

# ASPECTS RELATED TO THE VERSATILITY OF THE F-16 MLU AIRCRAFT

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**Abstract:** *The intelligent use of the armament capabilities of the modernized F16 aerial platform, combined with the gradual training of the pilots, gives Romania a plus in the fulfillment of the missions assigned to the Air Force. Increasing the number of F16 aircraft from 17 to 49, diversifying armament capacities, training aeronautical personnel and the sustained, pragmatic use of these resources for a few years is bound to enable the Romanian Air Force to gradually advance towards higher generation aircraft.*

**Keywords:** *agility, variants of armament, transition period, engagement.*

## 1. INTRODUCTION

The strategy of modernizing Romania's combat aircraft fleet, as observed, broadly included the stages: the first is represented by the staggered purchase of 17 F-16 aircraft to equip a squadron (Portugal) in conjunction with the training of aeronautical personnel and the preparation of the infrastructure for the new technique; the second stage consisted in the introduction into combat service of the F16 plane in parallel with the MiG-21 plane (which was gradually abandoned); a third stage is the addition of 32 F16 aircraft (Norway), in order to obtain a consistent vertical combat component, the numerical capacity reaching 49 F16 aircraft corresponding to three squadrons that will ensure the missions of the air forces, especially those of the air police and the last stage will be reached by equipping the F-35 aircraft around 2030 according to the CSAT decision, at which time the F-16s will be gradually withdrawn from operation [1]. Returning to the current context, the 32 aircraft purchased from Norway are in the M 6.5.2 configuration, superior to the 17 aircraft in the M 5.2 R configuration [1,2].

The 49 Romanian aircraft will gradually be upgraded to AEROSTAR in a superior M. 6. X configuration, according to the Romanian Ministry of Defence [2].

## 2. THE VERSATILITY OF THE F-16 AIRCRAFT AND ALTERNATIVE ROLES

The essential added value of the F-16 plane is its versatility. The aircraft, designed as a light supersonic combat aircraft, can be armed with a wide range of weapons, such as air-to-air missiles of the latest generation, with increased accuracy and range, with high jamming protection, bombs and intelligent guided or classic munitions.

The ability to use of active electronic countermeasures to avoid enemy radars or passive radars such as electromagnetic dipoles or thermal traps should not be omitted either.

The F-16 is equipped with advanced optoelectronic sensors, including a multimode radar system that provides an unprecedented level of situational awareness.

An important sensor for the destruction of ground or aerial targets is the versatile and advanced AN/APG-66(V)2 radar, with good capabilities for searching, tracking and framing targets in multiple scenarios.

The AN/APG-66(V)2 radar is the main sensor for both air-to-air and air-to-ground targets, providing the pilot with information on the combat situation and possibilities for target identification [3,4,5].

The AN/APG-66(V)2 on-board radar has multiple operating modes, allowing the F-16A/B MLU Block 15 to adapt to various mission situations. Some of its key roles are:

**1. Air-to-air interception modes:**

a. Track While Scan (TWS): In this situation, the radar can simultaneously track multiple aerial targets while scanning the airspace for additional threats [4].

b. Range While Search (RWS): RWS mode allows scanning over a wide area for possible targets with ranging to them [5].

c. Single Target Track (STT): when the radar locks on a target. This mode provides precise target tracking, allowing the aircraft to hit the selected enemy with precision-guided munitions [3,4,5].

**2. Air-to-ground interception [3,4,5] :**

a. Ground Moving Target Indication (GMTI): GMTI mode allows the radar to detect and track moving ground targets, even in crowded environments [4].

b. Synthetic Aperture Radar (SAR): by using SAR technology, the radar can form high-resolution radar images of the Earth's surface, enabling accurate target identification [4].

In essence, the presented radar is capable and adaptable, leading to a significant increase in the combat capability of the F-16. We can point out as a plus of this radar: advanced features that allow the activation of last-generation missiles, multiple operating modes and increased resistance to jamming, which makes the F-16A/B MLU Block 15 a feared multi-role fighter. As a minus we can point to the fact that a radar with a larger range of action would be required [3,4,5].

### 3. SOME OF THE ADVANCED WEAPONS OF THE F-16 MLU AIRCRAFT

Among the on-board weapons of the F 16 A/B MLU, we mention:

1) *Air-to-air missiles:*

- AIM-9 Sidewinder, short-range missile, self-guided in infrared, fig.1 [5].

