S.C. Advanced Training Aircraft IAR 99 (A) SOIM

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Abstract: *The use of subsonic single control aircraft and especially of double–control ones, instead of supersonic combat aircraft in the military pilot training programs in the operational units, has become a necessity due to the economic and financial world-wide crisis which began during the 70's-80's, with the advent of the oil crisis, affecting many countries, which have their own Military Air Forces.*

Key Words: *subsonic single control aircraft, the flight cost, supersonic combat aircraft, advanced training version, general aerodynamics, flight dynamics*

1. INTRODUCERE

IAR 99 (A) - SOIM (SC), will be carried out according to a complex program, which is based on a new strategy of intensive use of subsonic training aircraft in the combat training of military pilots usually flying supersonic fighters. The program includes, inter alia, upgrading, re-motorization and conversion of the double control basic aircraft IAR 99 - SOIM, in a simple control advanced training version.

2. GENERAL CONSIDERATIONS

The (DC) basic aircraft IAR 99 - SOIM is a school, training and combat aircraft, designed within the Institute for Aerospace Research and Design of Bucharest, between 1974 to 1981, by a wide group of researchers and designers under the leadership of Program and Advanced Project Director, Fleet General Dipl. Eng. Aviator Ioan STEFANESCU.

The prototypes have been manufactured in the aviation companies of Aerospace Industry complex in Romania (IAR) during1981-1985, with Craiova Aircraft Company as integrative unit.

The first flight of the prototype (S.001) took place on 21.12.1985 at 15, 17 hours at the Flight Test Center of Craiova with Lieutenant Commander VAGNER STEFANEL as a pilot. The aircraft was designed and engineered in accordance with the aviation main international regulations, namely, English regulations A.Pv. 970, supplemented by some sections on the flight controls of the French AIR or the American MIL (for calculation of general aerodynamics, flight dynamics, etc.

The execution of the aircraft was based both on specific technological rules (German LN, French MP, Romanian NAR) and the existing internal ones within the main aviation companies which have contributed to the aircraft carrying on (AVIOANE Craiova, I.A.R Brasov, AEROSTAR Bacau, ROMAERO, AEROFINA and IMP Av. of Bucharest, INCAS prototyping workshops and others).

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The design technical solutions for the main board systems (engine installing, flight controls, hydraulics, fuel, landing gear, aerodynamic brakes, servos, etc.) were confirmed, based on functional and endurance tests performed in the Institute and on functional models, especially meant for this purpose, which took place over a period of approx. 4 years and totaled over 4 million flight hours equivalent cycles. Total operational resource of the aircraft was established in the Institute, based on static and endurance tests, performed on sets of structure, especially intended for this purpose, such as wing, above, center and rear fuselage, horizontal and vertical empennage, pressurized cabins, fuel tanks, etc.

The approval and flight certification of the aircraft was based on ground and flight tests carried on at the Flight Test Center of Craiova, in accordance with specific internal procedures and programs developed for this purpose by experts of INCAS Bucharest.

The aircraft was certified and homologated for flight in two versions, the school and training version in 1987 and the fight version in 1988.

After calculation of strength and after static and endurance tests, according to safety coefficients obtained, the designer has established an operating resource of 20 years or 3,000 flight hours or 30,000 landings, with possibility of extending this resource up to 50% of the initial established one. Therefore the total operating resource can be extended up to 30 years, in compliance with MIL regulation procedures (chapters referring to extension of aircraft operating resource).

The program for carrying out of SC subsonic training aircraft is mainly intended to the following purposes:

- Improving performance and flight characteristics, such as, for example, the rate of climb and the maximum speed in horizontal flight, the practical ceiling, the distance, duration and aircraft tactical range, reducing the taking off - landing distances, etc. (see Table I)

Table I - COMPARATIVE DATA OF IAR 99 -SOIM (DC) AND REMOTORIZED IAR 99(A)-SOIM (SC)

