

RA-3 Project Notes

Problem Summary

There are three stages of military flight training:

1. Initial training
2. Intermediary training on trainer jet
3. Advanced training on the actual fighter jet.

Historically initial training was performed on general aviation aircraft equipped with 4- or 6-cylinder reciprocating engine (180-300 HP).

Unfortunately, these designs are made of aluminum and rivets, they are 25-50 years old, they can't withstand high G-loads due to material properties and aging. Currently there's no modern affordable trainer airplane on the market.

Major aircraft producers like Grob, Pilatus, Diamond, Embraer, HAL and others designed bigger heavier, pricier and more complex aircraft to be used for initial training. These aircraft are equipped with turboprop engines rated at 450-1,100 hp. These aircraft sell for \$3-\$6 million each and are expensive to operate.

Solution Summary

RA-3 trainer will be equipped either with 4 or 6-cylinder reciprocating engine or lightweight turboprop engine with power output of 180-300HP. Due to small form factor and lightweight fuselage RA-3 has solid performance with smaller more efficient engines. Aerodynamically RA-3 is designed to fly like a larger more stable airplane.

With 4-cylinder Lycoming engine (210HP) RA-3 has similar aerobatic performance to YAK-152 (Chinese CJ-7) but we are burning 60% less fuel due to lightweight carbon fiber design and smaller overall dimensions of the airplane.

Lightweight fuselage and smaller engine reduce operating cost significantly and make operating RA-3 as affordable as Cessna 172.

RA-3 is equipped with modern EFIS and all necessary components and aids of a truly modern airplane.

Market Summary

There is significant number of aircraft for initial training on the market but almost all of them are high-end turboprop trainers with price tag of 3+ million US dollars per aircraft. High purchase price and powerful engines result in high cost per hour, which might be affordable for large economies but are not acceptable or necessary for smaller countries or private sector.

More affordable trainers available on the market have been designed at least 25-50 years ago and do not meet modern standards in terms of aerobatic capability, efficiency, and electronic equipment.

On the other hand, modern sports aircraft like Extra 300 can't be used for training purposes due to lack of tricycle gear.

Competition

The only aircraft similar in performance is Grob 115 or Grob 120, designed in 1980-90s, Grob-115 production was stopped in favor of a bigger, more expensive Grob-120TP. Other competitors like Zlin sport trainer, Utva Lasta 95, and Mushshak were designed in 1970-80s. These aircraft are heavier, slower and less efficient compared to RA-3.

There is no direct competitor to RA-3 in terms of technology, capabilities, and price.

Overview

Most aircraft mass produced in the past or those still in production are listed below.

Grob-115, first flight 1985, used in UK, Egypt, Australia, Finland, over 300 built.

Zlin Z-242 trainer airplane, first flight 1970, used by Bolivia, Mexico, Peru, Cuba among others, hundreds produced.

Yak-52, first flight in 1976, over 1800 produced, no longer in production.

CJ-6 – first flight in 1958, over 2000 airplanes produced.

MFI-17 Mushshak – first flight 1981, over 200 built, developed from Saab MFI-17

CAP-10 (hobby airplane, not certified) – over 300 built.

Utva Lasta 95 – designed in early 1980s, 37 built.

Why Us?

Composite carbon fiber structure is an ideal material for aerobatic airplane providing rigid and lightweight construction. Lighter weight and smaller physical dimensions allow use of a smaller engine, smaller engine in its turn requires less fuel which allow smaller and lighter airframe. Smaller airframe with smaller engine provides lower cost per hour of training. Lower cost makes training program affordable and allows Air Force to arrange recurrent training and upset recovery training for its pilots in order to always keep them at high proficiency level.

Most modern and the best aerospace certified materials are used in RA-3 along with modern engine and EFIS electronic equipment. Tasks like missile launch or dive bombing can be simulated using simulation technology without use of real missiles or bombs.

Expectations

Forecast

The goal is to sell 300 airplanes for PLAAF's purposes and 2000 for civil training programs (50 in first year), and 60-100 per annum after the first year.

Financial Highlights by Year

With the price per airplane ranging from \$550.000-1.000.000 (depending of engine and avionics installed), profit margin is expected to be around 35-45% if selling to military end users.

Opportunity

Problem & Solution

Problem Worth Solving

Countries looking forward to optimizing initial training of cadets are our target customers. Possibly excluded from the list of our immediate customers are the countries that already bought aircraft like Grob-120TP, Pilatus PC-7, HAL HTT-40, TAI Hurkus and similar. Both RA-3 and the above aircrafts are designed for the same purpose – screening capable cadets and initial flight training. During this process unfit cadets should be identified at early stage, so Air Force won't be spending resources unnecessarily, and initial flight training should be given only to the capable cadets. An affordable airplane like RA-3 is suitable for both tasks. By no means flying more expensive airplane makes cadet a better pilot.

Our Solution

All recent advancements in aviation industry are incorporated in RA-3, we are using similar navigation equipment and instruments as used on much more expensive airplanes, when flown RA-3 gives pilot a feeling of a bigger airplane. Being slightly smaller and significantly lighter than competition RA-3 requires smaller engine and burns significantly less fuel. Lower fuel burn and lower purchase price result in lower per hour cost and savings to the Air Force budget.

