Tech focus

This month's focus is on some unmanned aerial vehicle programs and technologies developed to enhance UAV capabilities.

by ***Ryan Gehm***

Boeing ScanEagle demonstrates net-centric technologies, supports U.S. Navy operations

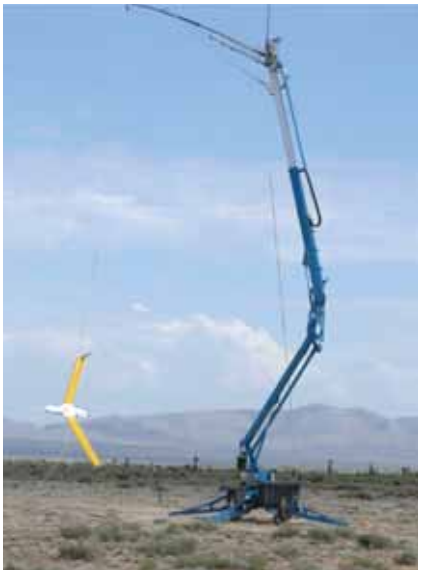
In April, **Boeing** and a team of industry and academic researchers demonstrated a series of advanced network-centric technologies at a joint military exercise held at White Sands Missile Range, NM. The technologies were developed under sponsorship from the Defense Advanced Research Projects Agency (**DARPA**), with support from **Air Force Research Laboratories**.

For the demonstration, the team used a long-endurance ScanEagle unmanned aerial vehicle (UAV) developed and built by Boeing and **The Insitu Group**.

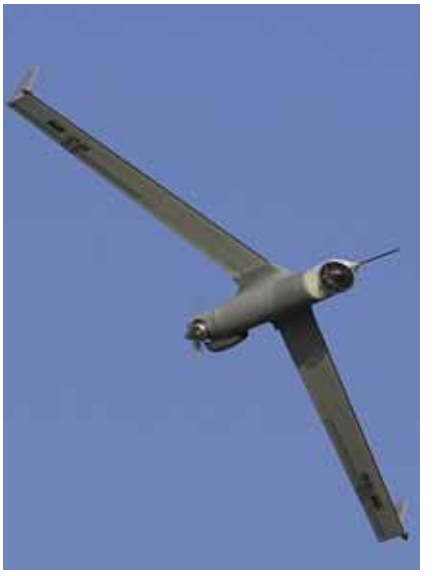
During the live-fire exercise, two airborne ScanEagle UAVs, carrying embedded autonomous control software, performed intelligence, surveillance, and reconnaissance (ISR) roles to find, identify, and track ground targets. The UAVs also provided timely and accurate aim points for delivery of **U.S. Army** and **U.S. Air Force** weapons, and supported post-strike battle damage assessment.

"We demonstrated, in a tactically relevant scenario, how strategic employment of network-centric concepts and technologies can dramatically improve the war fighter's ability to prosecute time-critical targets," said Patrick Stokes, Boeing Program Manager for Network Centric Operations Contracted Research and Development programs. "These advanced technologies and machine-to-machine interfaces not only enhance overall UAV mission effectiveness, but significantly reduce operator workload."

The autonomous control software technology used for the demonstration was developed as part of DARPA's Program Composition of Embedded Systems (PCES). The embedded PCES technology enables a UAV in the field to autonomously map its own path without operator input. At present, an operator on the ground has to plot the UAV's course via way points to ensure the vehicle reaches and remains in the proper position to accomplish its assigned task.



Following a successful net-centric technology demonstration at White Sands Missile Range, NM, Boeing's ScanEagle UAV is retrieved with a patented "Skyhook" system in which the UAV catches a rope hanging from a 50-ft high pole. (Photo courtesy of White Sands Missile Range)



ScanEagle has surpassed 2400 operational flight hours in Iraq supporting the First Marine Expeditionary Force. As a result of a recent agreement, the UAV also will be used to support U.S. Navy operations. (Photo courtesy of Ed Turner)

For the exercise, real-time streaming imagery was passed from ScanEagle to operations personnel and a mission commander on the ground more than 100 mi away. After assessing potential targets, the commander told ScanEagle via a mouse click where ISR coverage was needed. ScanEagle then flew autonomously to the target area, gathered and sent additional imagery, provided accurate aim points, and monitored the weapons strike.