PERFORMANCES AND CHARACTERISTICS	**UNITS OF MEASUREMENT**	**IAR 99 – SOIM D.C.**	**IAR 99 (A) – SOIM S.C.**	**OBS.**
ENGINE		**RR VIPER 632 – 41**	**RR VIPER 680 – 43**	
THRUST	Lib / KN	4.000 Lib/ 18,14 KN	4.400 Lib/ 19,95 KN	
SPECIFIC COMPSUMPTION	Kilo-f_C/Kil-f_T/h	0,975	0,736	
WEIGHT	Kilo-f	374	379	
WEIGHTS				
EMPTY WEIGHT EQUIPPED	Kilo-f	3.220	3.200	
FUEL LOAD	Kilo-f	1.080	1.280-1.450	
CREW	Kilo-f	180	90	
MAXIMUM TAKEOFF WEIGHT	Kilo-f	4.480	4.570	
PERFORMANCES				
MAX SPEED (H=0)	km/h	850	895 – 900	
RATE OF CLIMB	m/s	32	33,73	
MIN. SUSTENTATION SPEED	km/h	200	208	
GLIDING LIMIT SPEED	km/h	266	273	
CEILING ALTUTUDE v_z = 2,5 m/s	m	12.900	13.700	
MAX FLIGHT DISTANCE	Km.	1.128	1.590	
MAX. FLIGHT TIME	hours/min	2h./42′	3h./48′	
MAX. RANGE	km	352	735	
MAX. TAKE-OFF RUN LENGTH(H=15m)	m	760	549	
MAX LANDING DISTANCE. (FROM H=15m)	m	934	522	

- Improving the attack and defense capacity of the aircraft by increasing the firepower and precision of the on board weapons,
- Increased ability to discover, track and destroy the air and ground targets, within specific subsonic speeds,
- Reducing the aircraft empty weight equipped up to the best values for this type of aircraft, (to fit in standard weight calculation),
- Reducing the cost price of the aircraft and implicitly of the flight hour,
- Reducing the financial burden on Military Air Force allocations to support the combat training programs of the military pilots,
- Increasing the number of SC subsonic training aircraft from the operational units and on this basis, increasing the number of flight hours, for the crew in these units.

To achieve these objectives, the followings are taken into consideration:

1. Aircraft re-motorization with a new engine with greater thrust and a lower specific fuel consumption, compared with current RR VIPER 632 – 41M engine which has a maximum thrust of 4,000 lbs. and a specific fuel consumption of 0975 Kilo-f C / Kilo-f T / h.; this requirement must take into account the low cost price principle.

For the transformation of DC into SC version, (re-motorized) to be made at the lowest possible costs, it is necessary that changes be minimal. This can be achieved only if instead of the current engine an engine of the same Rolls – Royce range will be installed, such as, for example, one of the RR engines VIPER 680-43 or RR. VIPER 632 - 46 with a thrust between 4400-4450 lbs. and a specific fuel consumption of about 0930 Kilo-f_C / Kilo-f_T / h.

2. Equipping new aircraft with the latest avionics, similar to that found on the supersonic combat aircraft.

During 2003 – 2008 a number of 8 aircraft DC IAR 99 - SOIM equipped with new avionics similar to that on the aircraft MIG - 21 LANCER was manufactured. The avionics is compatible with that existing on current generation supersonic combat aircraft.

3. Replacing the old equipment (from the 80's) of the main board systems with new equipment from the current generation, with features and superior performance, such as for example, higher resource in flight hours, smaller weights and size, better performance and technical specifications, simpler and more economic, operating conditions and repairs, etc.
4. Equipping the aircraft with an advanced radar system for detecting, tracking and destruction of the air and ground targets within the specific speed limit.
5. Improving the characteristics of the landing gear during the takeoff and landing roll by installing a hydraulic device for the nose wheel guidance on the front wheel strut.
6. Increasing the number of attachment points (of the warhead), from 5 to7, by placing launching beams for self-directed (air –to- air) missiles at the wing tips.

The type and characteristics of missiles (air –to- air) and the (air –to- ground), will be similar to the existing ones on supersonic combat aircraft in operational units.

7. Increasing the amount of internal and external fuel by multiplying the number of tanks.

The internal fuel will rise from 1,100 Kilo-f. to 1,450 Kilo-f and the external will increase from to 440 Kilo-f to 660 Kilo-f.

