HITTING THE BOX

By T.J. Ortega

Lines of computer code fill the screens of software engineers with complex calculations that allow unmanned systems to make decisions autonomously. Line after line of navigation and guidance code helps air vehicle operators control the U.S. Navy's premiere autonomous helicopters, the MQ-8B and MQ-8C Fire Scout. The sophisticated technology found on the Fire Scout enhances and extends human potential, leveraging our autonomous solutions to their full advantage.

To operate from any class of U.S. Navy ship, all aircraft must complete Dynamic Interface testing aboard a vessel of the class from which it will operate. Dynamic Interface testing is the phase in which Northrop Grumman systems and software come together to test Fire Scout's ability to adjust for ship movement and wind over the flight deck.

"Landing an unmanned vehicle on land, at a fixed location, is easy," said Russ Common, Fire Scout chief engineer. "But landing Fire Scout on a ship moving geographically — and also pitching, heaving and rolling — becomes a bit trickier."

MQ-8C Fire Scout, the Navy's next-generation autonomous helicopter, recently completed Dynamic Interface testing aboard the Independence-class Littoral Combat Ship, USS Montgomery (LCS 8), during a week-long demonstration.

For the past 11 years, the smaller MQ-8B Fire Scout has been successfully flying on and off U.S. Navy ships, providing unprecedented support and increased situational awareness. During the most recent round of testing, engineers repeatedly flew the Fire Scout on and off the USS Montgomery, once again demonstrating this revolutionary autonomous technology to the fleet.

HITTING THE BOX: HOW IT WORKS

To land on a moving ship, Fire Scout has to perform an incredible feat by hitting three virtual (in other words, invisible) boxes that Northrop Grumman software engineers have designed.

First, an air vehicle operator (AVO) on the ship sends a "return-to-ship" command to Fire Scout. It returns to the ship and hovers 100 feet behind it within an eight-foot virtual cube, known as "the box." When the Fire Scout confirms a stable hover behind the ship, the AVO gives a command to proceed.

Fire Scout then moves into a recovery perch position about 30 feet above the flight deck, holding stable in a second eight-foot virtual box. At this critical point, Fire Scout adjusts to the pitch, roll, yaw and vertical heave of the ship, with lines of complex code and systems working fast to ensure this maneuver is performed flawlessly. At this point in the landing, wind over the flight deck becomes a major factor as well.

Once Fire Scout is holding steady in the recovery perch, it will descend autonomously to 15 feet above the flight deck. It must now hold its position within a third, smaller four-foot moving box directly above the touchdown point. If the aircraft can hold its position within that box for a specified time interval, it will then autonomously proceed to the deck and land. If it cannot hold its position because of heavy seas or high winds, it will autonomously wave-off and try the approach again.

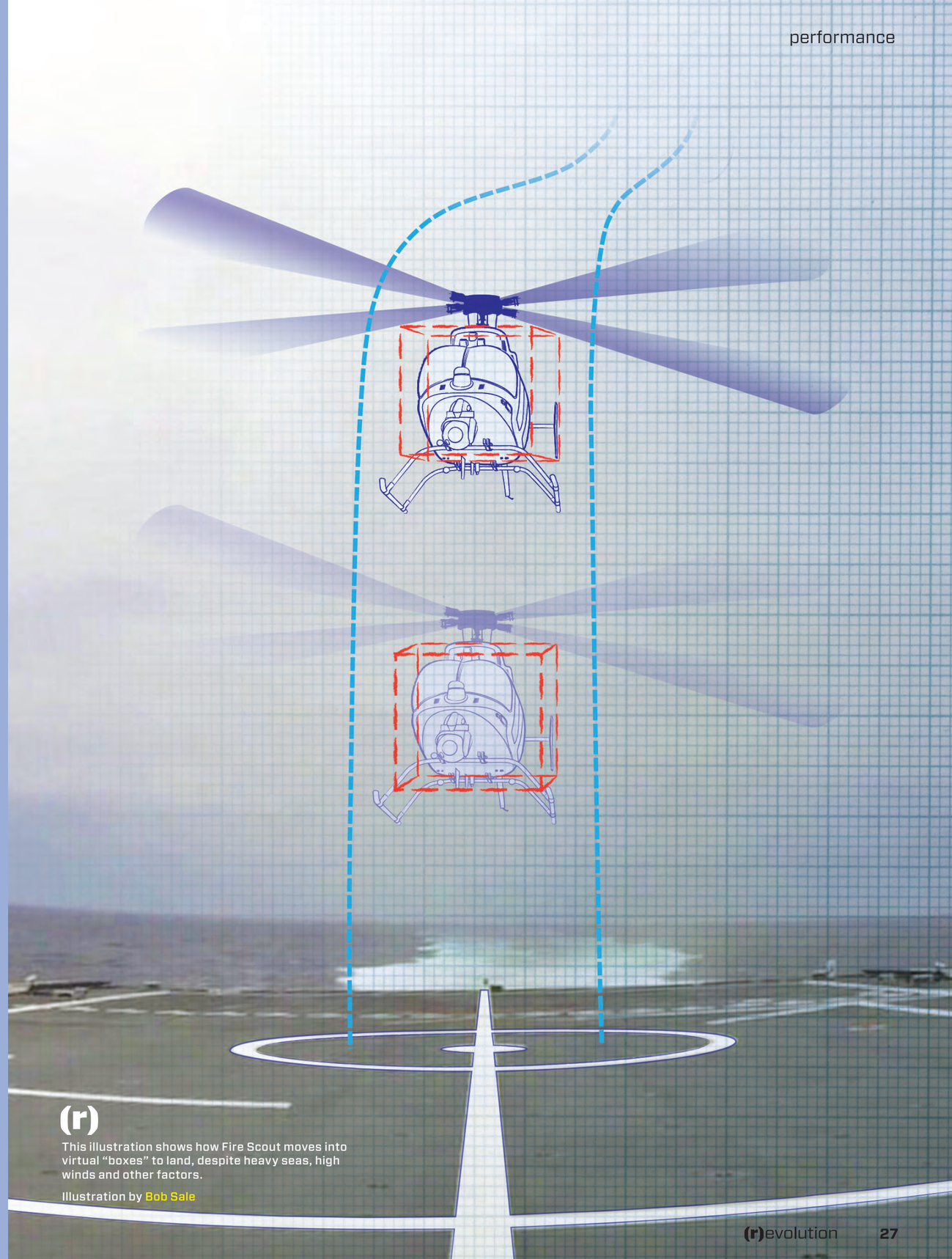
PERFORMANCE

Proven performance, combined with extreme agility and sophisticated control logic, allow Fire Scout to reliably operate off any air-capable ship.

"The first time I saw Fire Scout land on the ship, it looked like it was moving all over the place relative to ship motion," said Mike Moselle, Fire Scout guidance, navigation and control engineer. "But when it starts to descend and track the ship motion, it appears to hold perfectly still. It is very interesting to watch and really quite a peaceful thing to witness as it touches down within the required three-foot-radius landing zone."

MQ-8C Fire Scout's Dynamic Interface testing represents a significant milestone for the program. The Fire Scout system is extending ship capabilities and will offer the Navy a dynamic, multipurpose autonomous helicopter with increased endurance and payload capacity.

"The autonomous technology inside our Fire Scout system is truly a game-changer," said Melissa Packwood, Fire Scout program manager. "Performing precision landings repeatedly on ships is critical to the U.S. Navy, and our engineers have given them the autonomous solution to get the job done." **(r)**



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This illustration shows how Fire Scout moves into virtual "boxes" to land, despite heavy seas, high winds and other factors.

Illustration by Bob Sale