

Unmanned and unlimited

Growing demand for unmanned systems is driving Boeing's business, and ingenuity, in new markets—and the sky is not the limit **By Jay Spenser**

When Somali pirates held an American cargo ship captain hostage in April 2009, they didn't count on a spy in the sky. A ScanEagle launched by a U.S. Navy destroyer circled above the pirates' vessel during the five-day standoff near the Horn of Africa. Too small and quiet to be noticed, the unmanned craft provided real-time video surveillance that contributed to a successful rescue operation.

Built by Insitu, a Boeing subsidiary in Bingen, Wash., ScanEagles have logged more than 320,000 flight hours assisting coalition forces in Iraq and Afghanistan, according to Bill Clark, vice president of Emerging Programs at Insitu. They also perform many other surveillance missions, from helping scientists track polar bears and monitor ice floes to examining volcano calderas and flood plains.

The success that ScanEagle has had since entering service in 2002 underscores the global demand for unmanned aircraft—and unmanned systems in general.

Over the past decade, there has been a dramatic shift toward unmanned systems, according to Darryl Davis, president of Boeing Phantom Works, which has a number of unmanned programs in the works, including Phantom Ray, a fighter-sized technology demonstrator scheduled to make its first flight at the end of this year. Phantom Ray builds on Boeing's success with the X-45A unmanned vehicle.

"Our customers have recognized the value of unmanned systems taking on the dull, dirty and dangerous missions that are ill-suited for manned platforms," Davis said. "Unmanned systems fill a niche when the optimum design of an aircraft is limited by the human element. Taking people out of the cockpit allows designers to reduce the size of an aircraft, eliminate many of the environmental controls and increase the range or overall flight time. More important, they also take our most important resource—people—out of harm's way."

The company's talent and vision, however, are not just focused on the sky.

Boeing has teamed with manufacturer iRobot Corp. to develop the Small Unmanned Ground Vehicle (SUGV) 310, a lightweight robot designed to give soldiers and emergency responders real-time awareness of critical situations.

The SUGV 310 weighs 29 pounds (13 kilograms) with no payload and can climb steep grades, go up and down stairs, and investigate potentially hazardous environments through the use of a variety

UNMANNED SYSTEMS ON DISPLAY AT AIR SHOW

Boeing's unmanned systems will be a featured attraction at this year's Farnborough International Airshow, which takes place July 19–25. This biennial aerospace industry gathering near London is one of the world's premier aviation trade shows.

More than a dozen large-scale models of Boeing unmanned systems, including a full-scale Phantom Ray with a 50-foot

(15-meter) wingspan, will be featured in the Boeing Unmanned Systems Display. Touch screens will provide information about the various products, and videos will describe Boeing's "sea-to-space" market coverage.

"The display is impressive because it highlights the breadth and depth of unmanned systems and projects across the Boeing enterprise," said Darryl Davis, president of Boeing Phantom Works, which is developing both Phantom Ray and

Phantom Eye unmanned airborne vehicles. Vic Sweberg, director of Unmanned Airborne Systems for Boeing Defense, Space & Security, noted that the unmanned systems business is as "robust internationally" as it is domestically. "Farnborough offers us a very exciting opportunity to showcase our unmanned solutions before a broad set of customers from around the world," Sweberg said.

Davis and Sweberg will conduct media briefings during the air show.



PHOTO: Insitu's Kristopher Froehlich, lead air vehicle technician, downloads telemetry files from the Boeing subsidiary's new Integrator unmanned aerial vehicle, which can carry a heavier payload than Insitu's successful ScanEagle. **BOB FERGUSON/BOEING**

of sensors and a manipulator arm. It also can traverse 6 inches (15 centimeters) of water.

Boeing's Echo Ranger, on the other hand, can explore ocean depths of 10,000 feet (3,000 meters). It is a large, autonomous unmanned underwater vehicle, or UUV, capable of performing commercial surveys, as well as intelligence, surveillance and reconnaissance missions for the military.

But it is the unmanned aerial vehicles that are getting most of the attention these days.

"Boeing has a varied portfolio of unmanned systems designed to meet the rapidly evolving needs of the warfighter," said Chris Chadwick, president of Boeing Military Aircraft. "Our customers have always looked to us for best-of-industry solutions, and the unmanned systems market is no different."

The fast-growing market for unmanned aerial vehicles (UAVs) saw sales surpassing \$4 billion last year and is forecast to more than double over the next decade. Some 50 companies around the world today offer about 300 UAVs of all sizes and descriptions.