The missile used mainly on aerial targets, has good maneuverability with the possibility of tracking targets from various angles, increased resistance to jamming.

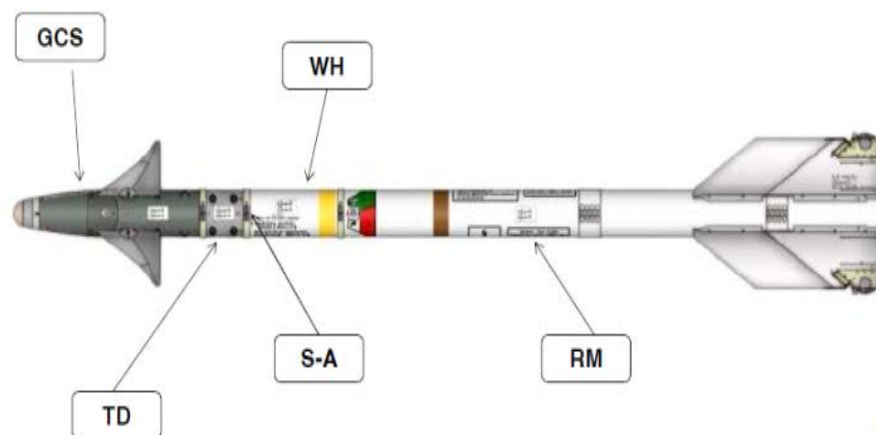


FIG.1 AIM-9 Sidewinder [5]

The rocket is composed of five major sections: 1. Guidance Control Section (GCS) 2. Target Detector (TD) 3. Safety arming device (S-A) 4. Focos (WH) 5. Rocket motor (RM) [5,6].

-AIM-120 AMRAAM, medium-range missile, with active radar type action principle.

The rocket is part of the range of weapons dedicated to aerial supremacy, used mainly on aerial targets, it has its own radar-type guidance system with high target tracking accuracy and good jamming protection [6].

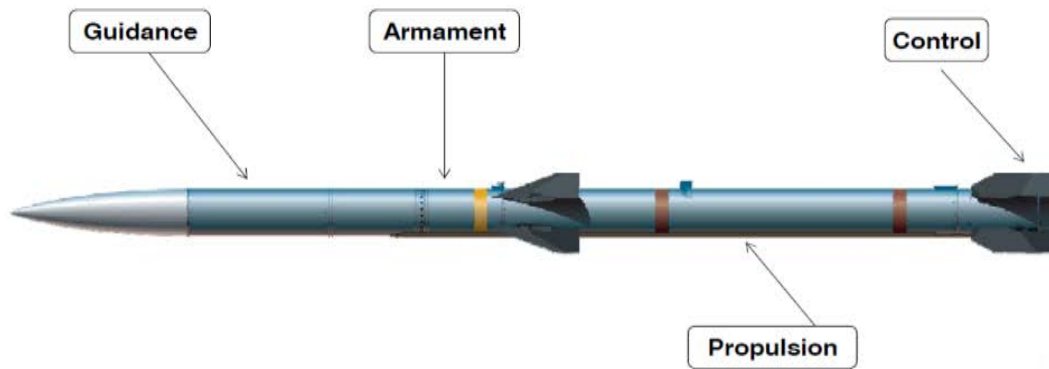


FIG.2 AIM-120 AMRAAM [6]

Below, we have illustrated an arming option using the two types of missiles in a possible air interdiction mission:

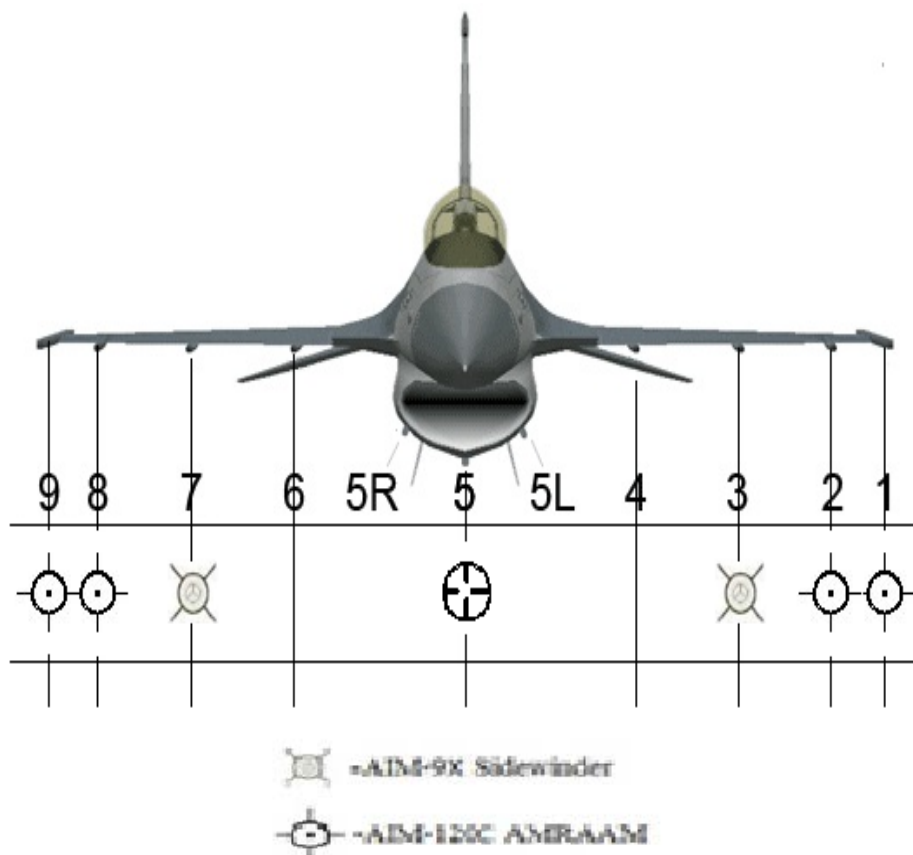


FIG.3 Configuration of the ground attack variant [6.7]

## 2) Air-to-ground weapons:

– Air-to-ground missile/AGM-65 Maverick, which relies on 3 types of sensors: infrared, laser and video camera. The composition of the rocket is modular, which allows it to be assembled in various configurations, depending on the mission. The missile has an increased striking power against a multitude of types of armored or unarmored, tactical, air defense targets, ships, mobile transport systems, warehouses, communication points or troop management [7].



FIG. 4 AGM-65 Maverick [7]

The F-16 MLU allows for the integration of new advanced weapons systems, which leads to the permanent increase of the aircraft's capacity, as well as to a higher efficiency in combating threats and increased versatility, allowing for the increase of omni-role functions. This integration enables precise targeting, a wider range of weapon selections and threat engagement methods in both air-to-air and air-to-surface situations.

We consider the following possibilities:

The maximum efficiency ( $E$ ) is considered as the sum of the proposed targets ( $\sum_{i=1}^n n_i$ ) that must be hit and the destruction power ( $\Omega_i$ ), corroborated by the exits of the aircraft ( $\sum_{j=1}^n i_j$ ) multiplied by the number of aircraft per exit ( $M$ ) [8]:

$$\Omega_i = \frac{\sum_{k=1}^n p_k}{N} \quad [8] \quad (1)$$

Where

$$E = \frac{\sum_{i=1}^n n_i + \Omega_i}{\sum_{j=1}^n i_j \cdot M} \quad [8] \quad (2)$$

$\sum_{k=1}^n p_k$  is the total number of attacks/objectives required to eliminate the chosen targets – the number of objectives [8].

We have:

3 targets, 6 F-16 aircraft scheduled in 3 departures of 2 aircraft each.

The following armament is used: AGM-65 H.

$$\Omega_i = \frac{10}{3} = 3,33$$

$$E_M = \frac{\sum_{i=1}^n n_i + \Omega_i}{\sum_{j=1}^n i_j \cdot M} = \frac{6,33}{9} = 70\%$$

The acceptable yield of 70% is therefore 2 hits for the first target, 3 for the second target, 5 for the third (and a total of 10).

#### 4. CONCLUSIONS

Permanently sustained efforts to implement advanced weapons technologies such as missiles and guided bombs with improved precision and increased jamming protection are recommended.

As the missions may vary according to the new situations and requirements, it is recommended to ensure increased flexibility and adaptability in the sense of diversifying the armament of aircraft equipped with intelligent ammunition and with a wider effective range of action.

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