Currently, the modernized aircraft IAR 99 - SOIM (DC) have a new configuration comprising an instrument panel modularly equipped according to international standards supplemented by two side consoles as can be seen in Fig. 1.

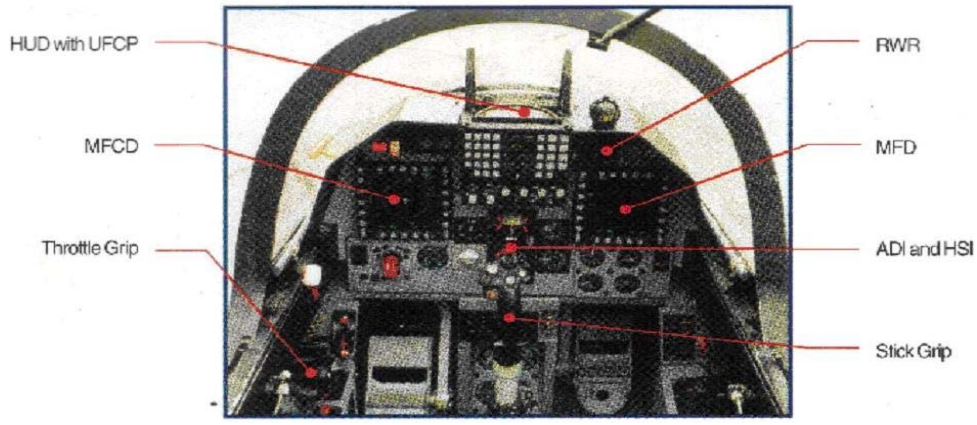

Fig. 1 CONFIGURATION OF THE INSTRUMENT PANEL OF THE SC AIRCRAFT IAR -99 (A) SOIM

The aircraft is equipped with modern navigation and flight control, weapons sights and firing control systems, radio transmission and reception, control systems of engine operation and other board systems and also has optical (visual) and sound warning systems, hydraulically assisted primary controls and unassisted auxiliary and secondary controls.

The cabin is equipped with an ejectable seat of V = 0, H = 0 type, is pressurized and has a modern air conditioning system supplemented with an anti-gravity system for the pilot. The aircraft is equipped with modern avionics of latest generation -type AWDNS (Advanced Weapon Delivery and Navigation System) integrated with a SCCM (Central System for Mission Control) Fig. 2.

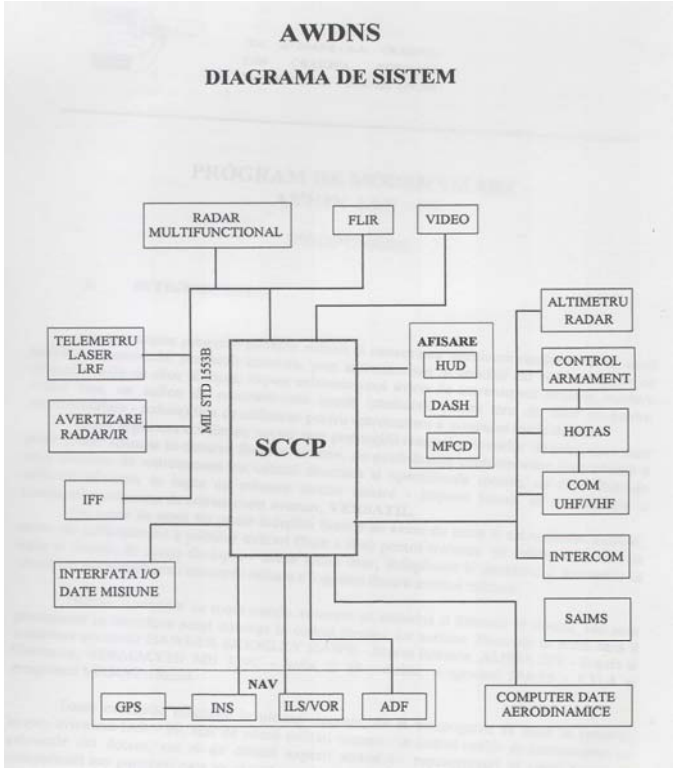

Fig. 2 CENTRAL SYSTEM FOR MISSION CONTROL

As it is equipped with the latest generation systems, in accordance with the requirements of an advanced training plane, the SC Aircraft IAR -99 (A) SOIM is modern within specific speed limit, with a high capacity for combat training of military pilots, similar to that offered by a supersonic jet fighter.

