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L-39 SKYFOX – SUPPORTIVE FIGHTER-TRAINING MULTIFUNCTIONAL NEW GENERATION AIRCRAFT

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Summary: *The author supports the idea that the Bulgarian Air Force should optimize the system of our military aviation by finding a strategic partner in the field of the 5th generation of aviation technology, through which they can prospectively replace the decommissioned old modifications of L-39ZA, Su-25 and partly MiG -29 with a new multifunctional fighter-training aviation platform. We must rely on traditions and explore European opportunities for industrial cooperation.*

Keywords*: aviation, human cognition, multi-functionality, modernization, close support*

INTRODUCTION

One of the main problems of the Bulgarian military aviation system is the 35-year period of oblivion, during which no combat and combat training aircraft entered service. The last models were delivered in 1990, when the deals for the MiG-29 and L-39ZA were concluded. If the MiG is assigned the role of the main combat fighter of the 4th generation, then the Czechoslovak aircraft are assigned the function of the main training jet aircraft and one for conducting aerial reconnaissance during the mobilization and deployment of the Bulgarian army in war conditions.

Of course, the cadets and instructors from our training regiments also used the 36 available L-39ZAs for close air support, given their decent armament, consisting of a twin 23-mm cannon located in the nose of the aircraft and a set of conventional hangar weapons, with a total weight of 1000 kg.

EXPOSITION

In operation, the L-39ZA aircraft proved their exceptional efficiency. Hundreds of Bulgarian pilots passed through their cockpits, who then filled the ranks of the Bulgarian Air Force. The military repair plant in the city of Dobrich, which we so frivolously closed, coped perfectly with the regulatory and repair activities. This helped the system to maintain over 90% of the available aircraft in airworthiness. During the entire period from 1986, when

the first 18 L-39ZA were received, not a single accident or catastrophe has been allowed due to a technical malfunction, which practically proves the high reliability of the machines. During this period, the L-39 program continued to develop, unfortunately without the participation of Bulgaria, despite the Bulgarian Air Force's more than 60-year tradition of operating Czech jet training aircraft and over 85 years of operation of Czech aircraft in general. The latest variant of this Czech aviation project is the multifunctional new generation L-39 Skyfox (Aero, n.d.-a; Wikipedia, n.d.). Multifunctionality refers to the aircraft's ability to perform multiple primary operational tasks with equal efficiency.

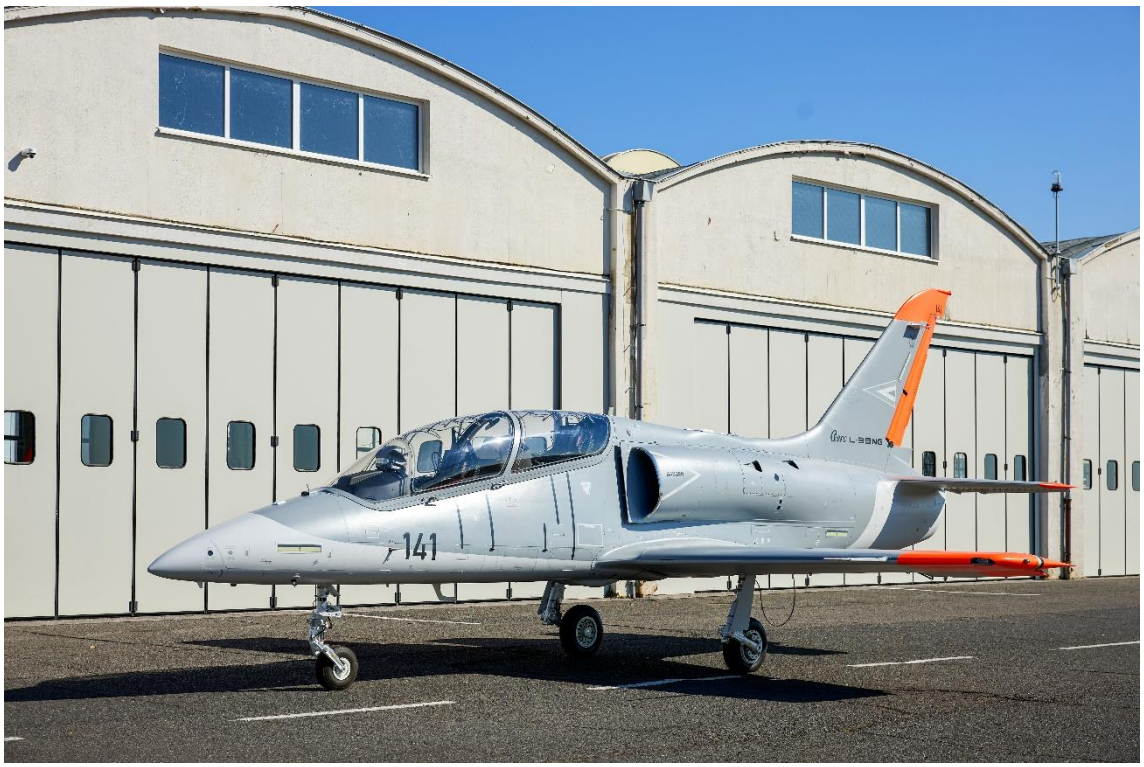

Figure 1. L-39 Skyfox aircraft on the ground.
(*Source: Aero Vodochody, 2024a.*)

