AOC ADVOCACY

AOC ISSUE REPORT

E-2 HAWKEYE ELECTRONIC WARFARE SUPPORT INTEGRATION

BACKGROUND

The E-2 Hawkeye is an American all-weather, carrier-capable tactical airborne early warning and control (AEW/C) aircraft. Developed in the late 1950s and early 1960s, its mission was to be an airborne radar picket system to detect aircraft, ships and vehicles at long ranges and perform command and control of the battlespace in an air engagement by directing fighter and attack aircraft strikes. The E-2 has also been used to carry out surveillance, including over ground targets and frequently perform command and control, battle management (C2BM) functions similar to air traffic control. The most recent variant of the E-2, currently still in production, is the E-2D Advanced Hawkeye. It incorporated arguably the most capable airborne sensor systems ever designed and produced—and the core of the air defense mission of the carrier strike group.

One can immediately understand the traditional role of the E-2. A strike package, or no-fly zone package launches from the carrier. The E-2, in cooperation with cruisers and destroyers attached to the carrier battle group, provide an air and surface picture, directing fighters to enemy aircraft, and also helping to provide the combat identification (positive identification), of enemy aircraft, which allows for proper weapon target pairing. It was the APS-145 radar (and the new APY-9 radar) on the spinning disk atop the E-2 that was the key detection system.

But with the increased capability of the E-2, especially with its AN/ALQ-217 electronic support measures system, the E-2 is able to be a key player in the electronic warfare aspects of air operations. Integrating this passive sensor across the carrier strike group is the key to fully leveraging their potential and makes for a more capable and survivable naval force.

THE ELECTROMAGNETIC SPECTRUM AND AIR OPERATIONS

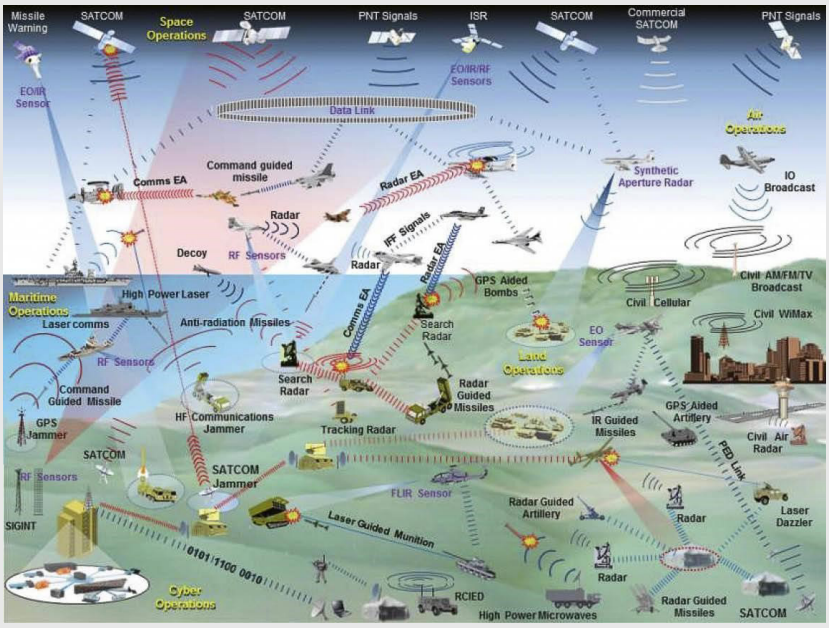
The dominance of American air power since the Vietnam War is one of the seminal accomplishments of the U.S. military in the past forty years. Only a handful of American aircraft have been shot down by enemy fire. And while students of air power will debate whether or not American forces have been able to achieve air supremacy or just air superiority, the results from Iraq to the Balkans to Afghanistan to Libya to Syria are impressive-- and cannot be assumed with today's emerging, near-peer adversaries.

In laymen's terms, when thinking of air operations, the challenge for American forces is always to fly aircraft without a threat of enemy interference (doctrinally known as prohibitive interference). An enemy force facing American air forces will rely on fighter aircraft, though that has not proved successful in any measurable way since the Vietnam War, or ground based systems - what is doctrinally known as an

integrated air defense - comprised of surface-to-air missiles and anti-aircraft artillery, all provided information from a network of radar and other sensors.'