"A multitude of new mission capabilities and concepts of operation is emerging right now for UAVs that people never imagined," said Vic Sweberg, director of Boeing's Unmanned Airborne Systems. "That is what's driving growth on the military side today, and it will spur similar growth in commercial markets down the line."

Boeing currently markets more than a half-dozen unmanned aerial vehicles. "This product line benefits from our structures, control system, aerodynamics and other strengths as a developer of manned aircraft," Sweberg added.

Strategic acquisitions such as Insitu have further strengthened the Boeing Defense, Space & Security portfolio of unmanned capabilities.

Insitu's latest product is the Integrator, a UAV that meets military needs for a larger, more robust stablemate to ScanEagle. In addition to its standard sensor array, Integrator can carry 25 pounds (11 kilograms) of payload for 15 hours or, like ScanEagle, be configured for 24-hour missions.

"Integrator's name reflects our driving focus on seamless payload integration to rapidly support our customer's missions and intelligence, surveillance and reconnaissance needs," said Insitu's Clark.

Intelligence, surveillance and reconnaissance is the primary role of UAVs, the others being mobility, strike applications and communications relay. Within these categories, the list of current or possible UAV applications is large and growing fast.

Take Boeing's A160T Hummingbird, an unmanned rotorcraft. In March, in a demonstration for the U.S. Marines, a Hummingbird flew two 150-nautical-mile (278-kilometer) round trips to shuttle 2,500 pounds (1,134 kilograms) of cargo from one simulated forward operating base to another—in less than five hours.

"In military service, Hummingbirds could potentially save lives in war zones by substituting for trucks vulnerable to roadside [bombs]," Sweberg said. "Down the line, this type might play a wide variety of civil roles. With its performance, I can even imagine it retrieving injured climbers from the world's highest peaks."

Earlier this year, Boeing put the nearly all-composite A160T into production in Mesa, Ariz. Paulina Bryant is a veteran composite fabrication expert there, helping to build the A160T. "Boeing has had top talent on this project from the beginning," Bryant said. "We are all excited to see the Hummingbird in production at Boeing Mesa and view unmanned systems as the wave of the future."

Boeing has built and delivered unmanned aerial vehicles

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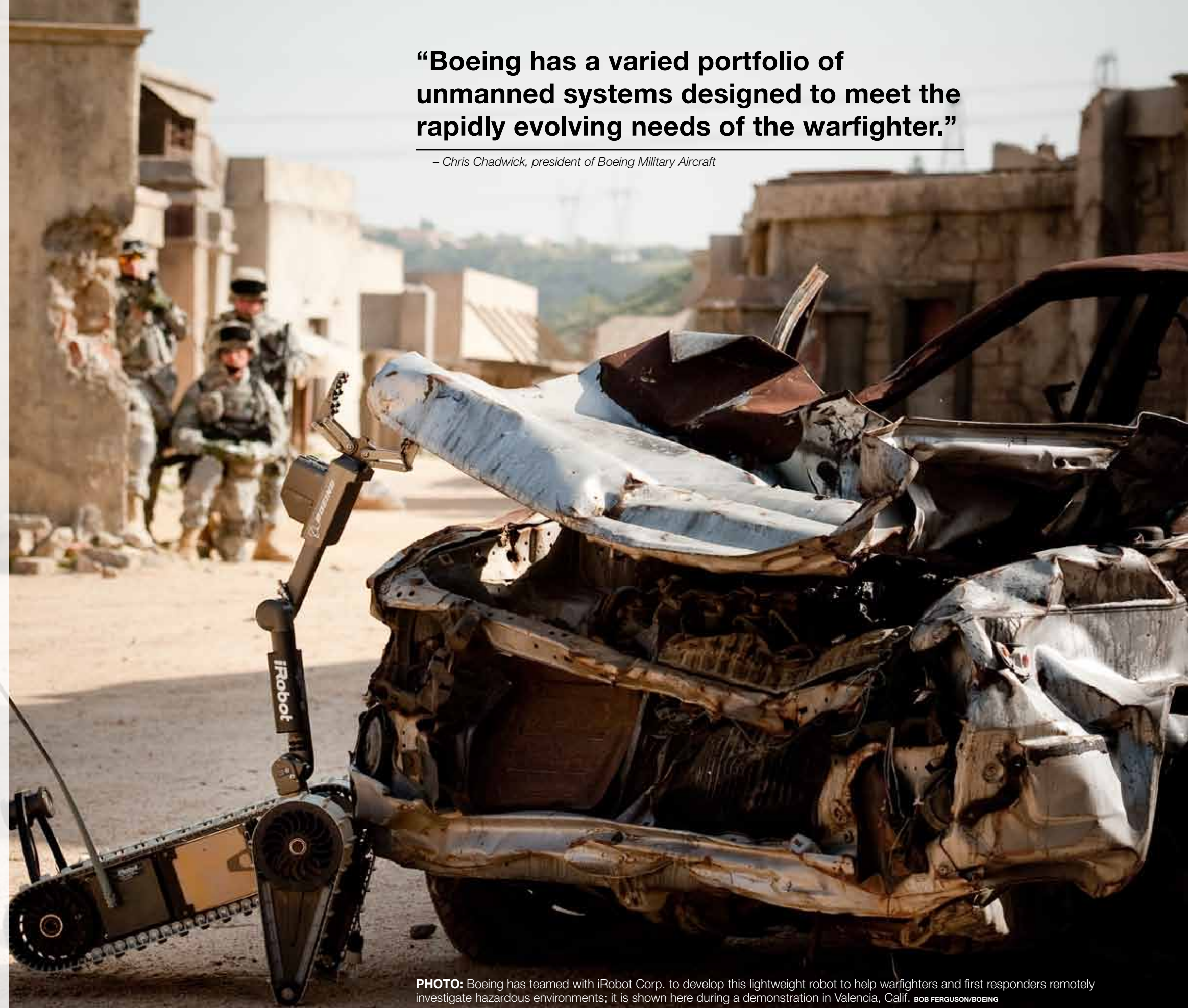


