Analyst: Unmanned Systems Developers Need to Create Platforms That Allow Human Interaction

Unmanned systems that can operate alone, such as this MQ-4C Triton, could take on more missions if they could also be controlled by people for some missions, a defense analyst said Sept. 22. *NORTHROP GRUMMAN*

ALEXANDRIA, Va. — The developers of unmanned systems must do more to create platforms that can operate in the "messy middle" between being totally autonomous and being controlled remotely by humans, with some autonomy but also some ability for humans to interact with the vehicle, an analyst said Sept. 22 during a defense industry event.

Bryan Clark, a senior fellow and director of the Center for

Defense Concepts and Technology at Hudson Institute, told attendees of the AUVSI Defense conference that a lot of focus has been placed on getting unmanned systems to the field faster, and the way to do that is to introduce a manned element to make the system more flexible — which also opens up new missions the platform can do.

"It requires you to increase the level of human involvement in the machine and operate in this 'messy middle' where you have varying levels of human-machine interaction," he said after the event.

Right now, most unmanned platforms fall in two categories: a completed automated intelligence, surveillance, and reconnaissance platform that operates independently of the manned force, and remotely operated vehicles that are entirely dependent on human input.

"Those are basically the bulk of the unmanned vehicle spectrum," Clark said. "There's not that much in the middle where you have the mixed operator-machine interaction. It's hard to build a force around that, because you're not sure how much operator intervention you need for a particular mission and scenario, but that's where the value lies.
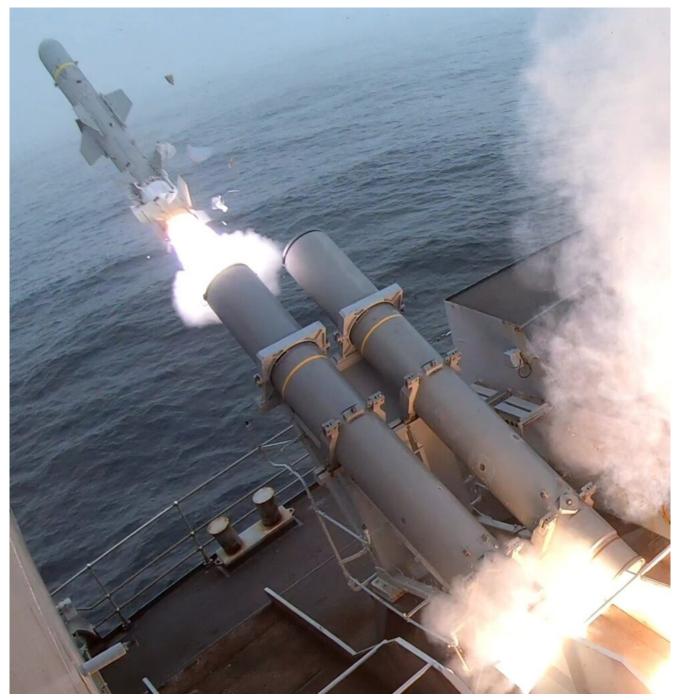
"If you have a force that can operate between a lot and a little human intervention depending on the vehicle, it gives your commanders lots of options, and it mitigates some of the automation shortfalls," he continued.

Clark said the Navy is already having to take that approach with some unmanned surface vehicles that were supposed to be entirely automated for months at a time.

"They are finding out they're not lasting as long as they were hoping," he said. "It's not a six-month deployment — it's more like a week at a time, and then they need to fix and maintain and refuel them, and some cases may have to put people on there all the time."

It is the same situation with unmanned aerial vehicles, such as MQ-4C Tritons that can operate on their own but would need human intervention in order to be used for something more "creative" like as a targeting platform for missile attacks. "You need humans operating sensors and telling the vehicle where to go," he said.

"It's the messy middle where you have an undefined level of automation and human interaction by design," he added. "That's where 90% of the DoD mission set lies. Until you are ready to bring unmanned systems into that middle part where most of the work is, you're never going to realize their benefits."

U.K. and U.S. Conduct SINKEX during Atlantic Thunder 22

The U.K. and U.S. navies conducted a sinking exercise Sept. 7 in the North Atlantic. *U.S. NAVY*

ATLANTIC OCEAN — Ships and aircraft from the United Kingdom and the United States conducted a long-planned multi-domain sinking exercise (SINKEX) called Atlantic Thunder 22 in the North Atlantic, Sept. 7, U.S. Naval Forces Europe-Africa Public Affairs said Sept. 23.

