



CARGO UAS GET A LIFT

Designers Pursue Conventional and Futuristic Options

By Marc Selinger

The U.S. military's recent deployment of unmanned cargo helicopters to Afghanistan highlighted the potential future role of such aircraft. Several efforts underway in the United States and overseas are poised to build on that mission.

Some projects involve traditional-looking helicopters, while others use designs that seem like they flew out of science fiction movies. But they all share the same goal: keeping crews out of harm's way.

"Difficult terrain and threats such as ambushes and improvised explosive devices can make ground-based transportation to and from the front line a dangerous challenge," says DARPA. "[Manned] helicopters can easily bypass those problems but present logistical challenges of their own and

can subject flight crew to different types of threats."



U.S. agencies working on cargo unmanned aircraft systems include DARPA, the Office of Naval Research and the Marine Corps.

DARPA's Aerial Reconfigurable Embedded System program has begun building a prototype of an unmanned vertical takeoff and landing aircraft whose payload could be reconfigured to perform a variety of missions, including cargo resupply, casualty evacuation, troop transport and reconnaissance.

ARES will be equipped with tilting twin ducted fans instead of conventional rotors so it can use landing zones half the size of a comparable

helicopter. The compact design will also allow ARES to fit into small ship hangars or C-130 transport aircraft, according to Lockheed Martin, which leads the industry team with Piasecki Aircraft.

ARES would be operated by infantry soldiers and Marines in small ground units. Flight testing of the prototype could begin later this year, Lockheed Martin says.

ONR continues to develop the Autonomous Aerial Cargo/Utility System, or AACUS, a sensor software package designed to make it easier to deploy unmanned cargo helicopters in war zones. In April 2014, ONR selected Aurora Flight Sciences to be the prime contractor for the program's second phase.

Aurora's selection followed a flight demonstration in which Aurora's AACUS version flew on the Boeing Unmanned Little Bird and Lockheed Martin's flew on the Lockheed Martin/Kaman K-MAX. During the tests, which occurred in early 2014 at Marine Corps Base Quantico, Virginia, Marines with minimal training in piloting unmanned aircraft used handheld tablets to operate the AACUS-equipped K-MAX and Unmanned Little Bird.

Tactical Robotics, a subsidiary of Israel's Urban Aeronautics, is developing the AirMule, an unmanned rotorcraft with internal rotors.

Phase two will involve more flight tests, but "specific details ... have not yet been finalized," says Max Snell, ONR's AACUS program manager. Although the initial demonstration did not involve transporting actual cargo, ONR has said it plans to add that activity in future tests.

While K-MAX did not win the AACUS phase two competition, it achieved several other milestones in 2014.

During a one-hour firefighting test at a central New York airport in November, K-MAX used a helicopter to pick up more than 24,000 pounds of water from a pond and drop them on several fires. A small Indago quadrotor unmanned aerial vehicle helped K-MAX identify the hot spots.

Local, regional and national firefighting agencies observed the Lockheed Martin-sponsored event. Jon McMillen, the company's K-MAX business development manager, says K-MAX could allow aerial firefighting at night or in heavy smoke, which is not allowed with manned aircraft.

"If they had an unmanned asset, they could fly 24/7. It doesn't matter what the visibility conditions are," McMillen says. "For the guys on the ground who are trying to put out the fire, it

gives them the ability to be resupplied 24/7 from the air, which they don't have today."

In an August 2014 test at Fort Benning, Georgia, K-MAX autonomously used a sling load to deliver a Squad Mission Support System unmanned ground vehicle to soldiers defending a simulated village. That test was done with the Army's Tank Automotive Research, Development and Engineering Center.

And in July 2014, two K-MAX helicopters returned to the United States after transporting 4.5 million pounds of cargo for Marines deployed in Afghanistan. The K-MAX mission, which lasted 33 months, was designed to reduce the number of resupply convoys by manned trucks, which were vulnerable to attack from insurgents.

