(Scroll down to get to the article)

The gang that created the Waypoint magazine and resurrected the computer version of the Harpoon naval & aerial warfare simulator in the early 2000s, strikes again!

Command: Modern Air / Naval Operations is the high-fidelity warfare simulator from **WarfareSims.com**. Combining massive scale (the entire earth is your theater) and incredible depth and breadth (conflicts from 1946 to 2020+) with unprecedented detail, realism and accuracy, a powerful Windows interface and challenging AI, Command has set the new standard for air-naval war games.

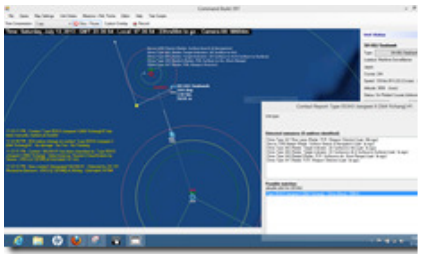
Praised by military professionals, hobbyists and the gaming press alike, Command swept the *Wargame Of The Year 2013* awards and shattered sales records in its category:

> **United States Naval Institute:** *"Command will find a following not only among civilian gamers but might have value among military, government, and policy circles as a simulator of modern warfare. […][This] is a game with broad appeal for everyone from casual gamers to government users looking to model unclassified, informal simulations. It likely will be the main choice for hard modern warfare simulators for years to come."*
>
> **Michael Peck, War Is Boring:** *"This isn't just a game. It's a simulation that's as close as many of us will ever get to real Pentagon simulation.* C:MANO*, as fans call it, is a real-time game that boasts an incredibly rich—and unclassified—database of the aircraft and ships of the Cold War and beyond. [...] I strongly suspect that this game won't prove any less accurate than the government's tippity-top-secret simulations."*

Multiple awards.
Over 150 scenarios (as of June 2014).
Thousands of fanatical players.
Tens of thousands of planes, ships, submarines, land units, satellites, weapons, sensors, and other systems.

Command: Modern / Air Naval Operations is available only at Matrix Games.

For more information go to **WarfareSims.com**.

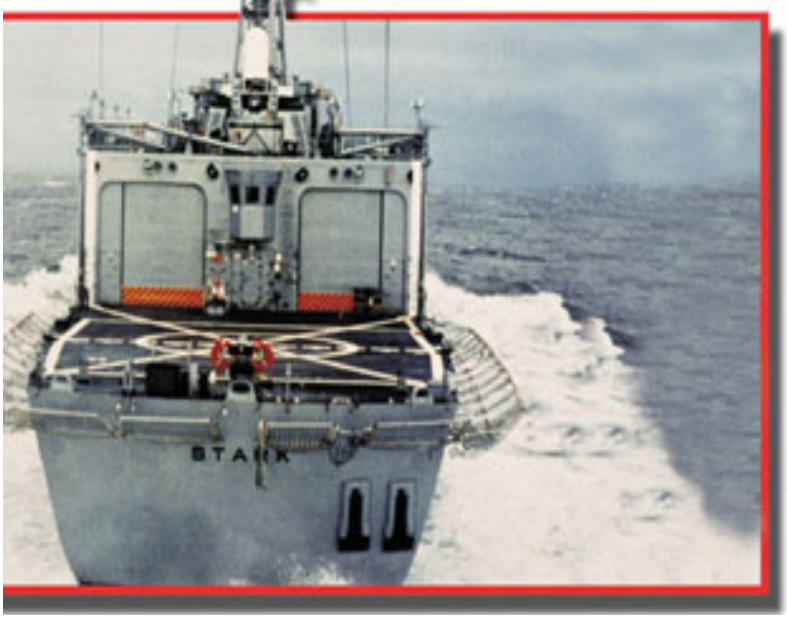


JED SPECIAL

Pocket Cruiser EW

Can the new multi-mission surface combatants weather advanced anti-ship missile threats?

