METHODOLOGY SHARK AIRCRAFT FLIGHT TRAINING

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The article examines technical characteristics of Shark aircraft and its use for pilot training of Slovak Air Force. Briefly describes the main parts and control elements of aircraft. The last part is focused on training of military pilots with proposal for improvements which contains methodology of training on Shark aircraft.

Keywords: shark aircraft, methodology, military pilot, flight training

1. INTRODUCTION

Currently, the military sector uses several types of aircrafts designed for basic military training. Article proposes an alternative for Slovak Air Force. There are several suitable types of aircrafts that have specific technical and performance characteristics which are required for training.

Important factors for the selection are possibilities such as financial, human and technological. The best option is an aircraft that combines low operating costs, easy maintenance and adequate flight characteristics. In my opinion, the best choice is Shark aircraft manufactured in Slovakia, which is suitable and prospective to fulfill the requirements defined by OSSR for pilots. An important part was creating an effective basis for pilot training divided to 150 hours. Detailed definition of this basis is presented in the methodology of training that includes a description of the elements that are required by pilots.

After completing basic training, pilot continues in advanced training on the aircraft L-39 Albatros. The methodology has been processed on the basis that pilot flies not only navigational flight, but also for the best handling of pilotage at tandem aircraft with the use of elements of acrobatics and group flying.

Figure 1 Shark - military camouflage

2. TECHNICAL SPECIFICATIONS

Shark is a composite high-performance low-wing aircraft with classic tail and tandem seating, designed according to European UL and US Light Sport Aircraft criteria.

Aircraft is powered by 75 kW/100HP Rotax 912ULS flat-four cylinder four stroke engine with variable-pitch composite propeller and 100 litres integral fuel tanks in wings.

Standard Shark version has got tricycle type retractable undercarriage with steerable nose wheel and main wheels with hydraulic disc brakes.

Aircraft has got completely upholstered two-seat tandem cockpit with adjustable seats, full dual controls – with sidesticks on the right and throttles and flap levers on the left panels. Elevator trim tab is controlled by electric switch on the sidestick.

Table 1 Technical specifications

Aircraft model:	Shark UL
Wing span	7.9 m
Length	6.7 m
Wing area	9.5 m²
Engine	Rotax 912ULS - 75 kW (100 HP)
Empty weight	275 kg
Max. take-off weight	480 kg
Max. permissible speed V_{NE}	333 km/h
Max. cruising speed V_H	290 km/h
Optimum cruising speed	250 km/h
Stall speed, clean	80 km/h
Stall speed, full flaps	64 km/h
Max. climb rate at the MTOW	7.2 m/s
Fuel capacity	100 litres
Fuel consumption economy flight	15 l/hour
Maximum load factor +4/-2, max. ultimate +6/-3	

Instrument panels with EFIS/EMS displays for both pilots are complete with the transceiver, transponder and GPS and secondary analogous indicators. The single-piece cockpit canopy opens to starboard and is supported by gas struts. Great baggage compartment is located behind the rear seat, accessible from the rear pilot place, and mainly through great lockable baggage door, from left side.

Monocoque fuselage is produced from carbon-fibre and glass-fibre /epoxy composites with integral fin and integrated arm-rests, seat backs, floors and instrument panels.

Fowler flaps are monocoque sandwich design, hinged each in three lever-hinges and driven from its root-rib lever. System of electric flaps BETAKOM has deflections 20° (take-off), 30° (short take off/ landing) and 40° (landing).

Shark is modern ultralight aircraft equipped with advanced technology, especially in the equipment of the instrument panel. Nowadays, glass cockpits are more preferred in comparison with conventional instruments, so Shark is adapted to this requirement. In Shark are installed glass cockpits Dynon SKYVIEW or FLYMAP. The front screen of glass cockpit is usually 10” (Dynon SKYVIEW) or XL (FLYMAP) and the rear screen is 7”(Dynon SKYVIEW) or L (FLYMAP).

2.1. Control System

Full dual control with right-side sidesticks and pedals for front pilot adjustable and equipped by toe-brakes on front seat, fully controllable for both pilots. Flap control panel and undercarriage retracting control panel is located on left side of instrument panel, throttle and choke levers are placed on the left board of cockpit for both pilots. Trim control switches are placed on the sidesticks grips.

Elevator is controlled by sidesticks, hinged in control column through system of rods and levers and connected directly with two elevator levers of two-piece elevator.

Ailerons are controlled by side movements of sidesticks, hinged in right-side located control column, through system of rods and levers, hinged in carbon brackets on the front side of main wing beam.

Rudder is controlled by wires in plastic slide tubes and connected through front undercarriage leg control levers. Turnbuckles are located in the front – accessible from the cockpit and stretched to 15 kg.

Flaps are controlled by electric actuator LINAK LA 12 placed in the left cockpit arm rest of rear pilot, through torsion tube with connection into wing root ribs and fork-levers on both sides of torsion

tube ends. The system is controlled by electric module BETAKOM, control and display panel is situated on the instrument panel connected with undercarriage panel, optionally also on the rear instrument panel.