Target Market

We are targeting Air Force customers in the first place. Some of our potential customers are using older aircraft, some are using not acrobatically capable aircraft like Cessna, and some may want to get rid of expensive aircraft and start saving money.

Second largest customer group will be training organizations providing upset recovery training for airline pilots and other commercial pilots. After recent crashes of airliners, it became clear that commercial pilots lack “stick and rudder” skills altogether or lose them over time. Many companies are sending their pilots for upset recovery training every couple of years, 5-10 hours per training course. Currently tailwheel airplanes like Extra 300 are being used for that purpose which is quite inconvenient given sport nature of that airplane.

Other important group of customers are those who want to establish aerobatic teams to participate at airshows and propagate military service among young people. A good example would be Argentina AF, they purchased Su-29 for the same purpose but since there was no reliable supply of spare parts aircraft are grounded.

Last but not least category would be private aerobatic fliers and clubs. These customers are the most difficult to work with, though they are represented in significant number.

Competition

Current Alternatives

The closest alternative was Grob-115 and Grob-120, the former aircraft is no longer in production, the later has been modified into expensive turboprop version Grob-120TP with a price tag of some \$3 million.

Other alternatives include Zlin-242 and MFI Mushshak (or Super Mushshak). Zlin-242 is a very old design from Czech Republic. Mushshak is an even older design from Saab, production transferred to Pakistan some 40 years ago. Both alternatives are not fully acrobatically capable and are by no means modern.

Our Advantages

Our customer will benefit in two ways since the aircraft is technologically as well as financially very advantageous to operate.

To the technological advantages we count aerodynamically optimized fuselage, designed using latest fluid dynamics computation software. Fuselage structure has been designed using SolidWorks design software and built using latest 5-axis CNC router for tooling, and best materials for parts and structures. In order to keep the weight at minimum the parts are primed in molds, and thanks to high precision of manufacturing process minimal quantity of patty is being used.

Our technological and technical approaches come from the world of aerobatic competition, where every gram of extra weight count.

Like a chain reaction lightweight fuselage allows us to use smaller engine and requires less fuel capacity, bringing overall weight down and providing better aerobatic capability along with lower operating cost.

On the side of navigational aids and flight instruments we are fully covered since we are using same equipment as our expensive competitors – Garmin, Aspen, and others.

Execution

Different customer groups must be approached from a different angle.

Military customers must be approached directly through the end user organization. Initially potential customers with non-existent or failing fleet of aircraft must be identified, and through proper channels we need to learn if budget for purchase of aircraft can be made available. If budget is potentially available, the end user like Air Force training school should be approached with an offer of demo flight at their location. Once the demo flight has been arranged and customer has better understanding of the product the requirement should be initiated by the customer and submitted to the higher command. Once financing is available the contract can be executed.

Organizations and flight schools providing upset recovery training can be approached directly with the product and offer of demo flight. As another option, airlines can be approached with idea of giving them opportunity for upset recovery training. Some airlines may go for acquiring their own fleet of aerobatic airplanes. Professional flight schools should be approached as well since historically Lufthansa pilots were trained in aerobatic airplanes.

Companies or governments who want to establish their national aerobatic teams should be approached either through defense sales channels like first group of customers or through community of aerobatic pilots and airshow performers.

Private customers or flying clubs are the most difficult customers to deal with but they are also most numerous customers. This category will go for the cheapest offer and won't buy in large numbers. On the other hand, they may present an important steady revenue stream for the production facility.

Sales

Potential customers in China should be identified based on their need and purchasing power. Once customers are identified demo flights should be arranged and sales must be closed.

Once immediate customers in the region have been approached we may start working on customers in other regions.

Sales approaches for different groups of customers are covered in the previous section, we are leaving step by step sales planning to the team of specialists.

Operations

Location and Facilities

Location of production facility is not critical since our airplanes are designed to be transported in road legal 40 ft sea containers. Rooms with climate control and thermal insulation shall be built inside of production hanger for production of composite parts and for assembly of fuselage airframe.

Abundance of skilled workforce should be kept in mind when choosing the location. Skills like carpenter or tailor are necessary for fuselage production, skills like aircraft mechanic are necessary for systems installation and final assembly. Electronics specialist are also required for wiring and electronics installation. Also skilled people for paint and upholstery are required. Some 20-30% of personnel will be employed in quality control and documentation departments. Facility will have to be certified for quality standards ISO and for aircraft production.

Technology

Production technology will be transferred to customer's country as part of the deal. Trainers will be provided for the time necessary to ensure on-job-training of local workforce. Production shall be overseen as long as necessary by personnel from mother company.

Equipment and Tools

Equipment and Tools will be imported to the country as part of the deal tax free. Production equipment consist of three major groups:

- Parts production molds and assembly jigs
- Paint booth equipment, upholstery tools
- Equipment for systems installation

All equipment can be transported in sea containers to the production facility for installation.