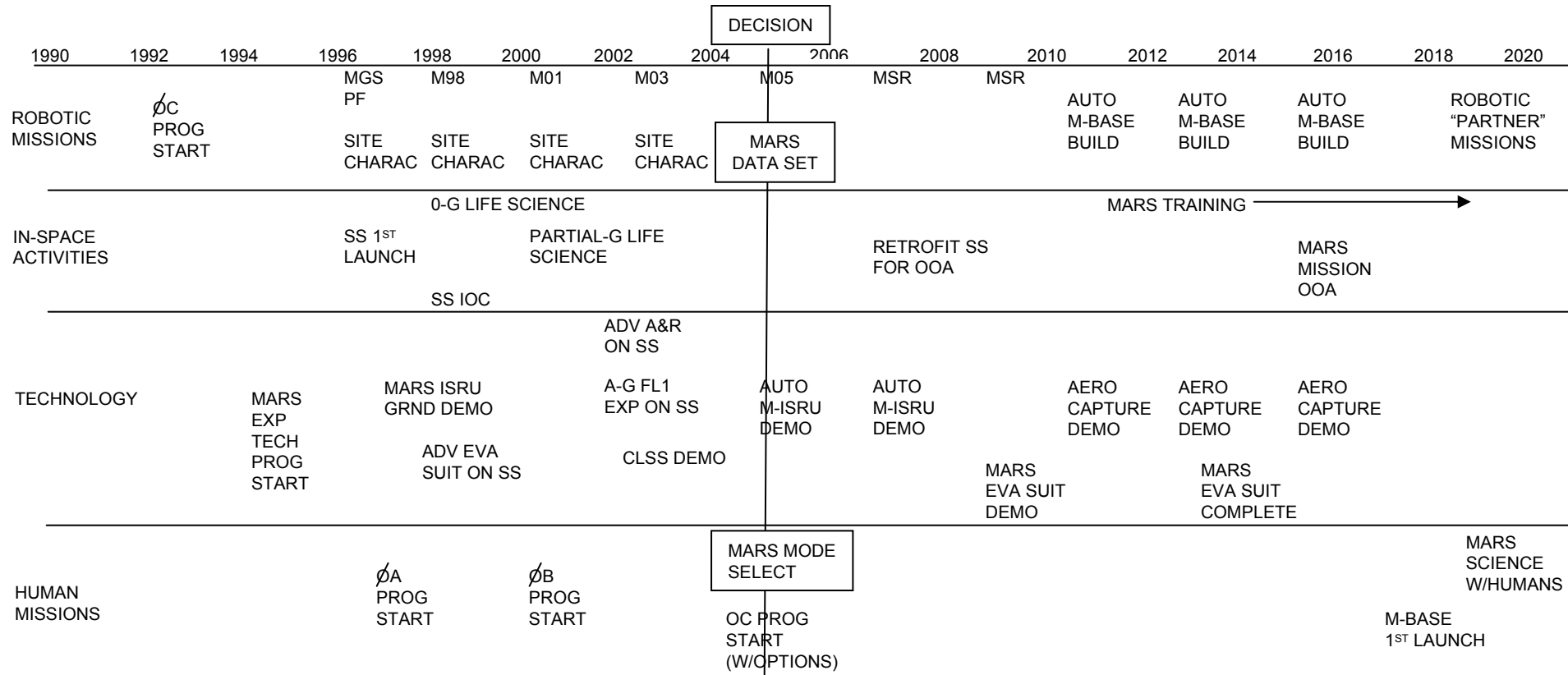
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NOTES:

- 1) FINDS WATER = IN EXPLOITABLE FORM
- 2) AMBIGUOUS = NOT CLEAR IF EXPLOITABLE WATER IS AT THAT SITE
- 3) MAY BE MORE THAN ONE OF EACH MISSION AT A TIME, OR THEY MAY BE REPEATED AT DIFFERENT SITES TO FIND WATER OR RESOLVE AMBIGUITIES.
- 4) HUMAN EXPEDITIONS ARE TO SEARCH FOR OR VALIDATE THE PRESENCE OF WATER
- 5) HUMAN COLONY BUILDUP INCLUDES ROBOTIC AND/OR HUMAN EXPEDITION MISSIONS FOR SITE PREPARATION & INFRASTRUCTURE EMPLACEMENT AT A WATERHOLE
- 6) MULTI-YEAR SPANS ALLOW FOR
 - (A) MULTIPLE REPETITIONS OF MISSIONS, AND
 - (B) DEVELOPMENT TIME FOR HUMAN MISSIONS

Human Settlement Program Schedule



MGS=MARS GLOBAL SURVEYOR
 PF=MARS PATHFINDER (DISCOVERY)
 LP=LUNAR PROSPECTOR (DISCOVERY)
 M98, M01, M03, M05 (SURVEYOR ORBITERS/LANDERS)
 MSR=MARS SAMPLE RETURN
 M-BASE=HUMAN MARS BASE

CLSS=CLOSED CYCLE LIFE SUPPORT SYSTEM
 ADV=ADVANCED
 ISRU=IN-SITU RESOURCE UTILIZATION
 A-G=ARTIFICIAL GRAVITY
 SS=SPACE STATION
 FL1 DEMO=FLIGHT DEMONSTRATION
 AUTO=AUTOMATED

Conclusions and Implications for Mars Architecture: *Robotic Missions*

Assuming a **\$300M per year** robotic mission budget.

The Truth Myth: Set aside ~ 25% of the Mars Program **budget** for:

- a) Thorough program and mission definition.
- b) Technology development, including instruments.
- c) Science/engineering analysis and synthesis for future program planning.

The Open NASA Myth: 5% of the Mars Program budget for:

- a) “Customer” deliberative polls.
- b) Non-NASA participation (education, private, interesting experiments).
- c) Public information (interesting!).

Leaves about \$200M per year for the projects, inc. launches =

- More than initial Mars Exploration program with Water strategy.
- One U.S. mission per opportunity – allows one Pathfinder or MGS.

The Flexible NASA Myth: 5% of the Mars Program budget for:

- a) Replanning and redesign in response to things learned, either from science, engineering, or economic/policy changes.
- b) Exercising options in the program “decision tree.”

Human Missions

- Human missions to Mars will depend on new myths about human exploration.
- Apply all new NASA myths to human elements of Mars Exploration Program.
- HEDS provide a budget for human exploration elements.

Human Missions

- Human elements must depend on:
 - (a) Space Station experiments for demonstrating partial-g issues, closed loop life support, etc.
 - (b) Space Station adaptations of habitats, radiation protection, etc. for Earth-Mars transit.
 - (c) A funding wedge (if any) from post-station construction to finance needed advancements from Low Earth Orbit to Mars.

Finale

- A Mars Exploration Program employing honesty, openness, flexibility, patience and hard-nosed management can get us (at least a steady stream of robots – and hopefully, eventually people) to Mars on a regular basis. Standing firmly by the old myths has been proven not to work.