Michael Puttré



The USS Stark (FFG-31) was a dedicated anti-submarine escort ship with some limited air-defence and basic anti-surface warfare capability.
The vulnerabilities of the frigate were underscored when it was hit by two Iraqi Exocet missiles in a case of mistaken identity while on patrol in the Persian Gulf in May 1987. The US Navy subsequently concluded that frigates had no place in its future requirements. File photo

Destroyers - originally torpedo-boat destroyers in the navies of Tsushima and Jutland - once served to protect the capital ships from lighter units that would attack at night from close range. Frigates in the modern usage (as opposed to the days of fighting sail) evolved in the Second World War to protect merchantmen from submarine attack, when they were often referred to as destroyer escorts, at least in US service. During the Cold War, frigates generally were specialist escorts, while destroyers evolved into air-defense vessels. As with all generalizations, there were many exceptions to the rule, and certainly both types of vessels were often capable of engaging a variety of targets, including other surface combatants. And, of course, the operational concept of destroyers and frigates varies widely with the navies that employ them, where a frigate under one flag is a large patrol ship under another - or even a destroyer.

Today, the distinction between frigates and destroyers is less informative than ever. Mostly, this is because frigates and destroyers are the capital assets in many navies. So rather than protecting other ships, these surface combatants are the ships of the line, equipped to engage the enemy on sea, in the air, and on land. Although the battleship is long gone, and the cruiser is fading into history, their spirit lives on in destroyers and frigates. Call them "pocket cruisers."

Here They Come

The anti-ship cruise missile is the chief nemesis of these lighter surface combatants (see *"In Peril on the Sea"*, *JED* January 2002). Experience shows that a hit by a single missile is enough to cripple a destroyer or frigate size ship, leaving it unable to carry on the fight, even if it does not sink it outright. Modern navies and maritime strike forces are festooned with such missiles: Penguin, Exocet, Harpoon, Gabriel, Sea Skua, Otomat, Uran (Switchblade), etc. Moreover, there is a new generation of some very capable missiles that have been tested and are becoming available, some with ramjets that are supersonic and low flying, with high-g maneuverability and enough of a warhead to put a pretty good size hole in a ship: Moskit (SS-N-22 Sunburn), Yakhont, C-101 (Saw Horse). Many of the missiles can be fired from land-based platforms, such as rotary- and fixed-wing aircraft, shore batteries, or from "brown water" boats and patrol craft. So even if ships today are not likely to find themselves in blue water exchanging salvoes of anti-ship missiles, they are still at grave risk in littoral encounters.

The first line of defense against anti-ship cruise missiles hangs on the ability of a ship to detect them far enough out so that she can deny the inbounds their initial targeting information. At this stage, the enemy knows roughly where

you are, possibly from a satellite-based radar, maritime-patrol aircraft, or some other reconnaissance asset. The missiles are cruising at wave-top level, flying at high subsonic to supersonic speeds with their own radars off, using inertial navigation or GPS, and quite possibly receiving mid-course correction from the launching platform or an intermediary via datalink. The missiles are in the air, and they are for all intents and purposes undetectable. The first opportunity for a ship to detect such an inbound threat is when the missile performs its first pop-up maneuver in order to acquire the target with its targeting radar. This point might be 50-100 miles out for some missiles, such as the large cruise missiles developed by the Soviet Union and the new generation of Russian missiles. There is an opportunity here to deny the missile its initial acquisition, but it is a very brief one because then the missile drops back down to sea-skimming mode again. (It is interesting to note that the missile is essentially following the same attack profile as an aircraft intending to attack with short-range anti-ship missiles.) In that moment, did the ship see the missile? Was she able to jam its radar seeker? Probably not, and if the target is a US ship, then jamming wouldn't have been a priority anyway.

