

Outlaw Viking

BY DAVID READE

The new capabilities brought about by the S-3B has given the aircraft a multitude of new mission opportunities in a world filled with continuing contention since the Gulf War. The S-3B's mission performance surprised everyone, in being able to do what it was supposed to do a little better than was expected. Meanwhile, some key technologies emerged that could be applied to the already advanced intelligence gathering activities of the Viking.

"Outlaw" is a term used specifically to indicate a system under development, and has no significant meaning to this particular Viking aircraft other than to indicate a special operations system is being developed. This Viking enhancement resulted from an identified mission requirement for a battle group asset with advanced surveillance, targeting, connectivity, and endurance capabilities. It is a lethal platform with the survivability to remain outside the surface-to-air threat envelope.

Outlaw Viking is a prototype, proof-of-concept aircraft based on the third generation OASIS system developed for the P-3C. OASIS is an acronym for Over-the-horizon, Airborne Sensor Information System. Applying the description to service with the battle group, Outlaw Viking may be defined a dedicated over-the-horizon command, control, and communications computer-and-intelligence capable equipped S-3. The



OASIS III system aboard the S-3 is specially modified for the smaller aircraft, and incorporated into the TACCO station with minimal impact on the existing S-3B capability.

The system integrates the S-3B's ISAR radar, FLIR, ESM, acoustic sensors, as well as visual location information, with GPS, SATCOM, and data link networks, such as OTCIXS, to create a tactical plot of the operational theater. Additionally, the system provides near real-time standoff surveillance reporting, and pinpoint targeting information that substantially increases the situational awareness of the battle group commander.

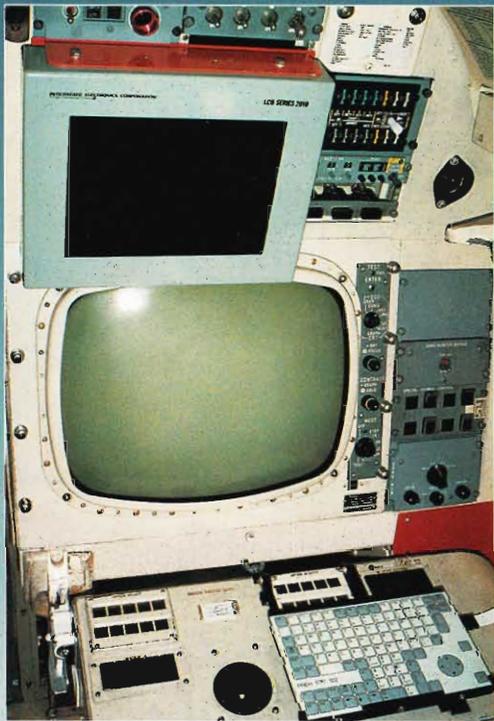
Outlaw Viking is an outgrowth of the Space and Naval Warfare Command

over-the-horizon targeting program that has provided the funding for Outlaw Hunter and OASIS P-3 Orion programs. SPARWAR supports Outlaw Viking, while the Navy acts as project coordinator.

Systems integrator for the project is Tiburon Systems, who also handled Outlaw Hunter. Naval Air Warfare Center, Warminster, (PA), assisted with software development and testing. NAWC Patuxent River performed the installation, system test and evaluation, with emphasis on flight testing for the carrier environment.

Outside the aircraft, the visible differences are the GPS and SATCOM antennas on top of the fuselage. Outlaw Viking is the first S-3 to be equipped with GPS, although it is wired for input to the OASIS system only. Inside, the TACCO Station is modified with a 10-inch diameter liquid crystal display mounted above the large display. Additionally, a quick release, thin membrane OASIS control keyboard with track ball is attached to the TACCO's flip-down control console.

Outlaw Viking recently completed a year-long operational testing phase, which included a WESTPAC deployment. The aircraft was assigned to



Outlaw Viking's TACCO Station with 10-inch LCD display and membrane keyboard attached to the control console.



Outlaw Viking flying with VS-37 near San Diego.

VS-37, Carrier Air Wing 15, aboard the USS *Kitty Hawk* (CV-63). The one-of-a-kind Viking was extensively tasked in exercises that included long range strike support, Harpoon firings, FLEETEX and COMTUEX. There were no hardware failures dur-

ing the deployment, and no spares were utilized even with the COTS (commercial off-the-shelf) equipment installed. The system surpassed all expectations.

Outlaw viking is currently assigned

to VS-33 at NAS North Island, CA and is being utilized for system familiarization training and local tactical exercises. The Sea Control community is hoping to incorporate the system into all its S-3B aircraft.

