LÁSZLÓ KOVÁCS

# HIGH-TECH IN ELECTRONIC WARFARE: THE EF-18G ELECTRONIC ATTACK FIGHTER

# CSÚCSTECHNOLÓGIA AZ ELEKTRONIKAI HADVISELÉSBEN: AZ EF-18G ELEKTRONIKAI ELLENTEVÉKENYSÉGI REPÜLŐGÉP

This paper main goal is to present the EF-18G new electronic attack fighter. The modified version of F-18 Hornet will replace the EA-6B Prowler has served from the Vietnam War in the US Navy. This new fighter has many high-tech electronic warfare assets and capabilities on board which allows it to give adequate answers for the new requirements on today's and tomorrow's battlefield. Keywords: EF-18G Growler, electronic warfare ~ EF-18G Growler.

Jelen írás fő célja, hogy bemutassa az új EF-18G elektronikai ellentevékenységi vadászrepülőgépet. Az F-18 Hornet repülőgép módosított változata váltja le az US Navy vietnámi háború óta szolgálatban lévő EA-6B Prowler repülőgépét. Az új vadászgép számos olyan high-tech elektronikai hadviselési berendezéssel és képességgel rendelkezik, amelyek lehetővé teszik számára, hogy megfelelő válaszokat adjon napjaink és a jövő harcmezején megjelenő új kihívásokra.

## Electronic Warfare in the Air Force

The electronic warfare is military actions involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy's electronic assets. Electronic warfare consists of three major parts: electronic warfare support, electronic attack and electronic protection. The electronic warfare support involving actions tasked by, or under direct control of, an operational commander to search for, intercept, identify, and locate or localize sources of intentional and unintentional

radiated electromagnetic energy for the purpose of instantaneous threat recognition, targeting, planning and conduct of future military operations. Electronic attack as a part of electronic warfare involving the use of electromagnetic energy, directed energy, or antiradiation weapons to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capabilities. The third part of electronic warfare is the electronic protection involving actions taken to protect personnel, facilities, and equipment from any effects of friendly or enemy use of the electromagnetic spectrum that degrade, neutralize, or destroy friendly combat capability. The electronic warfare has major roles in the Air Force and its operations. Airborne integrated electronic warfare systems are vital to survive any missions in case of fighter airplanes as well as transport aircrafts. These onboard and integrated electronic warfare systems provide functions for [1]:

— Detection and localization of threat signals.
— Signal processing for threat identification.
— Automatic selection of appropriate countermeasures reaction.

To execute these tasks there are many onboard electronic warfare assets:

— Radar warning receivers.
— Laser warning receivers.
— Missile approach warning sensors.
— Intelligent countermeasure dispensers.
  - Infra-red (flare) dispenser.
  - Dipole (chaff) dispenser.
— Decoy.
— Radar jammer.

A typical integrated onboard electronic warfare system is shown in Figure 1.

Other electronic warfare function in the air force is the Suppression of Enemy Air Defenses (SEAD). SEAD is “that activity which neutralizes temporarily degrades or destroys enemy air defenses by a destructive and/or disruptive means.” [2]

SEAD “has long been in critical mission essential to US and allied air superiority and all that springs from it. … Non-lethal means of SEAD have included the use of support jamming aircraft, such as the Navy’s EA-6B Prowler, to protect packages of strike aircraft by temporarily blinding enemy early-warning, SAM and anti aircraft artillery (AAA) radars.” [3]

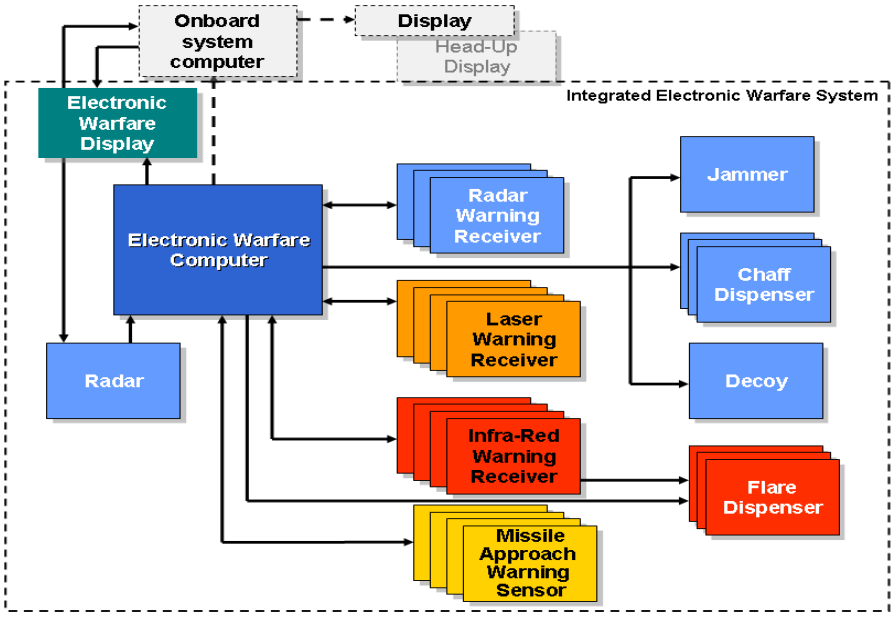


Figure 1.
Onboard integrated electronic warfare system

## The Ancestor: EA-6B Prowler

The EA-6B Prowler is a modification version of the basic A-6 Intruder airframe. Its development started in 1966 as a replacement for EKA-3B Skywarriors for the US Navy. It debuted at the end of Vietnam War and was used in the first Gulf War in 1991 and Kosovo in the middle of the '90s.