Atlantic Thunder 22 participants, assigned to U.S. Naval Forces Europe, U.S. Air Forces Europe, the U.K. Royal Navy and U.K. Royal Air Force sank the decommissioned guided missile

frigate ex-USS Boone, during the live-fire SINKEX to develop combined proficiency in tactics, targeting and live-firing against a surface target at sea.

"Sinking exercises not only provide excellent opportunities to gain real world operational experience in long range maritime strikes but also demonstrate the collective power of our combined forces," said Rear Adm. Oliver "Ollie" Lewis, U.S. Naval Forces Europe-Africa's (NAVEUR-NAVAF) Director of Maritime Operations. "Most importantly, gaining real world proficiency in the tactics, techniques and procedures we have developed and tested alongside our British Allies not only validate our weapons systems but ultimately contribute to NATO alliance readiness."

The exercise was not only a unique and valuable opportunity for sharpening and proving partner capabilities, but also an exercise of multiple firsts.

The ex-Boone was struck by Martlet air-to-surface missiles from Wildcat helicopters assigned to the Type 23 frigate HMS Westminster. The helicopters provided inaugural laser targeting for fixed-wing U.K Royal Air Force Typhoons using Paveway IV precision guided munitions.

A U.S. Navy P-8 Poseidon maritime patrol aircraft assigned to Patrol Squadron 46 shot a long range anti-ship missile. U.S. Air Force F-15E Eagles, assigned to 494th Fighter Squadron, dropped maritime strike joint direct attack munitions.

Finally at sea, the U.S. Navy Arleigh Burke guided-missile destroyer USS Arleigh Burke (DDG 51) struck the ex-Boone with a Standard Missile 6 (SM-6), the first anti-ship SM-6 engagement in the U.S. European Command area of responsibility, while HMS Westminster fired the first live RGM-84D Harpoon missile salvo from the U.K. since 2004.

Also aboard Arleigh Burke, Marines assigned to the 22nd Marine Expeditionary Unit provided vital imagery and battle damage

assessment by deploying a V-BAT 128 vertical take-off and landing unmanned aerial vehicle, marking the first launch of a V-BAT 128 from an Arleigh Burke guided-missile destroyer.

"Ex Atlantic Thunder has demonstrated that U.K. and U.S. naval and air forces can integrate to deliver an end-to-end kill chain against a maritime target at long range," said Cmdr. Ed Moss-Ward, commanding officer of HMS Westminster. "The integration of high end weapons, sensors and communications with our NATO allies is key to the collective war fighting capability of the Alliance demonstrated by the sinking exercise. The firings have supported the development of the Royal Navy's targeting and weapon capabilities, and afforded opportunity to conduct realistic training to validate tactics and operating procedures."

Former U.S. Navy vessels used in SINKEXs, referred to as hulks, are prepared in strict compliance with regulations prescribed and enforced by the Environmental Protection Agency under a general permit the Navy holds pursuant to the Marine Protection, Research and Sanctuaries Act.

Prior to being transported for participation in a sinking exercise, each vessel undergoes a rigorous cleaning process for environmental safety. Aligned with U.K. Ministry of Defense environmental policy, robust monitoring was conducted above and below the sea's surface with trained personnel using specialized equipment to reduce the overall risk of inadvertently impacting the marine environment and marine mammals during the SINKEX.

Ex-Boone is a decommissioned guided missile frigate, which entered United States Naval service, May 15, 1982. It was decommissioned on Feb. 23, 2012. The 20th ship of the Oliver Hazard Perry class, it was the first ship named for Vice Adm. Joel Thompson Boone, a Medal of Honor recipient and the most highly decorated medical officer during World War I.

UNITAS Concludes After Successful Exercise

Commander, U.S. Naval Forces Southern Command/U.S. 4th Fleet, Rear Adm. Jim Aiken, congratulates participants for their performance at the UNITAS LXIII Closing Ceremony in Rio de Janeiro, Sept. 22. *U.S. NAVY / Cmdr. Myers Vasquez*

RIO DE JANEIRO — UNITAS LXIII (63), the world's longest-running multinational maritime exercise concluded with a closing ceremony in Rio De Janeiro on Sept. 22, U.S. Naval Forces Southern Command / U.S. 4th Fleet said in a release.