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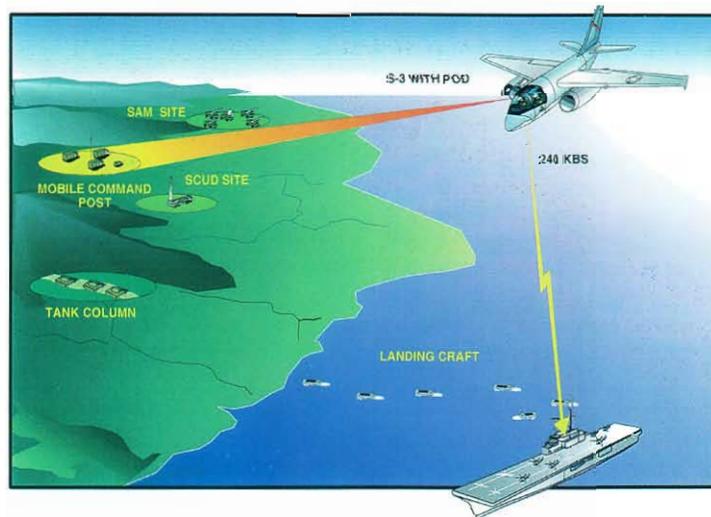
PROJECT GRAY WOLF

In the years since the Gulf War with Iraq, the U. S. Navy has taken the lessons learned and devised measures to fill the gaps that were revealed during the conflict. With the future rooted in both the littoral environment and jointly operating forces, the Navy battle group has the need for a first-on-scene, real-time, standoff, overland surveillance and targeting capability. Although there are other similar DoD systems that do provide a level of defense against the threat of theater ballistic missiles, no organic battle group capability exists to locate and destroy these missiles and their mobile launchers.

A new focus of the Naval Sea Control Wing Command is SEASTARS, an acronym for Sea-based Surveillance, Targeting and Attack Reconnaissance System. SEASTARS is a program to evaluate off-the-shelf sensor technology for potential employment by S-3B Vikings. This includes new IR and electro-optical sensors as well as enhanced and improved sensors for the S-3 to fulfill its new sea based requirements in the littoral environment. At the heart of SEASTARS is a specially configured S-3B called Gray Wolf, that is being tested to evaluate

the effectiveness of the Viking in a maximum standoff, overland surveillance, targeting and strike support role. This aircraft is uniquely configured with a multi-mode radar system, coupled with a moving target indicator and a digital video transmitter. The radar, a product of Westinghouse and Norden Systems is a multi-mode syn-

thetic aperture radar housed in an S-3 cargo pod slung under the starboard wing of the aircraft. Use of the Gray Wolf system has demonstrated the capability of first-on-scene surveillance over the beach, providing initial targeting of hostile air fields, and the elusive mobile missile launchers. With the same system, the aircraft's crew can provide real-time amphibious assault surveillance, providing landing positions for joint expeditionary



forces, and inland intelligence. Besides Theater Missile Defense (TMD) and amphibious assault force support, the system has other inherent capabilities such as Strike Attack Vectoring (SAV) for battle group air assaults, battle damage assessment (BDA) and ancillary border patrol and embargo surveillance in support of UN/NATO operations.

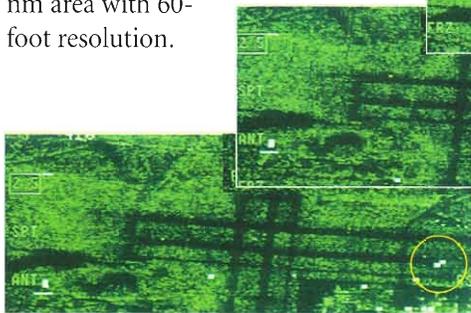
At the core of the Gray Wolf project is Norden Systems radar, the AN/APG-76. This is a multi-mode radar system (MMRS) that was developed in the late 1980s. The technological capabilities of the MMRS were to have been incorporated into the A-6F but the program was cancelled. The MMRS has been exported under contract to the Israeli Air Force as part of a larger IAF F-4 upgrade program known as "Phantom 2000." Some 60 units have been produced and delivered to the IAF with more units expected to be exported to the Turkish Air Force for their F-4s.

Although the APG-76 radar in the IAF F-4s is the same unit in Gray Wolf, its capabilities are not. The Gray Wolf APG-76 is an enhanced version that has GPS/INS navigational system interfaces coupled to the radar, which aides in improving the accuracy of targeting

data. The system includes a recording capability for all the SAR imagery which can be used in later evaluation.

The Gray Wolf radar encompasses a digital data link system for long-range transmission of real-time SAR and tactical data to a ground station. The ground station views the same imagery as is displayed in the aircraft. This real-time situation awareness is unique among all other defense assets.