Another advanced concept highlighted during the successful demonstration was the PCES Quality of Service (QoS) network optimization technology, developed by Boeing partner **BBN Technologies**. The QoS technology allowed delivery of multiple ISR imagery feeds to the mission commander over a resource-constrained data network. Based on the commander's assigned priorities for each ISR platform, it managed data-stream properties such as frame-rate, compression, and latency to provide high-quality, persistent, and low-latency imagery while operating within available bandwidth.

In addition, Boeing Phantom Works-developed Precision Image Registration

(PIR) technology used ScanEagle imagery to derive aim points for precision weapon deployment. As demonstrated, integration of PIR further enhanced ScanEagle's mission effectiveness by extending its ISR role to include an advanced targeting capability.

Since being deployed in theater with the First Marine Expeditionary Force (I MEF) last summer, ScanEagle has surpassed 2400 flight hours during operational missions in Iraq. Boeing received a contract from the **U.S. Marine Corps** in July 2004 to provide two ScanEagle "mobile deployment units" for use with the I MEF.

In a separate April announcement, Boeing received a $14.5 million contract from the **U.S. Navy** for UAV services in support of Operation Iraqi Freedom and the Global War on Terror. The company will provide ScanEagle UAVs, communication links, and ground equipment to support the Navy's requirements. The Navy will use the ScanEagle systems during Naval Expeditionary Strike Group (ESG) missions to provide persistent ISR coverage and to increase oil-platform security in the Persian Gulf. The UAVs supporting ESG will be ship-launched and recovered.

This will be ScanEagle's first deployment aboard a Navy vessel, said Peggy Holly, Boeing ScanEagle Program Manager. "ScanEagle's unique ISR and long-endurance capabilities will provide the Navy with real-time intelligence and situational awareness."

As standard payload, ScanEagle carries either an inertially stabilized electro-optical or an infrared camera. The gimbaled camera allows the operator to track both stationary and moving targets, providing real-time intelligence. Capable of flying above 16,000 ft, the UAV has also demonstrated the ability to provide persistent low-altitude reconnaissance.

ScanEagle is launched autonomously via a pneumatic wedge catapult launcher and flies pre-programmed or operator-initiated missions. It is retrieved using a "Skyhook" system in which the UAV catches a rope hanging from a 50-ft high pole. The patented system allows ScanEagle to be runway-independent and operate from forward fields, mobile vehicles, or ships.

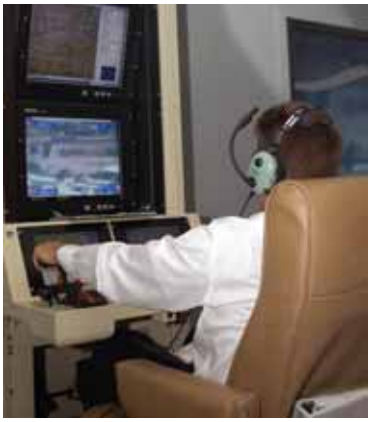
According to Boeing, in August 2004 ScanEagle completed the longest flight ever recorded by a UAV launched and retrieved at sea—16 h and 45 min. During the flight, it did aerial surveillance of sea conditions and ships in Puget Sound, WA, demonstrating the type of mission anticipated for shipboard operations. The ScanEagle "A-15"—the company's current model—can remain on station for more than 15 h. Future planned variants will have an endurance of more than 30 h. The UAV is 4 ft long and has a 10-ft wingspan.