Why? "Unfortunately, there is a culture in the US Navy, a very high level of belief in the ability of its outgoing missiles to knock down incoming missiles," said one expert who wished to remain anonymous. "Anecdotal evidence from real life says that such belief is a little misplaced. Consider the Standard missile: It comes up out of the vertical launch system of the ship, effectively like a silo, and then it has got to get back down again to engage the threat. It has to pick up the incoming missile against the water, and then hit from the top, which is not easy. One of the jokes that isn't really funny is: *"How can you tell who the EW guys are on a ship when there are missiles coming in? They have their lifejackets on."*

A US Arleigh Burke-class destroyer launches a Standard air-defense missile from a vertical launcher. Although air defense of the battle group is its primary mission, the guided-missile destroyer is a multi-purpose surface combatant capable of engaging all manner of threats on land, at sea, and in the air. The two antenna arrays for its AN/SLQ-32(V)3 electronic-warfare systems are visible to the left of the octagonal phased-array radar and just outside the smoke plume. Destroyers in this class prior to DDG-69 are equipped with SLQ-32(V)2, which has no active jamming component. Northrop Grumman photo

An EW specialist with the US Navy's Fleet Information Warfare Center (Norfolk, VA) said that this was a very common attitude in the service. "Primarily it comes down to the commanding officer's thinking," he said. "Some COs are gunslingers. They may think: 'I don't care if I have the best EW system in the world. If I can't see that missile blow up, if I can't see that destruction, it doesn't suit me. I'm going to shoot it, regardless'."

This culture is not unique to the US. In the UK, the Type 45 destroyer is currently not slated to receive an active EW jamming system to counter anti-ship missiles. A Radar Electronic Support Measures (RESM) system is to be supplied by Thales Defence Ltd., (Crawley, UK) however the active jammer was considered and dropped (see *"UK's Type 45 Program Steams Ahead", JED* May 2001). This is because of the faith professed in the vessel's Principal Anti-Air Missile System (PAAMS), a collaborative effort of the UK, France, and Italy consisting of a 48-cell Sylver vertical- launch system for Aster missiles, the Sampson multi-function radar for surveillance and fire control, the S1850 long-range radar for air and surface search, and the command and control system. Advocates say the PAAMS has been designed to match and defeat the evolving threat of attacks from sophisticated anti-ship missiles and to deal with attacks by aircraft. It can control a substantial number of missiles in the air at once, thus making it difficult for attackers to swamp fleet air defenses.

It is very interesting to note that the UK Type 45 program is a splinter from the defunct Horizon Common Frigate Program that sought to develop a single class of surface combatant for the navies of the UK, France, and Italy. France and Italy have continued with their development of Horizon after the UK withdrew in 1999 to build the Type 45 instead. The Horizon and Type 45 are very similar in appearance, displacement, and role (yet the Horizon is classified as a frigate). The Horizon will also carry the Sylver vertical-launch system with Aster missiles. But unlike the Type 45, the frigate will have a full EW suite, with the passive ESM system supplied by Thales Airborne Systems (Paris, France) and the active jamming component coming from Elettronica (Rome, Italy).

Another high-profile European surface-combatant program is the F-100 frigate, under development by a partnership of and E.N. Bazan (Ferrol, Spain) and Lockheed Martin Surface Systems (Moorestown, NJ). The F-100 frigates are primarily for area air-defense of a task force or battle group and are envisioned as participants in coalition fleet deployments. These vessels carry the AN/SPY-1 Aegis radar and associated combat system and, as such, are unique among frigate classes in the world. They carry the Aldebaran ESM system and Elnath radar jammer, both from Indra (Madrid, Spain). Primary armament is a 48-well vertical-launch system with Standard missiles, along with eight Harpoon missiles in two quad launchers. Pound for pound, the F-100s rank with the most capable surface combatants in the world and are frigates in name only.