The aircraft equipment consists of:

- Modern high-precision navigation systems as:
  - INS (Inertial Navigation System) which is the main system and includes
    - the *GPS (Global Positioning System)* and the
    - *ILS / VOR, DME (Radio Navigation System).*
      Both systems have been integrated to an HNS system (High Navigation System) which is a modern navigation system.
- A communication system equipped with VHF / UHF radio stations, completed with modern aircraft intercommunication system with the aircraft from the formation.
- A display system of data and board information which consists of several subsystems, namely:
  - DASH (Display and Sight Helmet Control) which is a sighting, display and warning system placed on pilot helmet.
  - HUD (Head Up Display) a sighting, display and warning system, located within the pilot's visual field (in front of him).
  - MFCD (Multi-Functional Color Display) that displays information on navigation, pilotage, warning, projection of electronic maps related to tactical, combat and irradiation warning operations, the condition of the attached weapons and ammunition, defects simulation, etc.
- A pilot - aircraft interface system,
  - HOTAS (Hand on Throttle and Stick) system that reduces the pilot's effort according to the 'hands on stick and throttle" principle.
- Video board system that records images displayed on the HUD, in order to analyze the carried out missions.
- A flight data recorder SAIMS (height, speed, overload, position of controls, engine speed, time, command signals, etc.
- A system for scheduling tasks and ensuring interface for data transferring, including electronic maps.
- RADAR - IFF and IF detection and pilot alerting systems for lighting and passive RADAR/ IR countermeasure control.
- Additional analogue equipment for the engine control and fuel system, installations and onboard systems.
- Acoustic and visual indications for detection of critical or limit regimes.
- Modern protection and self-defense systems such as active radio-electronic jamming accompanied by -release and dispersion of false targets, anti-radar warning.
- Identification friend - enemy system and a radar irradiation system
- The aircraft will be also equipped with a RADAR system for detection, tracking and destruction of air and ground targets.

The board avionics provides the information system on air and ground targets and also the accurate aiming needed in launching self-directed or guided rockets (air- to- air) or (air - to- ground) or conventional cargo, such as bombs of various weights with explosive charge or other type, guided or unguided.

To this end, the pilot can select convenient operating mode because integrated avionics features a number of operating modes (MASTER) which offers optimal configurations for

flying, navigation, launching of combat load, failure modes, etc. For such missions, the aircraft has the ability to navigate in the tactic zone of attack, penetrating the enemy air defense system, while also ensuring security, both in terms of air and ground attack.

This feature recommends it as an advanced simple - command training aircraft competitive, both internally and externally, given the cost price of the aircraft compared to other planes, in the same category, such as ALPHA - JET, L - 159 ALCA, HAWK - 200 and others.

The journal TOP - GUN, in an article published in 2003, compares prices of IAR 99 - SOIM and of other competing aircraft mentioning that:

– The aircraft IAR 99 – SOIM is three times cheaper than the HAWK - 60, 2.5 times cheaper than a MIG - AT or 2 times cheaper than an aircraft ALPHA - JET and the examples could continue.

The necessity to approach a combined training and combat program of military pilots (already instructed), both with supersonic aircraft and subsonic aircraft is also supported by other specialists in the field, which promotes, in different occasions, the new training methodology.

Therefore the journal TOP - GUN, no. 47/2003 published an article widely addressing the new concept of pilot training under the drastic reduction of funds allocated to the air forces of various countries, especially those experiencing economic difficulties, increasingly larger. James Elliot, the author of the article, highlights the high cost (mentioned in this study) of supersonic combat aircraft of new generation, drawing attention to the followings:

- Is a clear fact that the current fleet of fighters will be replaced in the near future with a significantly lower number of new generation aircraft, due to their high price, an immediate consequence being that the number of Air Force combat aircraft from different countries will be much lower in the future.