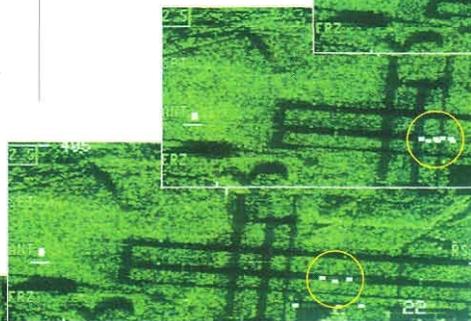
The APG-76 encompasses a number of air-to-ground modes for target acquisition. The first is a normal, or regular radar “real beam”, for a large area cross section. The next mode is called Doppler Beam Sharpening or DBS. This mode examines a 14x14 nautical mile (nm) area with 180-foot resolution. There are three SAR modes that provide imagery at ranges upwards of 100 nautical miles and are labeled by the area that they cover. SAR 5 scans a 5x5 nm area with 60-foot resolution.



SAR 2.5 maps an area 2.5x2.5 nm with a resolution of 30 feet. The third mode, SAR .8, is also called SAR Spotlight, which can scan an .8x.8 nautical mile area with 10-foot resolution.

The radar also possesses a unique Ground Moving Target Indicator / SAR mode capability. The system simultaneously detects moving ground targets and overlays them onto the

real-time SAR map imagery. This ground tracking capability is critical in being able to follow a moving target and then instantly image it as soon as it stops, without changing modes, thus avoiding the possibility of losing the target. The Gray Wolf APG-76 system is currently the only radar system with this unique real-time simultaneous GMTI / SAR capability. It must be noted that although the system was originally developed with the requirements for 40 nautical miles range, it was powered to overcome adverse weather conditions. The

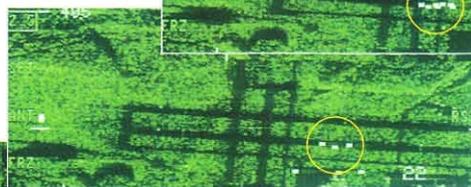
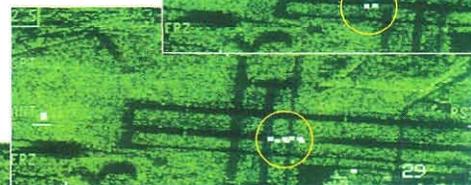
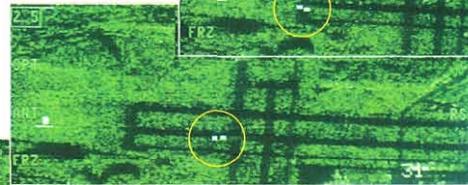
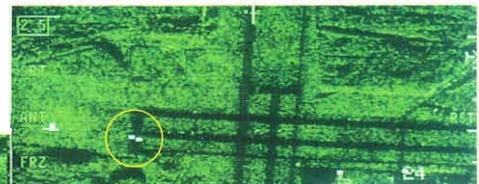


produces imagery at upwards of 100 nautical miles.

As a means to demonstrate the capabilities of the Norden Systems APG-76 and the additional down link data transmission of SAR imagery, Norden has developed a fully equipped mobile (demonstration) ground station to receive radar data from the aircraft in flight. The mobile ground unit contains three operator / analyst position stations to perform real-time analysis

and exploitation of the SAR imagery.

The first is the “Situation Station” that displays the aircraft’s position relative to Defense Mapping Agency maps (on the data base) and indicates numerical information as to heading, speed and altitude. The operator can perform a variety of tasks on the dis-



F-18 TAKE-OFF Mode: GMTT Resolution: 30 ft
Range: 41 nm Altitude: 27,000 Date: 11 JAN 95

play, such as distance and bearing measurements.

The next position is the “Director Station”, which receives the real-time SAR images every four seconds, interprets them, and directs their use to the C/I commander. The operator commands a variety of options to manipulate the display, from rotating it, and creating multiple track images, to freezing the images for closer examination. He may also extract geographical coordinates to within an accuracy of 20 meters. The director can re-fly a mission from the images stored on data base or pass selected imagery on to the third station, for further analysis.

The “Exploitation Station” enhances imagery via commercial off-the-



AN/APN-76 Radar installed in a modified S-3 cargo pod for the Gray Wolf Proof-Of-Concept Project. The original nose of the pod was replaced with an F-4 nose cone.