UNITAS, Latin for "unity," was conceived in 1959, first executed in 1960 and held every year since. This year marked

the 63rd iteration of the world's longest-running annual multinational maritime exercise.

This year's exercise was hosted by the Brazilian navy and included 19 warships/vessels, one submarine and 21 aircraft that conducted scenario-driven joint and combined operations and training in and off the coast of Rio De Janeiro. The exercise coincided with Brazil's bicentennial, a historical milestone commemorating 200 years of the country's independence and the birth of their navy.

"It is exciting to see 19 nations from across Central and South America, the Caribbean, Europe, and Africa participating in UNITAS," said Rear Adm. Jim Aiken, commander, U.S. Naval Forces Southern Command/U.S. 4th Fleet. "This exercise is a demonstration of not only our commitment to the region, but also the strong relationships forged between our nations. The Western Hemisphere is our shared home and exercises like UNITAS reinforce our permanent geographical and cultural ties, connecting us to our shared history and our shared future."

Navy and marine forces from Brazil, Cameroon, Chile, Colombia, Dominican Republic, Ecuador, France, Guyana, Jamaica, Mexico, Namibia, Panama, Paraguay, Peru, South Korea, Spain, United Kingdom, Uruguay and the United States participated in the exercise.

While the overarching goal was to develop and test command and control of forces at-sea, training in this exercise addressed the spectrum of maritime operations. Specifically, there were scenarios addressing electronic warfare, anti-air warfare and air defense, anti-surface warfare, live fire, maritime interdiction, littoral operations and amphibious operations.

"One of the main benefits of UNITAS is the ability of all participating nations to train together, and exchange ideas and tactics," said Capt. Meger Chappell, deputy commander,

Destroyer Squadron 40, and deputy commander, UNITAS Task Group 138.20. "Over the course of the exercise I saw firsthand how the participating nations came together as a multinational task force to meet all objectives. Together we have strengthened our maritime partnerships, enhanced our proficiency and improved our collaboration and interoperability."

The exercise progressed in phases, beginning in port with sporting events and community relations projects to build relations between partner nations.

The at-sea phase included a multi-threat, multi-day scenario that allowed participants to work together, further increasing preparedness for real-world crises that would require a multinational force response effort. Events included: surface tactical maneuvers, illegal drug trafficking training, live-fire exercises, anti-submarine warfare exercises, air defense exercises and maritime interdiction operations.

The amphibious phase included U.S. Marines with partner nations taking positions at areas along the coast to train in support of greater naval operations. This phase also consisted of landing from naval vessels.

UK Royal Navy Acquires Latest Generation REMUS 100 UUVs

MCLEAN, Va. — HII announced Sept. 21 the delivery of three REMUS 100s unmanned underwater vehicles to the United Kingdom's Royal Navy. The new systems bring enhanced endurance and the latest generation of sensors and payloads, allowing for increased data quality and mission efficiency.

"We're proud to continue our longstanding partnership with the U.K. Royal Navy," said Duane Fotheringham, president of the Unmanned Systems business group at HII's Mission Technologies division. "Our newest REMUS 100s will bolster their existing fleet with increased capability for the U.K.'s subsea autonomous operations."

With these new systems, the U.K.'s Ministry of Defence has acquired a mix of REMUS 100s and REMUS 600s used for mine countermeasure operations over the last 20 years. The Ministry of Defence's first two REMUS 100s, acquired in 2002, are still in operation today.

"On behalf of the frontline users, I'm delighted to accept into service this refresh of REMUS 100," said Cmdr. Rory Armstrong, mine warfare lead at the U.K. Navy Command Headquarters. "Our use of the REMUS family of vehicles over

the last two decades has paved the way for a future mine countermeasures capability with autonomy at its core. These vehicles represent an exciting evolution of our existing small autonomous underwater vehicle fleet and will make a valued contribution to the Royal Navy as a force for good both in home waters and on an expeditionary basis."

HII has sold more than 600 UUVs to 30 countries worldwide, including 14 NATO member countries like the U.K.

Bell Selects Sierra Nevada Corp. for its High-Speed VTOL Development Team

An artist's conception of Bell Textron's High-Speed Vertical Takeoff and Landing aircraft. *BELL TEXTRON*
National Harbor, Md. — Bell Textron Inc. has entered into a

teaming agreement with Sierra Nevada Corp. for Bell's High-Speed Vertical Takeoff and Landing aircraft, Bell announced Sept. 19. As part of the collaboration, SNC will specifically support the design and development of mission systems for HSVTOL variants.