A generation ago, a traditional integrated air defense system (IADS) was comprised of long-distance early warning radars tied into target tracking radar systems with surface-to-air missiles at the ready prepared to shoot their missiles at any incoming American aircraft. And this has changed little, though the technology of IADS have matured significantly.American tactics would barrage jam early warning radars, seeking to deny the enemy IADS a picture of the air package, be it a strike package or a no-fly zone enforcement package. But enemy radars have become more sophisticated, and as IADS have grown more complex, it has become more and more important that American forces have an accurate picture of not just what radars and passive sensors "might" be contributing to the enemy air picture, the effectiveness of a suppression of enemy air defense (SEAD) mission demands that American forces dominate the electromagnetic spectrum. Knowing in real time what enemy radars and sensors are active and passing that information to other parts of the IADS becomes a center of gravity in itself.

American electronic warfare support (ES) systems have matured in capability. Nearly every aircraft and unmanned system have sensors that are monitoring the EW spectrum. Depending on their location and capability, some systems are better positioned than others to contribute to the EW picture. The picture to the right depicts the complexity of the air battlespace, and one can see immediately that the challenge is to integrate all these sensor inputs into an accurate EW picture of the enemy IADS.



No longer is the EW picture pieced together by crews on board an RC-135 Rivet Joint or an EP-3, with that platform providing threat warnings over a dedicated radio. We have devised links that share this information, just like the air picture of airborne threats is shared among all players. But in such a cluttered electromagnetic environment, the challenge is creating an integrated and accurate picture. A pilot flying an F-35 is likely mostly (and perhaps only) interested in radars that are an immediate or soon-to-be immediate threat. The rest is just noise to the F-35 pilot.

FUSING, FILTERING, CREATING A COMMON OPERATING PICTURE OF THE EMS

So how to collate all the various inputs of information and then share it out among friendly forces? Most of the information-sharing in air operations is via Link 16, a military tactical datalink system that allows military aircraft as well as ships and ground forces to exchange their tactical picture in near-real time. Link 16 also supports the exchange of text messages, imagery data and it also provides two channels of digital voice information. The text messages are coded "J-series" messages which are binary data words grouped in functional areas, and allocated to network participation groups (NPG) (virtual networks), specifically:

- PPLI, or Precise Participant Location and Identification (network participation groups 5 and 6),
- Surveillance (network participation group 7),
- Command (Mission Management/Weapons Coordination) (network participation group 8),
- (Aircraft) Control (network participation group 9),
- Electronic Warfare & Coordination (network participation group 10)

When thinking about the air picture, one can imagine how to build a common operational picture - the inputs of an E-2 radar, the Aegis system on a guided missile cruiser or destroyer, and the tracks seen by the radars of airborne F/A-18 fighters are all fused into picture that reflects the reality of airborne assets, be they friendly, neutral (like airliners), or potential enemy. The picture at the right depicts what a fight pilot might see displayed as the various inputs are fused into a common picture.

But what about the EW picture? How to discern whether or not an enemy early warning radar is emitting, or the tracking radar of an S-400 (also known as the SA-21 Growler)? It is possible that the E-2's ALQ-217 system can provide inputs to the EW picture, along with satellite systems, the systems aboard an EP-3 or RC-135, not to mention the systems of the EA-18G Growler. The challenge is to integrate all those inputs into a fused EW common operational picture. Future plans have the ALQ-217 systems integrated into the network participation group 10 (NPG-10, or the EW NPG on Link 16).

The challenge going forward is to discern what EMS activity is of interest in an increasingly congested spectrum, filtering, properly identifying, and locating that EMS activity, and then sharing that information throughout the battlespace - from time-sensitive threat warnings to fighters flying within threat rings to intelligence assets that will categorize and continue to build the libraries of enemy EMS activities.

No longer is a platform a single-mission platform. Every player on the battlefield is a sensor, and that sensor data must be shared to produce informed and actionable information. It will make our forces more capable and survivable in an ever-increasing contested environment.