Norden Systems



Norden Systems

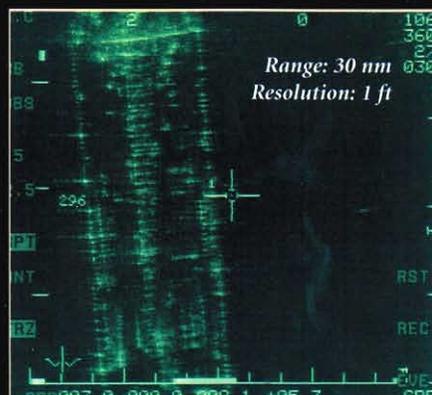
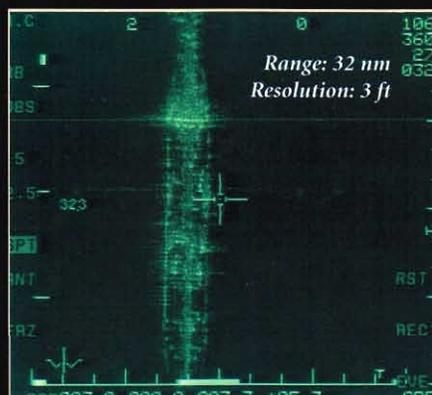
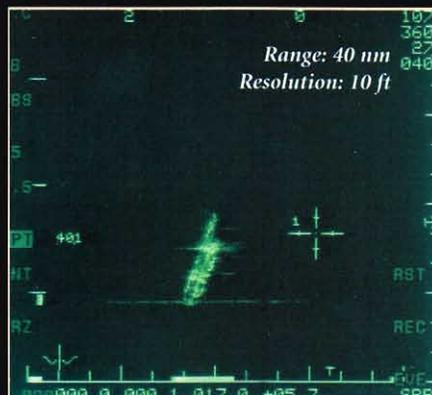
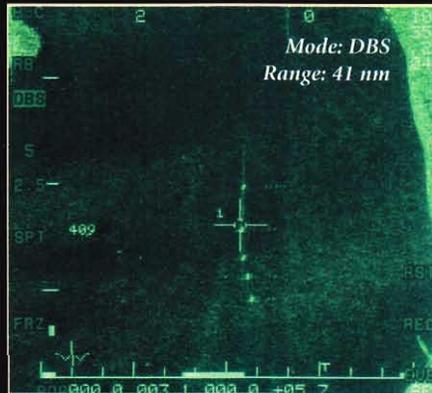
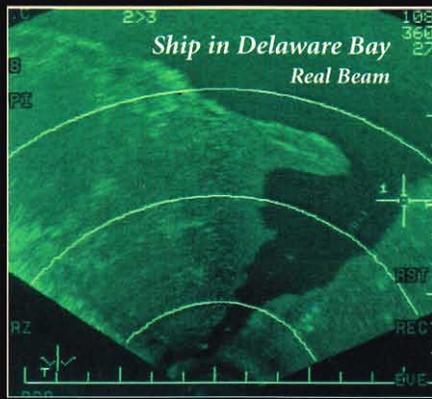


LCACs departing Onlow Beach.

shelf (COTS) image processing software to provide further exploitation of the digitized SAR data. Here the imagery can be enhanced, cropped, restyled or colorized to extract additional information. This aids in real-time enhanced target location and the acquisition of missed targets. The station is equipped with a high-resolution color printer to produce hard copy representations of the target data.

Gray Wolf has successfully demonstrated capabilities that can provide the Joint Task Force Commander with a flexible organic battlefield surveillance platform, a capability which currently does not exist. This system enriches the multi-mission capability of the already versatile S-3B Viking. The Gray Wolf project further demonstrates the ability to acquire new and additional capabilities through the exploitation of low cost, off-the-shelf technology.

It should be noted, that the costs of design, development and modifications to the aircraft, as well as the cost of initial safety of flight testing and certification were solely borne by Westinghouse Norden Systems, Inc. The Defense Airborne Reconnaissance Office funded the current operational / demonstration flight test.



Norden Systems APG-76 Projects

Westinghouse Norden Systems Inc.'s independent research and development program is also providing a similar APG-76 radar to the US Air Force to be installed in a wing mounted pod devised from a 600-gallon F-15 fuel tank and placed on a Lockheed F-16D, this is to demonstrate to the USAF the use of MMRS technology assisting in the detection, targeting and identification of mobile missile launchers.

Other related IR&D projects involve improving the resolution capability of the MMRS via utilization of new waveforming generator modules and through the enhancement of signal processing for resolutions down to 1 and 0.3 meters. This improved resolution will aid in another project to develop Automatic Target Recognition (ATR) techniques planned for the Gray Wolf system. The MMRS itself is a multi-channel, multiple antenna port - multi RF/IF receiver channel radar. Its unique architecture is being used to explore and demonstrate capabilities such as 3-D SAR and Interferometric Moving Target Focusing for clear imagery of ground moving targets.



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The Versatile Viking
— Still Stretching Her Wings —

Interview with
ADM Leighton W. Smith, Jr.
Allied Forces Southern European Commander
NATO Southern Regional Headquarters