In such circumstances, the high cost price and the reduced number of supersonic combat aircraft will make it difficult to use them for routine training of advanced military pilots for two reasons, namely:

- The cost price of the aircraft resource, due to its high price, ranging between 68 and 100 million dollars,
- Also the very high cost of flight hour ranging between 4,500 and 40,000 US dollars (see fig 3).

Currently, this trend is already happening in some countries, e.g. from an article published recently under the title "F-16 Versus GRIPEN", we found that the Croatian government decided to purchase for the Air Force only a total of 12 supersonic combat aircraft at a total cost of 800 million U.S. $ and it would choose between F-16, equipment Block and tasks 52 and JAS - 39 - GRIPEN, both aircraft being able to fulfill both interception and ground attack missions, according to new NATO standards.

The same applies to the Czech Republic that has already bought 12 aircraft JAS - 39 - GRIPEN at a price of 68 million U.S. $ per plane including the training package both in air and on the simulator, and other facilities offered by the provider.

Also Poland, which had a large number of supersonic combat aircraft bought only 48 new F-16, at a price of 74 million U.S. $ per plane (conditions not published).

These costs should be analyzed also considering the expenses for the pilots passage on new aircraft, which are typically provided by the provider for a fee, as follows: for GRIPEN it costs about 125 000 U.S. $ per pilot / year for F-16 about 185 000 U.S. $ per pilot/ year; these costs are calculated for a total of 50 hours of flight / pilot / year, representing a cost of 2,500 U.S. $/ flight hour for GRIPEN and 3.700 U.S. $ for F-16 without the training

packages, without the costs for logistics and without those for ground operation and maintenance.

It is estimated that these costs are unrealistic, because the content of the training package is not specified they depend, in general, on who communicate these costs.

According to other sources mentioned above, in an operative unit, the cost of a training flying hour complying with NATO standards is for GRIPEN of about 4.500 U.S. $ and for F-16 of approximately 5.500 U.S. $. in this case too, the manufacturer standards of the training flight on these two types of aircraft are not specified (see fig. 3).

According to the Swedish Air Force, the cost of flying hour with the two planes (when the pilot training package is taken into account) is that presented in Fig. 3.

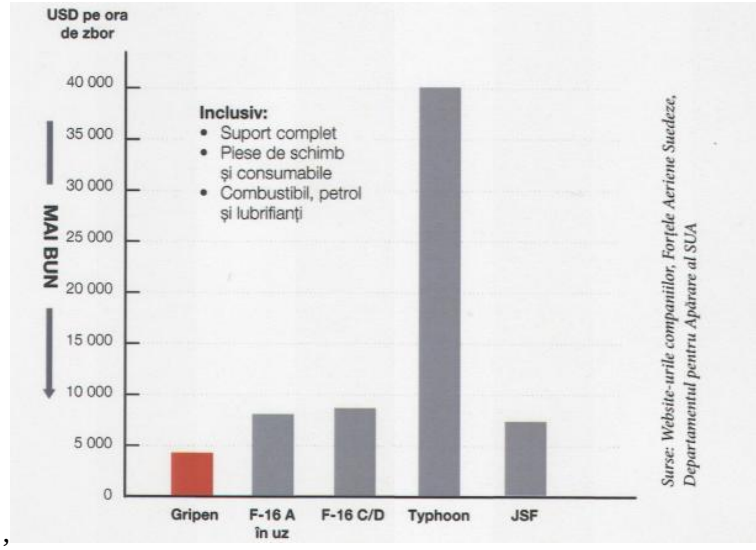

Fig. 3 The flight cost per hour for several combat aircraft of some OTAN member states

In the context of supersonic aircraft high cost, one should also consider their quite low resources, thus for the aircraft structure (wing, fuselage and horizontal and vertical tails) a resource of about 15-20 years is given, as compared to subsonic trainer aircraft of which resource may reach 30 years.

This difference involves additional costs, with respect to the aircraft fleet replacing and also for operation, maintenance, partial and overhaul repair that are very expensive, too.

These costs should be considered taking into account a certain dose of subjectivity, depending on who communicate and who examines them and, therefore, in this study they are presented as examples to support the idea expressed above.