NASA, NOAA conduct UAV 'science' experiment

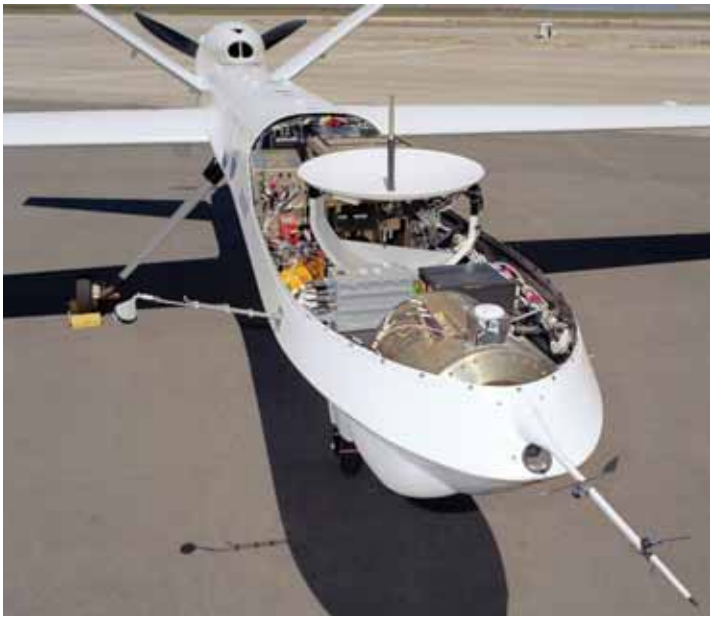
NASA and the **National Oceanic and Atmospheric Administration** (NOAA), in cooperation with **General Atomics Aeronautical Systems** (GA-ASI), have demonstrated the ability to fly a remotely operated unmanned aerial vehicle (UAV) in an operational environment during a series of atmospheric and oceanic research flights off the southern California coast this spring.

The UAV Flight Demonstration Project near the Channel Islands, which used GA-ASI's Altair remotely operated aircraft, was the first time NOAA funded a UAV Earth Science demonstration mission. According to NASA, the experiment was aimed at introducing "a new era of science" by filling research and operational gaps in critical areas, such as weather, water, climate, and ecosystem monitoring and management.

The Altair UAV—the development of which was funded in part by NASA—carried a payload of instruments for measuring ocean color, atmospheric composition and temperature, and surface imaging during six flights that totaled about 53 h flight time. The flights, which took place during late



The General Atomics Aeronautical Systems Altair remotely operated aircraft flew a series of climatic and environmental monitoring missions for NOAA and NASA this spring. A pilot for General Atomics guides the UAV from a ground control station using both visual and telemetered data. (All photos courtesy of Tom Tschida)



A satellite antenna, electro-optical/infrared and ocean color sensors (front) were among payloads installed on the Altair for the NOAA-NASA UAV flight demonstration.

April and early May, were flown at altitudes of up to 45,000 ft and as long as 20 h.

Objectives of the experiment included evaluating UAVs for future scientific and operational requirements related to NOAA's oceanic and atmospheric research, climate research, marine sanctuary mapping and enforcement, nautical charting, and fisheries assessment and enforcement.

"NASA is glad to see that UAVs are being used for more and more diverse and important operations," said Terrence Hertz, Deputy Associate Administrator for Technology, NASA Aeronautics Research Mission Directorate. "We're looking forward to more breakthrough research in areas such as regenerative fuel cells, multi-UAV operations through networking, and routine access to the National Airspace System that will allow UAVs to play an expanding role in Earth Science and other types of missions."

"UAVs will allow us to see weather before it happens, detect toxins before we breathe them, and discover harmful and costly algal blooms before the fish do—and there is an urgency to more effectively address these issues," said Conrad C. Lautenbacher Jr., Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator.

"This mission…marks the first time that scientific payloads of this quality and complexity have been flown in a remotely operated aircraft system," added Thomas J. Cassidy Jr., President and Chief Executive Officer of General Atomics Aeronautical Systems.

The Altair, a high-altitude civil derivative of GA-ASI's Predator B military UAV, was designed for scientific and commercial research missions. It has an 86-ft wingspan, can reach altitudes up to 52,000 ft, and remain airborne for more than 30 h.