At the same time the military conflicts in the Middle East, North Africa and Ukraine impose new strategies for the conduct of military operations and development of modern technologies related to security systems. In the field of aviation, light multirole aircraft have unequivocally proven themselves on the battlefield. Analyzing their operations, this type of aircraft is more cost effective even compared to new frontline combat aircraft.

Considering the need to rearm our military aviation with new combat and training-combat platforms, a careful review of the potential options is necessary for a similar type of support aircraft. One of the paradoxes of the current state of our military aviation is the variety of platform types. They

are over 20. This undoubtedly makes exponentially increases the cost of maintaining the system. In addition, the training of military pilots requires a highly proven platform for the transition to the next main combat aircraft F-16 Block 70 type which are already part of the 3rd airbase.

L-39 Skyfox built by the Aero Vodochody AEROSPACE ("Aero") takes a comprehensive approach to jet trainer design, providing a reliable and cost-effective source of flying hours for basic, advanced, fight, and tactical training. Their aircraft are renowned for their exceptional reliability, flight safety, low operational costs, and long-term operational and maintenance support, making them a top choice for pilot training programs.

The first flight of the L-39 Skyfox took place in December 2018. By January 2025 the first L-39 Skyfox had been delivered to Flight Training Center Pardubice, which is the training organization of Czech Air Force (Aero, n.d.-b). In terms of its capabilities, it is a new generation multi-role aircraft that can be used to train advanced cadets and pilot officers, as well as performing a wide range of Air-to-Ground and Air-to-Air combat missions, such as:

- training of flight personnel for combat skills before transition to a main combat aircraft of a new generation.
- close air support;
- air interdiction;
- air reconnaissance;
- intercepting and combat with an air opponent in the subsonic range including unmanned aerial vehicles.

Based on the available information, more than 40 L-39 Skyfox have been procured by 6 Countries worldwide with many more opportunities destined to come considering the emerging market of +400 new A/C delivery in the next 20 years.

The great success of the L-39 Skyfox is due to its proven performance which allows pilots to exceptionally execute a wide flight envelope, not permitted with aircraft of a similar class:

- Fuselage length overall [m] – 11.83;
- Fuselage height overall [m] – 4.87;
- Wing span [m] – 9.38;
- Empty weight [kg] – 3,280;
- Maximum take-off weight [kg] – 5,600;
- Payload [kg] – 1,650;
- Number of hardpoints – 5;
- Number of „wet" hardpoints – 2;
- Max Level Speed at 20 kft AMSL [KTAS] – 410;
- Rate of Climb at 5 kft AMSL, 1,000 kg of fuel [ft/min] – 4,500;
- Service Ceiling [ft] – 35,000;
- Endurance, internal fuel [hh:mm] – 3:45;

- Ferry Range, internal fuel [NM] – 1,025;
- Engine type – FJ44-4M;
- Engine control – 2 x FADEC;
- Engine total thrust dry [kN] – 16.89;
- Acceleration Time – idle to max power at S.L. [sec] – 3-5;
- Internal/external fuel volume [l] – 1420/700;
- Load limit [g] – +8/-4;
- Max sustained load factor at S.L. [g] – 3.5;
- Max. airframe service life [Flight Hours] – up to 15,000;
- Max. engine service life – not limited.