"This is a technology now that a lot of Marines are becoming very familiar with, very comfortable with," McMillen says. "So if another conflict breaks out, I think you could see this

re-tasked very quickly to go support that because of the utility it provided."

In a statement, the Marine Corps says its two K-MAX air vehicles will move to Marine Corps Air Station Yuma, Arizona, by summer 2015 so the VMX-22 operational test squadron can use them to "expand the cargo UAS concept."

"We will build on the lessons learned from using unmanned cargo delivery aircraft in Afghanistan by assigning our cargo UAS capability to VMX-22 in Yuma," the 2015 Marine Aviation Plan says. "We will continue to expand the capability of unmanned aerial logistics support to the [Marine Air Ground Task Force] in a wider variety of employment scenarios than used in Afghanistan and assist in requirements generation for future cargo delivery systems through experimentation."



Cargo UAS are also receiving attention outside the United States. Tactical Robotics, a subsidiary of Israel's

Photos: Tactical Robotics, Lockheed Martin

Lockheed Martin's K-MAX unmanned helicopter drops water on a fire during a firefighting demonstration in New York.



Urban Aeronautics, is developing AirMule, an unmanned rotorcraft with internal rotors. Tactical Robotics says the compact design, which is slightly larger than a Humvee, will allow AirMule to fly and hover in areas that are too constricted for helicopters, such as near buildings, mountains and woods.

A prototype has flown about 150

times, though not yet with cargo or people, says Rafi Yoeli, president and CEO of Urban Aeronautics. In its first fully autonomous flight, which occurred in December 2013, AirMule took off, flew to a designated spot and returned to the point of departure. Flight testing will move to the Negev desert in 2015.

“So far, testing has been done very close to populated areas, so the local [civil aviation authority] has required a long tether to catch the aircraft in the event of a run-away condition,” Yoeli explains. “In the Negev, this limitation will be removed and all flights will be untethered, fully preprogrammed and carried out autonomously.”

A second prototype, identical to the first, is under construction to serve as a reserve aircraft or speed up testing.

Tactical Robotics hopes to receive its first order for AirMule as early as 2015. Once that first order occurs, AirMule could be ready for operational use in about five years, the firm estimates. The company projects strong military demand for AirMule for cargo delivery and casualty evacuation. While the aircraft’s development is mostly self-funded, the Israeli Ministry of Defense is helping to pay for the flight tests.

Tactical Robotics expects AirMule to be stealthy on the battlefield due to its “maneuverability, small visual footprint, low noise and reduced radar and [infrared] signatures.” The firm also envisions many civil uses for AirMule, ranging from inspecting bridges to delivering food and medical supplies to earthquake victims.

AirMule is not the only international cargo UAS effort. The Golden Triangle Group, which consists of Dutch and other European organizations, is studying the possibility of developing a military unmanned cargo aircraft, according to Platform Unmanned Cargo Aircraft, a Netherlands-based advocacy group. The short takeoff and landing UAV would have a payload of one to 15 tons and a range of 300 to 5,000 kilometers. ■



The advertisement features a dark blue background with a stylized white wing logo at the top. Below the logo, the text "RAPID IMAGING SOFTWARE" is displayed in a white, sans-serif font. Underneath, "SMARTCAM3D" is written in a larger, bold, white font. The central part of the ad shows a 3D aerial view of an industrial facility, likely a refinery, with various structures, pipes, and storage tanks. Several labels are overlaid on the image: "Dunn Meany Rd." on the left, "Industrial Canal" at the bottom left, "Refinery" in the center, "Corn Product" on the right, and "Valero Way" on the right side. A road sign with the number "37" is visible in the upper right. At the bottom of the image, the slogan "Go from nowhere to know where." is written in a white, italicized font. Below the image, the text "Full Motion Video player with augmented reality overlays." is displayed in a bold, white font. A bulleted list follows, detailing features like "Video Player", "World Map Overlays", "Intelligence Overlays", and "Platforms". At the bottom, contact information for scheduling a demo and the company website is provided.

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