PHOTO: Boeing has teamed with iRobot Corp. to develop this lightweight robot to help warfighters and first responders remotely investigate hazardous environments; it is shown here during a demonstration in Valencia, Calif. BOB FERGUSON/BOEING



“Boeing’s UAV focus is on autonomy.”

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PHOTO: Lead mechanic Ray Rich secures a cargo sling to a Boeing A160T Hummingbird rotorcraft during testing in Victorville, Calif., earlier this year.

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and spacecraft over many decades, but today’s products are fundamentally different.

“Boeing’s UAV focus is on autonomy,” said Ron Perkins, director of Advanced Unmanned Airborne Systems for Phantom Works. “Our UAVs literally fly themselves. We don’t have remote pilots at the controls. We use sophisticated software that allows us to ‘fly by mouse,’ which reduces the number of people required to perform a mission and provides combat commanders more flexibility.”

Bob Feldmann, vice president and general manager of Airborne Battle Management, agreed. “We’re working with our military customers to help incorporate UAVs into their integrated battle-management environments, where they can enhance situational awareness and otherwise contribute to achieving military objectives,” he said. “In this information-rich environment, manned/unmanned interoperability is a key capability.”

A Boeing 737 Wedgetail, an Airborne Early Warning & Control aircraft, has already demonstrated during a test in Australia that it can control three ScanEagles in flight. In the near future, according to Feldman, UAVs will improve the ability of the Navy’s new P-8A Poseidon, a modified 737, to find and track subs and surface vessels.

UAVs can be more economical and better for the environment than manned aircraft. They can also stay aloft longer—about 2,000 days in the case of the SolarEagle, which will have a wingspan twice that of a 747.

SolarEagle’s performance comes from a combination of non-hydrocarbon fuels, nontraditional power systems and very lightweight, flexible structures. “The result is satellite-like capabilities with lower cost and greater flexibility,” said Pat O’Neil, Boeing’s program manager for SolarEagle.

The ultra High Altitude Long Endurance (HALE) aircraft will be able to provide continuous observation in roles such as border surveillance, port security, environmental monitoring and hurricane tracking. It can also provide vital communications relay for disaster relief.

Another HALE aircraft currently under way with Phantom Works is the Phantom Eye demonstrator. Like SolarEagle, Phantom Eye, a propeller-driven aircraft with a 150-foot (46-meter) wingspan and powered by two modified hydrogen engines, will fly at 65,000 feet (19,800 meters). However, instead of staying aloft for five years, Phantom Eye is designed to stay on station for up to four days to perform missions similar to SolarEagle.

What does the future hold? UAVs may someday share the same sky with aircraft that carry people. “This will happen once further advancements in autonomy, sense-and-avoid and air traffic management technologies combine with an updated regulatory framework to ensure safe operations,” Sweberg said.

Last month, the Federal Aviation Administration announced that Insitu will provide it with a ScanEagle system for research leading to recommendations for integrating unmanned aircraft into the U.S. airspace system.

“We create platforms with capabilities that are highly desired by several key customers,” said Davis, Phantom Works president. “It’s an exciting time because we are creating the future of unmanned aircraft, and the future is now.” ■

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To learn more about ScanEagle and Boeing’s Unmanned Airborne Systems, see the story beginning on Page 14 in the July 2009 issue of Frontiers.