The EA-6B's primary mission is to protect surface units and other aircraft of navy by jamming the enemy radars and communications. During the last decades the EA-6B has became an integral part of the fleet's defense. When the EF-111 Raven was retired the EA-6B was left as the only radar jammer in the US. [4]

The Prowler has been used against remote controlled improvised explosive devices (RCIED) in today's current conflict in Iraq and Afghanistan.

Picture 1.
EA-6B Prowler [5]

Prowler's receivers collect radio signals from the ground, which are analyzed by an on-board computer. As threats are identified, the plane's crew is able to block the signal with electromagnetic energy. To execute this task it is necessary to load the plane's computer with hostile signals' parameters before the mission. The jammer can block transmissions across wide range of frequencies, everything from TV and radio signals to mobile phones and wireless internet connections. [6] Prowler's specifications are shown in Table 1.

| | |
|---|---|
| Manufacturer | Grumman Aircraft Corporation |
| Power plant | Two Pratt & Whitney<br>J52-P408 turbojet engines |
| Thrust | 4767 kilograms per engine |
| Length | 17,98 meters |
| Height | 4,57 meters |
| Wing span | 16,15 meters |
| Speed | Maximum 0,99 Mach |
| Ceiling | Maximum 12,186 meters |
| Armament | ALQ-99 Tactical Jamming System (TJS); High Speed Anti-Radiation Missile (HARM) |

Table 1.
EA-6B's specifications [4]

## Electronic Warfare Capabilities of the EF-18G Growler

The EA-18Growler is the Navy's replacement for the EA-6B Airborne Electronic Attack aircraft. The Boeing Company delivered the first EA-18G Growler plane to the test processes in September 2006. The Boeing and Northrop Grumman set up an Improved Capabilities (ICAP)-III Airborne Electronic Attack (AEA) system onboard. This allows the Navy to deliver the next generation Airborne Electronic Attack capability at reduced cost and in the shortest possible timeframe. Since the EA-18G is very similar with the Super Hornet it would be expected to significantly reduce support and training costs. The Marine Corps is examining a range of possibilities that will provide the needed capability. [7] The Navy has ordered a total of 57 aircraft. [8] According to the original plans the new planes scheduled to earn operational capability in 2009 and will replace the Prowlers until 2013. The EA-18G is the fourth most important variant of the FA-18 family. It will provide many sophisticated capabilities: to detect, identify, locate, and suppress hostile radars or communication emitters.


Picture 2.
The EF-18 Growler Aircraft [12]

The EA-18G will perform electronic surveillance and electronic attack of enemy threat radars and communications nets in the full-electromagnetic spectrum. The Growler will have the capability to operate autonomously, and it could be a major node in a network-centric operation. It will provide accurate emitter target information for employment of onboard suppression weapons such as the High-Speed Anti-Radiation Missile (HARM).[7] The new EF-18G Growler represents a significant increase in capability over the former electronic warfare airplanes with the following assets and systems:

— Active Electronically Scanned Array (AESA) radar[1] for electronic support and electronic attack.
— Digital Measurement Receiver in ALQ-218 (v)2.
— Greater frequency coverage and power with new ALQ-227
— Communication Countermeasures Set.
— Nine weapons stations for more payloads.
— Greater agility and self-defense.
— Greater reliability and lower maintenance costs.
— Joint Helmet Mounted Cueing System. [10]

The electronic warfare system integrates the most up to date electronic attack technology. These high-tech electronic warfare assets onboard are shown in Figure 2.

The APG-79 Active Electronically Scanned Array radar has increased detection range. It tracks twice as many targets as existing systems. This radar can provide high resolution Synthetic-Aperture Radar (SAR) map at long standoff ranges, and has simultaneous air-to-air and air-to-surface tracking capability. With these enhanced capabilities, aircrews can detect and identify targets beyond the reach of most missiles. The APG-79's long standoff range also allows more time for persistent target observation, information sharing, and assessment by commanders before critical decisions are made. It provides greatly increased aircraft and aircrew effectiveness and survivability. [13]

[1] Active Electronically Scanned Array (AESA) „also known as active phased array radar is a type of phased array radar whose transmitter and receiver functions are composed of numerous small solid-state transmit/receive (T/R) modules. AESAs aim their "beam" by broadcasting a number of different frequencies of coherent radio energy that interfere constructively at certain angles in front of the antenna. They improve on the older passive electronically scanned radars by spreading their broadcasts out across a band of frequencies, which makes it very difficult to detect over background noise. AESAs allow ships and aircraft to broadcast powerful radar signals while still remaining stealthy." [11]