Elevator trim tab is controlled by servo Ray Allen T2-10A (electric actuator), placed inside of the left elevator. System uses original bolts for installation and drive, screws and ends.

2.2. Rescue system

Shark is standard equipped with 2-handle rescue system Stratos/Junkers Magnum 501. Parachute canopy is pulled out by a specially designed rocket engine. The time required to launch is in the range from 0.6 to 1.2 seconds, depending on the type of system and air temperature. The rocket engine is placed in the rocket case. After its activation by the activity handle is the movement mechanically transported by a bowden cable on a percussive device, which activates two percussion caps and they the load in the rocket box. After ignition, the rocket escapes under high pressure from the rocket box out. Towing rope of rocket releases the cap of the parachute container, the parachute is pulled from the container, then the bag of parachute is discarded and parachute canopy is filled with air.

3. PERFORMANCE CHARACTERISTICS AND LIMITATIONS

The part of work includes all the performance characteristics of the aircraft like tables of:

- speed limits
- stall speeds
- lengths of take-off
- lengths of departure
- rate of climb
- stamina, range

The next part of work is limitation like:

- speed limits
- weight limits
- overload
- weather and temperature condition
- permitted manoeuvres

4. TRAINING OF MILITARY PILOTS

Every pilot, who enters the Slovak Air Force should have a PPL license which means to have flown at least 50 hours. To begin training for the L-39, pilot must have to flown at least 200 hours and CPL theory. Slovak Air Force ensures this training through the civil flight training organizations, so I think that Slovak Air Force should have their own aircraft for this training. The best option would be the Shark airplane. Operation of the aircraft is inexpensive and it has good manoeuvrable characteristics, as well as satisfactory structural strength. Cabin equipment depends on the requirements of the Air Force. Aircrafts are small, low-maintenance, so the staff should check the main engines and liquid. Shark is a complex plane by which the pilots received habits and skills for advanced training on L-39. Shark provides these advantages:

- adjustable propeller
- retractable landing gear
- consumption
- high strength
- modern avionics
- tandem seating

5. PROPOSAL OF METHODOLOGY FOR MILITARY PILOTS TRAINING

This proposal is based on the assumption that the pilot has passed a PPL theory and the fact that the pilot will receive theoretical training in the scope of CPL and improved English language in radio correspondence and of course flight training at least 150 hours. Acrobatics and group flights are the basis of training and also IFR flights. The methodology is processed as a basic introduction to the various elements that must pilots handle during the training. The objective of the methodology is not to serve a technical manual but to familiarize the pilot with piloting techniques. The methodology consists of several parts, based on qualifications materials:

5.1. Ground training

Ground training includes theoretical training on the basis of which the pilot obtained knowledge that use in practical training:

- aviation law
- General knowledge of aircraft - airframe, control systems, engine, avionics…
- planning and performance of flights
- human performance and limitations
- meteorology
- navigation - general and radio navigation
- operating procedures
- principles of flight and connection

Figure 2 Shark prototype

5.2. Type retraining and recurrent training

In this section, the pilot must perfectly get to know Shark aircraft. The most important is the understanding of the aircraft flight manual. The pilot must also know except mandatory operations also emergency procedures.

5.3. Acrobatics

For the pilot it is important to physically to handle this heaviest part of the training. Pilot must get used to overload to gain experience of air acrobatics. The training includes the following elements:

- inside loop
- roll
- stall turn
- immelman (roll over the top)
- reversal
- combat turn

- tail-spin

5.4. Group flight

Pilots must handle take-offs in pairs, circuit and route flights in opening and sandwich formation. They must also handle with a turns in pair, crash dive and landings of course.

5.5. Group flight

In this phase of training, the pilots have to get used to flying in a low and ground height. They have to learn to copy terrain and use the uneven terrain and hills that pilot remained unnoticed. Pilot must deal with basic elements at ground level and he must learn to estimate the height which is safe or risky.

5.6. VFR night and IFR flight

Training consists of the following elements:

- Flight in the workspace - climbing and descending turns, training of unusual attitudes…
- Approach to the runway - ILS, VOR, NDB, Missed approach…
- Flights along routes domestic and international

6. CONCLUSION

Shark aircraft is not popular only in Slovakia but also abroad. It is one of the fastest ultralights and it is the holder of several awards. His excellent technical and performance characteristics associated with low maintenance and operability makes this aircraft suitable for basic training of military pilots. Tandem seating, high strength, retractable landing gear and variable pitch propeller bring this complex training plane to the upper class. While processing this methodology and basis of the training, it was necessary to use a variety of sources, but primary lot of information were obtained through consultation with pilots. In all ways, it should help to improve the basic training of pilots who do not pass out training in civil flight training organization but did so directly in their own unit, which would be as for them as well as for the Air Force. It is more convenient and effective solution.

7. LITERATURE LIST

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