Bell's HSVTOL vehicles blend the hover capability of a helicopter with the speed, range and survivability features of fighter aircraft, with low downwash hover capability and jet-like speeds of more than 400 knots. This family of scalable aircraft concepts is designed to carry out U.S. Air Force and Special Operations Command missions across the full spectrum of conflict and political scenarios, including personnel recovery, contested logistics and intelligence, surveillance and reconnaissance and strike.

"In an effort to advance technical maturity and deliver HSVTOL capability to warfighters sooner, Bell is assembling a team of industry-leading partners. We're thrilled to have SNC onboard," said Jason Hurst, vice president, Innovation, Bell. "We've made significant progress in Bell's HSVTOL technology development in 2022, and we look forward to showing this progress in the upcoming year."

Bell is currently executing its HSVTOL risk reduction effort and participating in the AFWERX HSVTOL Concept Challenge, a crowdsourcing effort for the Air Force and Special Operations Command. Bell is one of 11 companies from more than 200 challenge entrants selected to receive market research investments aimed at advancing HSVTOL technology.

GA-ASI Flies MQ-20A Avenger UAS Completely Autonomously

An Avenger MQ-20A, which recently flew using an artificial intelligence pilot. *GENERAL ATOMICS AERONAUTICAL SYSTEMS*

SAN DIEGO — General Atomics Aeronautical Systems Inc. used a company-owned Avenger MQ-20A unmanned aircraft system to fly a military aircraft using an artificially intelligent pilot deployed on an operationally relevant, open mission systems software stack on Sept. 12, the company said.

The Avenger's completely autonomous flight used the AI pilot for close to 30 minutes as a part of a cooperating live, virtual and constructive UAS swarm. The flight was performed as part of GA-ASI's ongoing commitment and investment into the development of advanced autonomy of AI and machine learning for UAS.

The flight made use of GA-ASI's novel Reinforcement Learning architecture to develop and validate an RL agent in an operationally relevant environment. RL agents provide a new and innovative tool for next-generation military platforms to make decisions under dynamic and uncertain real-world

conditions. The team flew "chase and avoid behavior" where real-time updates were made to the flight path to avoid adversaries using live fused tracks. Live tracks were provided to the system using the Infrared Search and Track sensor network supplied by Lockheed Martin.

"The flight was a tremendous success and demonstrated a number of groundbreaking capabilities in the race to operationalize autonomy for collaborative combat aircraft," said GA-ASI Senior Director of Advanced Programs Michael Atwood. "It's exciting to see how AI can be used to advance how and where we fly unmanned systems as the complexity of the battlespace increases. Our 'chase and avoid' agent's ability to dynamically update the flight path as threats were identified is the first step towards building an ecosystem of collaborative autonomous combat aircraft."

TacIRST is a new class of multifunction, embeddable sensor system with an open architecture. It was developed by Lockheed Martin to provide a range of capabilities for both crewed and uncrewed aircraft. "We anticipated the need for passive, long-range threat detection by autonomous aircraft and are proud to see this capability integrated successfully on the Avenger," said Terry Hoehn, Director of Lockheed Martin's Advanced Threat Warning Systems. "We look forward to further collaboration and testing with GA-ASI."

The team used a government-furnished CODE autonomy engine and the government-standard OMS messaging protocol to enable communication between the RL agent and the Tactical IRST. By utilizing government standards, such as CODE and OMS, rapid integration of autonomy for collaborative combat aircraft becomes possible.

General Dynamics Mission Systems also supplied key technologies to the flight. The mission computer used to host the OMS software is part of the Digital Backbone Node family of systems from General Dynamics Mission Systems. The DBN

architecture enables rapid and secure deployment of evolving capabilities needed for CCA through application of the latest government open architectures, high-performance computing, advanced cooling, and a high-speed backplane with multi-level security to maximize battlefield collaboration between platforms.

This flight was another in an ongoing series of autonomous flights performed by GA-ASI using internal research and development funding to prove out important AI/ML concepts for advanced UAS.