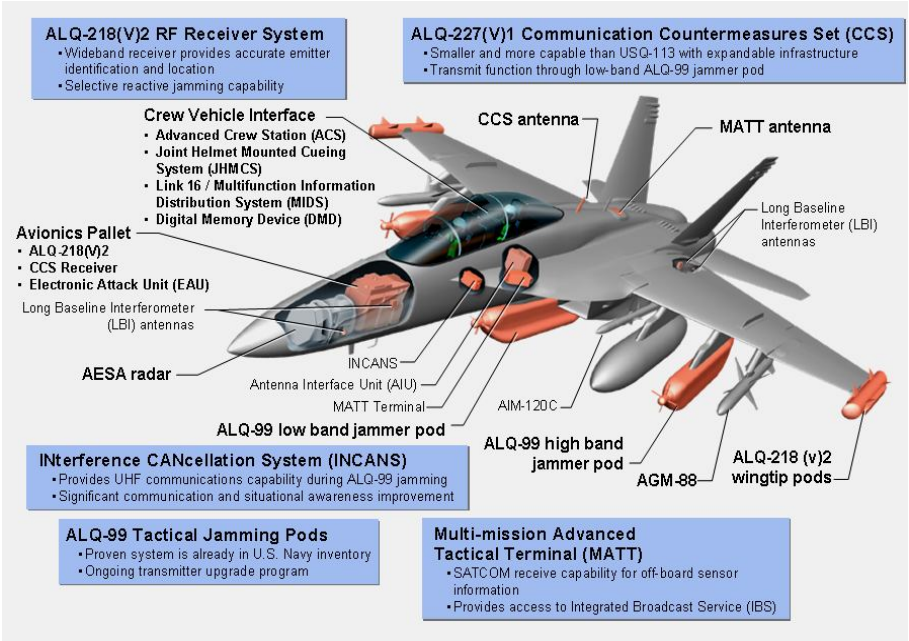


Figure 2.
The EF-18 Growler's EW assets [10]

The APG-79's multi-mission capabilities:

— Air-to-air and air-to-ground with one search-track mode.
— Detect/track multiple targets.
— Longer range.
— Improved resolution.
— Resource manager optimizes performance, reduces workload.
— Connectivity with on-board and off-board sensors.
— Advanced sensor integration and sensor fusion. [10]

The AN/ALQ-218(v)2 Tactical Jamming Receiver (TJR) system is often teamed with variants of the AN/ALQ-99 tactical jamming system. The ALQ-128's wideband receiver provides accurate emitter identification and location information. It is able to select reactive and pre-emptive narrowband jamming, enabling the EA-18G to electronically attack enemy communications, even before its presence is detected. These capabilities are also necessary for the AGM-88 anti-radiation missile in its range-known firing mode. A further requirement is the ability to function during concurrent surveillance, jamming and missile firing operations. [14]


Picture 3.
The EF-18 Growler's EW assets are on pylons.
ALQ-218 is on wingtip and ALQ-99 is on center pylon. [9]

The AN/ALQ-99 Tactical Jamming System was the first fully integrated computer controlled support jamming system. It intercepts and automatically processes radar signals. After the analyzing process the jammer manages the system's transmitters to effectively jam large numbers of diverse radar threats with very high effective radiated power. [15]

The ALQ-227(v)1 Communication Countermeasures Set is smaller and more capable than former USQ-113 with expandable infrastructure. It transmits function through low-band ALQ-99 jammer pod. [10]

| | |
|---|---|
| Manufacturer | Boeing and Northrop Grumman |
| Power plant | General Electric<br>F414-GE-400 turbofan engines |
| Thrust | 98 kN |
| Length | 18,35 meters |
| Height | 4,88 meters |
| Wing span | 13,69 meters |
| Speed | 1,6 mach |
| Ceiling | 15,240 meters |

| | |
|---|---|
| Armament | ALQ-99 Tactical Jamming System (TJS);<br>ALQ-218 Tactical Jamming Receiver (TJR)<br>ALQ-227(v)1 Communication Countermeasures Set (CCS)<br>High Speed Anti-Radiation Missile (HARM) |

Table 2.
EF-18G's specifications [12]

## Summary

The new EA-18G Growler U.S. Navy Airborne Electronic Attack Aircraft combines the next generation of electronic attack capability with the combat-proven Block II F/A-18F Super Hornet.

This new aircraft is scheduled to replace all Navy EA-6B Prowlers by 2013. In the background there are many strong industry companies as Boeing, Northrop-Grumman, Raytheon, and General Electric.

The Growler integrates the latest electronic attack technologies onboard which represent the new and enhanced capabilities of electronic warfare assets.

With the sophisticated systems it significantly increases situational awareness, and play as a node in the network centric warfare.

The EA-18G Growler is tomorrow's high-tech airborne electronic attack platform.

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