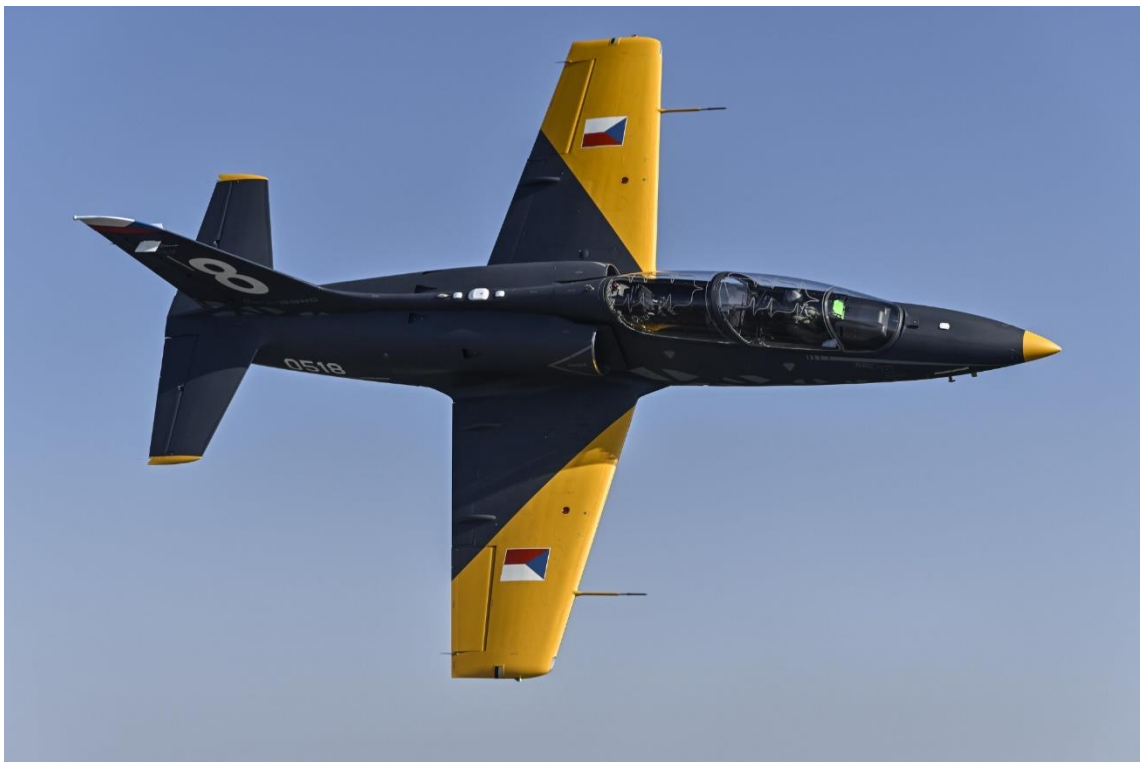

Figure 2. L-39 Skyfox in flight demonstration.
(*Source: Aero Vodochody, 2024b.*)

In its combat variant, the L-39 Skyfox can carry up to 1,640 kg of combat payload distributed on 5 hardpoints and it is capable of employing both guided and unguided weapons (Aero, n.d.-c), some of them expected to equip the F-16 Block 70.

As an air reconnaissance and targeting system, there is the option of mounting a pod equipped with sensors for day and night conditions or targeting equipment in the ventral pylon. The head-up display indication helps pilots to act without distraction in a combat environment. Aircraft Systems include Interconnection with the GBTS (Ground-Based Training System) and MPDS (Mission Planning and Debriefing System). They reduce

pilot workload and improves effectiveness of the training by streamlining briefing and debriefing.

CONCLUSION

In our opinion, within the scope of performing tasks of close air support and air interdiction of operations at full combat load, the L-39 Skyfox capabilities are extremely interesting, resulting in being even superior to combat and training-combat aircraft currently available in Bulgaria, and the qualities of the equipment and weapons determine unparalleled levels of combat effectiveness. This also applies to the performance of RECCE tasks. For Reconnaissance missions, the aircraft can be equipped with EO/IR Sensor (MX-15D Wescam or similar type) or others type of mission equipment and sensors. In this area, the L-39 Skyfox would fill the huge information deficit in the Bulgarian army.

In modern combat conditions, it is increasingly necessary to intercept low-speed targets including UAV. This practice is also valid for Bulgaria in recent years with the proven difficulties of doing this with supersonic interceptors. Not to mention the cost of performing such a task, which is many times lower when using L-39 Skyfox type aircraft. For comparison, the combat radius of the aircraft when performing an interception of an air target can reach 600 km, and the duration of duty in an area can exceed 2.0 hours. The time required to intercept a target within a radius of up to 100 km at an average altitude from the moment of the signal submission is comparable to that of the F-16 and MiG-29. In addition, the dimensions of the aircraft is fully compatible with the shelters available at Bulgarian airbases.

With these indicators, the L-39 Skyfox can successfully be considered as an option to replace the L-39ZA and Su-25 in service in Bulgaria. It has the ability to complement to a considerable extent the performance of air policing tasks together with the MiG-29, and then with the F-16 Block 70. Thus, with a single platform, the tasks currently performed by three types of aircraft can be covered with a higher degree of efficiency, which would reduce the operational costs of aviation equipment in the Air Force by almost as many times. For these reasons the L-39 Skyfox represent an acceptable solution for the Bulgarian Air Force and tax payers.

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