International Naval Forces Partner in Seychelles to Build Cooperation

Cutlass Express participating forces perform visit, board,

search, and seizure training in Victoria, Seychelles, Feb. 15. Cutlass Express, sponsored by U.S. Africa Command and conducted by U.S. Naval Forces Africa, is designed to improve regional cooperation among participating nations in order to increase maritime safety and security in the East Africa regions. *U.S. NAVY / Mass Communication Specialist 2nd Class Daniel Charest*

MANAMA, Bahrain — The world's largest multinational naval partnership, Combined Maritime Forces (CMF), launched a two-week mission in the Indian Ocean island nation of the Seychelles with other international organizations Sept. 18 to strengthen regional collaboration and enhance operational readiness, said Combined Maritime Forces public affairs.

CMF is leading Operation Southern Readiness in partnership with the Seychelles People's Defence Force, European Union Naval Force, United Nations Office on Drugs and Crime, and India which began partnering with CMF earlier this year. This is CMF's first iteration of Operation Southern Readiness.

"Seychelles is a strong regional maritime partner and we are very grateful for them hosting this new opportunity," said Vice Adm. Brad Cooper, commander of U.S. Naval Forces Central Command, U.S. 5th Fleet and CMF. "We are also excited to work with other international partners, including India, to train and build capacity in a vibrant way."

Nations including Australia, Canada, France, India, Italy, New Zealand, Saudi Arabia, Seychelles, the United Kingdom and the United States are slated to participate with personnel, ships and aircraft during several training events.

Multinational forces will conduct training on visit, board, search and seizure techniques; search and rescue operations; maritime law and information sharing.

"The training is designed to enable our partners to meet face-to-face and learn from one another and is only possible because of the teamwork and commitment from all partners,"

said Royal Canadian Navy Cmdr. Alexis Dieryckx, CMF's senior mission planner. "It's all about building relationships because relationships are the fundamental building blocks for greater collaboration at sea."

CMF consists of 34 member nations whose forces operate in the Red Sea, Gulf of Aden, Northern Arabian Sea, Gulf of Oman, Arabian Gulf and Indian Ocean.

CMF nations are united in upholding international rules-based order to protect the free flow of commerce, ensure regional maritime security and deter illicit activity by non-state actors.

First Australian MQ-4C Triton to Arrive in Mid-2024, Official Says

The Australian government's first MQ-4C Triton was unveiled Sept. 15 in Palmdale, California. *NORTHROP GRUMMAN*

PALMDALE, Calif. — The Australian government will receive its first MQ-4C Triton unmanned aircraft at Royal Australian Air Force (RAAF) Base Tindal in the Northern Territory in 2024, an official said at an unveiling ceremony here Sept. 15.

Air Vice-Marshal Robert Denney, the RAAF head of Air Force capability, said during the ceremony that when the RAAF receives the aircraft, it will be used for many capabilities beyond its core intelligence, surveillance, and reconnaissance functions.

"It will revolutionize the ways the Australian Defense Forces conduct operations with our allies," he said.

The aircraft was unveiled at manufacturer Northrop Grumman's high-altitude, long-endurance aircraft production site in Palmdale. Both Australian and U.S. government officials were on hand to talk about the Triton and the ongoing cooperation between Australian and U.S. defense forces.

Australia was a cooperative program partner in the Triton program as it was being developed. As a result, they will be able to share data with the United States that is collected by both countries' Tritons.

Rear Adm. Stephen Tedford, program executive officer for Unmanned Aviation and Strike Weapons for the U.S. Navy, said during the ceremony that continued partnership between Australia and the United States will "allow both of our nations to better project military power, maintain our competitive edge, and maintain peace and stability in the region."

He noted that Australian personnel had been embedded in the Triton program since 2009.

"Since that time, this platform has expanded its capabilities far beyond those it started with," he said. "I am confident that our dedicated team … will work tirelessly to deliver this aircraft and many more to come."

The MQ-4C provides persistent ISR capabilities in a maritime environment, making it useful as a long-endurance surveillance platform in the Asia-Pacific region.

Northrop Grumman started building the first Australian Triton in October 2020 at its facility in Moss Point, Miss. In December 2021, the fuselage and one-piece wing were joined together in Palmdale. Production completion is planned for 2023 ahead of delivery in 2024.

AeroVironment Introduces Puma VNS, a Visual-Based Navigation System for Small UAS

An illustration of a Puma small UAS equipped with the new Puma VNS, which determines the precise location of an aircraft during flight without relying on GPS. *AEROVIRONMENT*

ARLINGTON, Va. — AeroVironment Inc. on Sept. 15 introduced Puma VNS, a visual-based navigation system for Puma 2 AE and Puma 3 AE small unmanned aircraft systems that will enable GPS-denied navigation across increasingly GPS-contested environments.