Budget-Conscious EW Doctrine

According to the US Fleet Information Warfare Center, the official doctrine in the US Navy is to use an integrated hard-kill/soft-kill approach to stopping anti-ship missiles that is very closely tailored to the characteristics of different warships. For example, the Navy has a Tactical Memorandum (Tacmemo) for the DDG-51 (Arleigh Burke) class that describes specific techniques, tactics, and procedures of how they are going to fight that ship, how they are going to skew the ship to the threat based on the total power out, or the hot and cold spots in the radar cross-section. Is it better to have the threat to port forward or the starboard aft quadrant? These questions are integrated into that Tacmemo, and this forms the basis of the ship's battle bill, which describe procedures every station will follow in tactical situations. The crews train to it. The training goes from single-ship engagements on up to the battle-group environment. Test scenarios are constantly being developed and run to see how well the crew can fight the ship under different situations.

The AN/SLQ-32(V)5 installation on US Oliver Hazard Perry-class frigates consists of the SLQ-32(V)2 passive ESM array (above) and the Sidekick active jammer (below). The Sidekick was developed in a crash six-month program after the USS Stark was hit by two Iraqi Exocet missiles in May 1987. The existing SLQ-32(V)3 system with an integral active jammer was too heavy for the class. Raytheon photo

"The DDG-51 class destroyers in the US Navy are designed from the hull up with a low radar cross-section and then we combine that with the special countermeasures coatings that you can use to reduce it even further," said the EW spacialist at the Fleet Information Warfare Center. The French La Fayette class of multi-role frigates follows the same principle, with radical stealthy lines and radar-absorbing coatings. "That's part of the soft-kill: if you can't detect a target with a low radar cross-section, it's not a valid target."

Whether or not to put an active jammer (electronic attack) component to the EW suite boils down to money and weight. It was not possible to put the AN/SLQ-32(V)3 on a frigate. So what they did was come up with the Sidekick, the AN/SLQ-32(V)5 system for frigates because that system was able to fit it. But a key issue is that it wasn't until the USS *Stark* (FFG-31) was hit by two Exocet missiles fired from an Iraqi Mirage in May 1987 that the Navy was moved to put (V)5s on that class. Up to that point, the frigates were equipped with the Raytheon (Goleta, CA) AN/SLQ-32A(V)2 ESM system, which had no capability for countering the threats it detected. After the *Stark* incident, the Navy and Raytheon initiated a "Rapid Development Capability" project, which led to the fielding of Sidekick in six months. (The AN/SLQ-32A[V]2 in combination with Sidekick is designated AN/SLQ-32[V]5.) The Sidekick system consists of an additional equipment rack and support equipment, which are located in the EW equipment room, and two additional outboard enclosures containing the transmitter units. The transmitter units located on the port and starboard sides each provide 180 degrees of coverage. This demonstrates how effectively the Navy can move on EW when it perceives a need. Unfortunately, 37 sailors had to lose their lives before that need reached the awareness levels of decision makers with budget authority. Repairs to the *Stark* cost $90 million. (The ship was decommissioned in 1999.)

Despite the experience of the *Stark* , the Navy's decision making with regard to putting active countermeasures on warships remains heavily influenced by budget. According to the Fleet Information Warfare Center, the Navy wasn't able to fund SLQ-32(V)3 active countermeasures equipment on every DDG 51 in a class in excess of 50 ships, so installations started at DDG-69. The first 20 didn't get it. A similar dynamic is in play for the AN/SLY-2 Advanced Integrated Electronic Warfare System (AIEWS), the follow-on to the SLQ-32 under development by Lockheed Martin Naval Electronics and Surveillance Systems (Syracuse, NY).

The AIEWS program has a checkered history, with slipping schedules and threats of cancellation amid successful design reviews. However, so-called AIEWS Increment 1, which is the passive ESM components only, is nearly ready for prime time. There is talk that the active jamming component of AIEWS Increment 2, under development by Northrop Grumman (Los Angeles, CA), could be capable of jamming the radars on reconnaissance satellites, in addition to handling existing and future RF threats.