In what concerns the methodology of the military pilots training programs, a new trend can be noticed, namely that of simplification and resources saving in all areas.

A study conducted in the U.S during the 80's concluded that the instruction and training program of a pilot that before 1980 was held over a period of four years and which included 350-400 flight hours can be made in U.S. Air Force, in about. 2.5 - 3years, including 200-245 flight hours, in three phases, namely: phase I -school (initiation), phase II –transition phase and advanced training and phase III -combat training and specialization.

As already mentioned, after 1980, due to increased oil prices and repeated financial crises (which influenced the price of aviation fuel), the total training time was reduced in flight hours, from 350-400 hours at approximately 200-245 hours (excluding the training on

aircraft T.38) while the three phases of training were preserved, noting that, because of technical equipment improvement of school aircraft, phase I was greatly reduced. Phase II was practically unmodified and phase III which usually represents the flight with supersonic combat aircraft was reduced the most.

This strategy was accepted and acquired as such, in many countries that have their own air forces and facing critical economic situations.

Until this new methodology, there were four phases in the military pilots training, namely, phase I, of school(initiation), when conventional propeller planes were used, phase II (transition), when double - control jet were utilized, phase III, when double or single command training jets were used, usually supersonic jets as F.15 E, F.18.D or MIRAGE - 2000D, MIG - 21 (DC) and others and phase IV of improvement when supersonic jet fighters, from the operational fleet were utilized.

For instance, in the '70s, in Romania, classic school aircraft IAR – 823 were used in phase I, jets L - 29 or later and L – 39 in phase II and supersonic fighters were utilized in phase III. For transition in the upper stage phase, double – control MIG - 21 aircraft were utilized and in phase IV for training and combat, aircraft simple - control MIG - 21 were used -, the last two phases of training and combat instruction were held usually in the same operative unit.

In this case, the flight hours in stages III and IV, were made with very expensive fighters that involved high costs, consuming the expensive resources of combat aircraft, usually supersonic, with all the financial implications arising from such use of these aircraft, negatively influencing the number of flight hours allocated annually for each pilot.

Currently this system was abandoned, meaning that in Phase I two types of aircraft are needed, a classic one, adequately equipped for primary training of the pilot student, like YAK - 52 or other aircraft of this class and a double -control school jet-, properly equipped for the student transition into a higher stage, in which double - control aircraft are used (such as, IAR 99 –SOIM, HAWK – 100, L - 159, ALPHA - JET, MB - 339 and others).

In phase II, for training and combat instruction of advanced pilots, subsonic SC training aircraft are used, specially equipped for this purpose, such as L - 159 ALCA, HAWK - 200 and in future IAR 99 (A) - SOIM and others of the same type, which have much higher costs of flight hour. In phase III, of improvement, multi-role combat aircraft are usually used (of, MIG - 21 Lancer, F-16, GRIPEN, Eurofighter type and others) available for the operational units. As mentioned above, among the category of subsonic SC advanced training aircraft the Romanian IAR 99 (A) SOIM (SC), (see Fig. \4) is included which can perform, within the specific speed limit, almost the entire range of combat missions as the above mentioned supersonic aircraft. This type of aircraft is characterized by a cost price 3-8 times lower and cost of flight time 2.6 to 5.6 times lower in comparison with that of a current generation supersonic combat aircraft.

The advanced training aircraft IAR 99 (A) - SOIM (SC), (see Fig. 4), is one of the best aviation weapons versions, executing a combat training mission in tactical or operative field, because it has both artillery weapons (23 mm 2-barrel gun with 200 shells and a cadence of 3600-3800 of blows per minute) and defensive and offensive reactive weapons, namely self-directed missiles (air - air) and guided or unguided missiles (air - ground).

Missile type and characteristics will be similar to those that in the near future will equip supersonic combat aircraft of Romanian Military Air Force.

As the aircraft acts in the tactical or operative field, it also has two additional fuel tanks with a capacity of 220 Kilo-f each providing a range of flight tactics appropriate to fulfill the above mentioned mission (see Table 1).