The system will provide operators with continually advanced navigation capabilities, features and functionality through anticipated software and hardware updates, the company said in a release. The system will also enable the integration of future autonomy capabilities.

"Puma VNS gives operators an unprecedented advantage in the battlefield," said Trace Stevenson, AeroVironment vice president and product line general manager for SUAS. "Operators now can execute missions with more confidence in GPS-contested environment with the system's new navigational capabilities."

The next-generation navigation system features a suite of down-looking sensors that gather imagery data and track features on the ground, as well as an embedded compute module to process and determine the precise location of an aircraft while it is in flight. Designed with the operator in mind, the system automatically transitions to and from GPS-denied navigation mode without any input from the operator.

Puma VNS is available as an add-on option for new Puma 3 AE system orders and as a retrofit kit for fielded Puma 2 AE and Puma 3 AE systems.

Garmin G3000 Selected to Modernize Navy and Marine Corps F-5 Aircraft

An F-5N Tiger-II from the "Sun Downers" of Fighter Squadron Composite 111 takes off from Naval Air Station Key West's Boca Chica Field in 2020. *U.S. NAVY / Danette Baso Silvers*

OLATHE, Kansas — Garmin International Inc. announced Sept. 13 the selection of the Garmin G3000 integrated flight deck by Tactical Air Support Inc. as part of a contract with the U.S. Department of Defense's F-5N+/F+ Avionics Reconfiguration and Tactical Enhancement/Modernization for Inventory Standardization (ARTEMIS) program.

Tactical Air first selected the Garmin G3000 for their F-5 adversary aircraft training fleet in 2018. This recent award builds upon Tactical Air and Garmin's strategic relationship now serving the DoD fleet of F-5 adversary aircraft. Garmin's commercial-off-the-shelf G3000 open architecture supports integration with a wide range of mission equipment including military sensors, helmet mounted displays and advanced electrically scanned radar systems.

"It is an honor to team with Tactical Air and have our versatile G3000 integrated flight deck chosen for the ARTEMIS contract with the Department of Defense," said Carl Wolf, Garmin vice president of aviation sales and marketing. "Garmin is proud to see our integrated flight deck technologies,

deployed now on over 25,000 aircraft, also being adopted by the U.S. military and enhancing the mission and safety capabilities of our nation's warfighters."

The F-5 is a supersonic, multi-role tactical fighter and attack aircraft that in this role will provide air-to-air combat training, close-air support training, tactical development and evaluation support. The upgraded F-5 Advanced Tiger will be used in an aggressor training role, and the G3000 will transform the cockpit with one large area display and two touchscreen controllers. These upgrades bring modern safety systems and new tactical capabilities to the older airframes while also solving parts obsolescence and reliability issues within the existing avionics system.

"Tactical Air is thrilled to have Garmin's cutting edge G3000 in the F-5 AT cockpit," said RC Thompson, Tactical Air CEO. "The Garmin integrated flight deck gave us an outstanding COTS solution to the Navy and Marine Corps' recently purchased fleet of F-5 aircraft to make them an even more capable adversary fighter for our aviators to train against."

The G3000 boasts a large and vibrant high-resolution flight display that seamlessly interfaces to the F-5's existing mission computer, enabling advanced mapping, tactical radio capabilities, radar display and more. The non-proprietary interface, software-based human-machine interface and mission integration will enable the DoD to rapidly deploy new technologies in the future, while providing access to the latest in commercial Communication, Navigation, Surveillance/Air Traffic Management (CNS/ATM) capabilities. Tactical Air has integrated the L3Harris ForceX mission computer along with a wide range of military sensors, communications equipment, and weapons systems into the G3000 touchscreen HMI.

In addition to night vision goggle compatibility, the G3000 contains modern, state-of-the-art synthetic vision technology

that blends an "out-the-window" view of surroundings on the large area, primary flight displays, which is particularly helpful during nighttime operations and during close air support missions. Additional features within the G3000 integrated flight deck on the F-5 include Terrain Awareness and Warning System, Traffic Collision Avoidance System and Automatic Dependent Surveillance-Broadcast (ADS-B IN) traffic.