Another interesting element of AIEWS Increment 2 is a capability for countering missiles with IR and electro-optical (EO) seekers. This aspect of the program, known Shipboard Electro- optical Defense System (SHIELDS), was awarded to Lockheed Martin Naval Electronics & Surveillance Systems (Akron, OH) in January 2001. The system is designed to counter not only IR-guided missiles, but also the electro-optically (EO or TV) guided threats, such as the MBDA (Paris, France) Polyphem. John Wojnar, advanced programs business development director, said a lot of the technology developed under the $30-million LIFE program for the US Air Force is being leveraged under the SHIELDS program (see "*LIFE Closes the Loop", JED* July 2001). The common principle to both programs is the

closed-loop IR countermeasures (CLIRCM) approach, where an interrogating laser is used to produce returns off the missile seeker. The signature of the returns is compared to a threat library, and an appropriate jamming technique is created on the fly. The jamming is applied by a second, more powerful laser.

"The naval laser is a higher- powered laser than the one we use in the LIFE program," Wojnar said. "We need to engage the threat at longer ranges. We're going to be pushing the state of the art, looking at a 10- to 20- watt laser for mid-wave." The feeling is that, under recent DARPA mid-IR laser programs, both BAE Systems (Nashua, NH) and TRW (Redondo Beach, CA) developed some very promising designs. And under the LIFE program, BAE Systems actually built a large aircraft multi-band laser source that was tested at the White Sands Missile Range. "We visited both BAE Systems and TRW in the last few weeks, and they are both very confident," Wojnar said.

According to Denny Adams, SHIELDS program manager, the first three years of the program are primarily the risk-reduction effort, to develop long-lead technology required for AIEWS Increment 2, including the mid-wave lasers, but also new sensor technology, the laser rangefinder, and some processing capabilities. "We were involved in AIEWS Increment 1 in 1998; we did a system design for the EO/IR capability," Adams said. "We're going to be doing a systems integration effort for AIEWS Increment 2. This mid-wave IR laser has to meet certain environmental requirements tied to AIEWS."

The phase-one implementation of AIEWS is scheduled to go on the DDG-103 in 2004 or 2005[1]. There is no funding beyond research and development for AIEWS Increment 2, let alone to backfit existing vessels. As one source put it: that's a whole different pocket. And the pocket - how big and whose - remains the decisive factor. "What is the cost going to be for the electronic-attack element of SLY-2?" asked the US Fleet IW Center officer. "We have no idea. Right now we're talking double-digit millions for the passive suite only. So a lot of it has to do with money. When we're talking about 170 combatants in the Navy that are candidates for this system, who has the funds to provide them?"

This is not to say that the Navy is leaving its surface combatants completely unprotected. As indicated, DDG-69 on are equipped with SLQ-32(V)3. There also is reportedly a great deal of satisfaction with the Nulka offboard decoy, produced by BAE Australia (Elizabeth, Australia), as an interim solution. The Nulka is fired from a deck-mounted tube launcher and hovers by means of a rocket while generating decoying emissions intended to seduce active-radar-guided anti-ship missiles. As an offboard system, the Nulka has the ability to defeat a home-on jam threat capability. Of course there are also a variety of expandable countermeasures systems available for surface combatants of all sizes (see "Patterns of Protection", JED August 2001).

In the navies of continental Europe, and other parts of the world, new-build frigates and destroyers are more likely to have an integrated EW suite that includes an active jamming component. This is plainly due to the lower numbers the vessels are acquired in, and the fact that they are likely to be called upon to do a greater variety of tasks, and face a greater variety of threats. "In other navies, the frigate and destroyer is the capital asset," said the US Fleet IW Center officer. "They look at them like, 'That's all we got.' For us, they're missile sponges."

[1] *AIEWS was eventually cancelled on May 2002.*