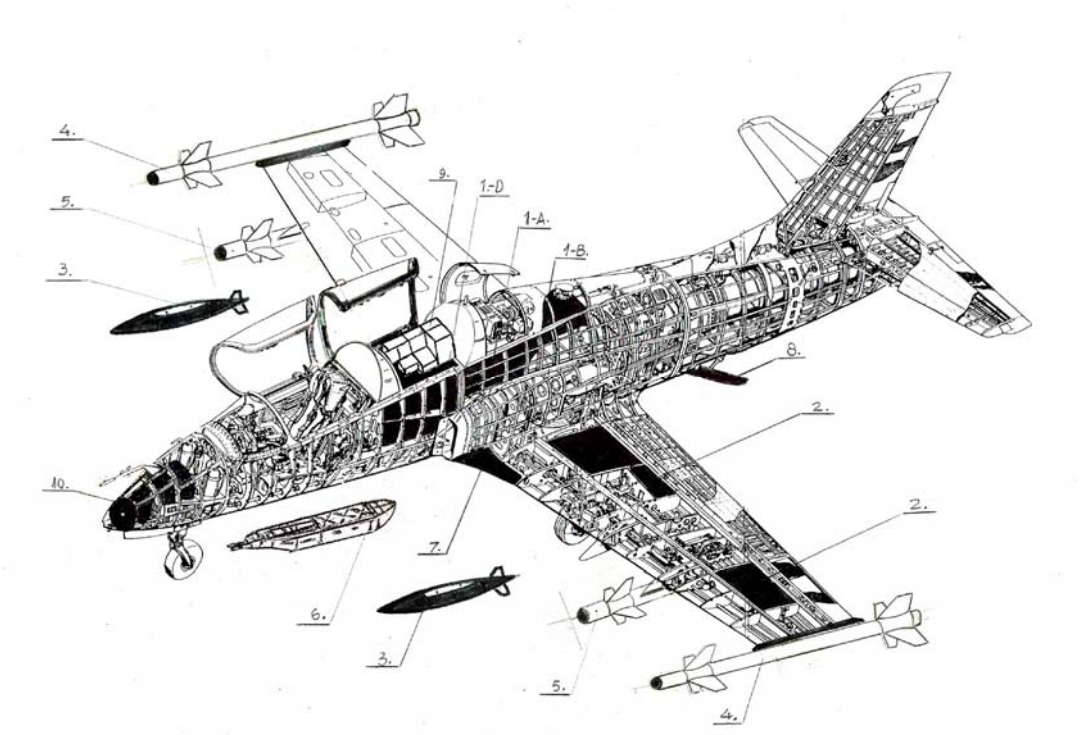

Fig. 4 The weapons system basic version of the SC TRAINING AIRCRAFT IAR 99 (A) – SOIM

(1 - A) (1 - B) and (1 - D) FUSELAGE FUEL TANKS, (2).WINGS INTEGRATED TANKS, (3).ADDITIONAL TANKS, (4).GUIDED AIR –TO-AIR MISSILES (5). GUIDED AIR –TO –GROUND MISSILES, (6). CANNON CONTAINER, (7).WINGS - FUSELAGE APEX, (8).AERODYNAMICS BRAKE, (9).RADAR EQUIPMENT, (10).RADAR ANTENNA.

In accordance to the above, all states that have aircraft fleets and face growing financial difficulties have cut their fighter plane acquisition budgets and military pilot second and third phase training budgets, as follows:

- The number of flight hours in these states has been drastically reduced to 125-150, in some cases even less, down to 60 to 90 flight hours.
- Total flight hours has been reduced even in developed countries, from 350 to 200-245 and in some cases down to 125-150 flight hours, and also the training period was cut down from 4 to 2,5 to 3 years.
- The supersonic fleet has been considerably reduced, so that states like Hungary, the Cech republic, Croatia, Serbia, Slovenia, Poland and even Romania, can no longer afford tenths of such aircraft, their numbers dropping, from country to country between 12 and at most 24, except Poland that acquired 48 F-16 new generation jets.

To counter this hindrance solutions were explored and I personally consider as one of the most the most effective to be ensuring 36-40% of the pilot annual third phase training hours on supersonic fighters and the rest of 60 to 64% on subsonic single command jets specially designed for the purpose, as done in several other states.

A recent concept in some NATO countries is to reduce flight hours on current fighter jets such as MIG-21-LANCER, F-16, GRIPPEN, MIRAGE, TORNADO, etc with up tp 60%, regardless of the number of flight hours per pilot per year, and the resulting savings to constitute a fund destined to be used to pay for more flight hours on advanced subsonic

trainer jet flights, so that the total flight hours increases and costs stay within budget limits, as shown in the chapter “A restructuring of the training and improvment programs (part II)”.

As Mr. James Eliott specifies in an article in TOP GUN magazine, regarding the efficiency of using subsonic trainer jets, I quote: “Probably the most ration idea from a cost to performance ratio point of view, is to have the 3 training phases, four aircraft types: for the primary phase, double control trainers (jet and classic propeller type) for advanced training- SC subsonic trainers and for the pilot proficiency phase-current generation multirole fighters”.

This concept makes possible the saving of the expensive combat aircraft resource. Thus the operational units have the possibility to train a large number of pilots in flight with a relatively small number of subsonic training fighters (as many states no longer afford to buy a great number of aircraft).

The solution found and adopted by most Air Force Major States from different countries to use alternatively the supersonic combat aircraft and the advanced subsonic trainer aircraft, upgraded to the combat aircraft level and affordable in terms of cost, with enhanced dynamic qualities and improved flight performances due to implementation of modernization programs including the re-motorization (such as SUPER GALEB G - 4, L - 159 ALCA, HAWK - 200 and in the near future of Romanian aircraft SC advanced training IAR 99 (A) - SOIM), created the possibility of increasing the total number of flight hours, in phase (II) of training, improving, in this way, the overall preparation of the crew in the operational units.

In conclusion, transformation of DC training subsonic aircraft, into SC advanced training aircraft, and their use in instruction and combat training programs for the military pilots in operational units, may have an important role in saving funds that can be used to increase the number of flight hours of the crew, even considering that these funds are quite low.

Due to their board systems modernization and their equipment with the latest avionics, the capability of these aircraft to perform training missions similar to those performed by supersonic combat aircraft to a greater extent than in the past and at lower cost in terms of the flight hour and logistics recommend them to be included in the flight programs of military pilots, with consequent benefits in increased fight ability of the air force in general and of the crew, in particular.

The manufacture, in the coming years, of a significant number of simple and double control IAR 99 (A) - SOIM (re-motorized) necessary for both the phase (I) of transition (the DC aircraft which in the next few years will no longer be in operation) and phase (II) of advanced training (the SC aircraft which are necessary and will equip the fleet as soon as possible) will have a beneficial impact for both the crew and the Aerospace Romanian Industry (IAR), which has a tradition in the aircraft manufacture of about 87 years. The IAR name is well known internationally and especially in France, as a name with tradition in aeronautics.

The company that bore that name (IAR) was founded in Brasov in 1925 as Romanian and French joint venture company - and built before the Second World War a high - performance one-seater fighter aircraft, namely the IAR 80.

It is known that the name IAR became increasingly well-known after the second world war period when other planes were built, such as phase I school plane IAR 823, the bombing and ground attack SC or DC IAR 93 or the utility aircraft (for use in forestry and agriculture), PUMA helicopters manufactured under French license and not least the DC school and training aircraft IAR 99 - SOIM (excerpt from the article "IAR 99 FAUCON ROUMAIN" published in AVIATION DESIGN no. 29 of January 1992).

3. CONCLUSIONS

In conclusion, new SC training aircraft IAR 99 (A) - SOIM upgraded, re-motorized and properly equipped, will have superior flight characteristics and performance which recommend them for training the pilots already instructed in operational units (see table I).

Manufacturing in Romania, the DC school aircraft IAR 99 - SOIM - and the SC advanced training IAR 99 (A) - SOIM, is very important in terms of currency funds saving, which, given the high costs of imported subsonic and supersonic aircraft, can amount to large sums and also in terms of thousands of jobs preserved in both aerospace and horizontal industry of the country. Therefore from this perspective, this program is reliable and recommended to be applied.

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