

the MAV and its fuel. A Raven system - ground control unit, batteries and airplane - weighs less than 12 pounds, and can be carried by on person.

Fixed-wing UAVs can turn off their engines and glide in order to save gas. The Raven flies for 90 minutes, compared with less than an hour for the T-Hawk. Vertical-lift MAVs "have to carry a considerably large [amount of] gas to achieve endurance," Flach said. "That then limits the payload you can carry." Noise is also an issue. The T-Hawk tends to fly at very low altitudes, making it easier to hear than a high-orbiting UAV. T-Hawk's noise reaches 60 decibels at a distance of about 100 meters, which is comparable to a crowd of people talking. Agility is where the T-Hawk shines, however. It can keep a bead on a target without having to do racetracks in the sky. It can look into third-story windows, and it negotiates canyons and cityscapes better than fixed-wing aircraft, Flach said. It also flies faster than some small UAVs,

such as the Shadow and Aerosonde.

The Army has yet to ink any production contracts with Honeywell, but Madden believes it will - and create a snowball effect. "We've been talking to a lot of different customers, ministries of defense across Europe, in Asia," he said. "And I think once the Army gets its orders out, there'll be a line-up of different military organizations coming in right behind it."

Meanwhile, Honeywell has been working the Miami Dade Police Department to arrange a demonstration of the T-Hawk MAV. However, there is an issue with Federal Aviation Administration regulations - where one can fly the vehicle and who is authorized to fly it. Daniel Knee, director of sales for Honeywell's helicopter and surface systems division, predicts the demonstration will happen next year.

The Navy started looking at the MAV in early 2007. The Navy did not examine other VTOL minis before making its selection, relying instead on the DARPA down-

select that occurred several years earlier. Nevertheless, the Navy - like the Army - has tested the MAV.

The Navy conducted a user assessment in Iraq in August 2007 and identified deficiencies, including excessive video jitter. The Navy paid Honeywell to fix the problems through an existing DARPA contract.

Many of the deficiencies were the same as those identified by the Army. The Navy's Anderson said special attention was put into avoiding overlapping radio transmissions. He said "we really looked closely at the electromagnetic spectrum to try to find, and found, a radio in a spectrum that would be amenable to EOD operations."

The Navy was convinced enough about the fixes to place the \$65 million order. Roudebush said that is probably just a start for Honeywell's MAV lineup. "I think, once the Navy operators, specifically the EOD technicians, get this in their hands, they are going to want more," he said. "Word will get out." ■



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C4ISR Tactical UAVS

Micro Air Vehicle revolution

Big orders hinge on Army's Future Combat Systems

By ERIC SCHECHTER

There's no way around it: The Honeywell Micro Air Vehicle (MAV) looks like a hovering lawnmower engine with kickstands. Even so, interest from the U.S. Army and the Navy has elevated these vertical-lift craft into top contenders in the quest to equip troops with personal-sized ISR aircraft.

The MAV, which comes in a 17-pound version and soon a 41-pound version, can hover over a target, duck into a target building or hide behind cover. Its "ducted" fan engine generates lift by sucking in air and passing it out through a duct containing flight control flaps. So far, the main operational customer has been the U.S. Army's 25th Infantry Division, whose troops are using about 20 laptop-controlled, pre-production models of the 17-pound version to scout for IEDs and insurgent ambushes in Iraq.

The MAV's limited usage is about to grow, though by how much will depend on decisions within the Barack Obama administration.

A Micro Air Vehicle provides a bird-eye view during an evaluation of the remotely controlled tactical UAV at Fort Bliss, Texas.



a bird's eye view

Honeywell

Visit us online at www.honeywell.com/mav

Honeywell's MAV provides unprecedented situational awareness for the modern war fighter.



Featuring vertical takeoff and landing, the lightweight and portable T-Hawk MAV can be quickly deployed to provide advanced reconnaissance along with security and surveillance functions for troops on the ground in a variety of operational terrains. Day or night, the all-weather units feature persistent hover and stare capability to deliver more accurate, real-time information to increase awareness and put soldiers at less risk. T-Hawk MAV is available for both military and civilian end-use.

Honeywell's biggest potential MAV customer is the Army's Future Combat Systems program, a multibillion-dollar effort to equip troops with ground robots, UAVs, network-equipped armored vehicles and networked radios. Honeywell is developing 10 demonstration models of a 41-pound MAV for FCS. Honeywell's orders could swell to more than a thousand if those MAVs perform as planned, but there is a potential hitch. During the U.S. presidential campaign, Obama said he would slow the development of FCS. If or when the orders do come, Honeywell says it will be ready to build them at its factory in New Mexico.

In October, the U.S. Navy and Honeywell signed a \$65 million contract for 180 of the 17-pound MAVs for use by bomb disposal teams across the military. Honeywell is scheduled to deliver the MAVs, renamed T-Hawks, in "systems" of two UAVs, a ground control unit and spare parts. For the Navy, the T-Hawk MAV purchase was notable because the service has more often leased its unmanned aircraft.

"This system is one of the very first unmanned air systems that the Navy is buying on its own contract," said Marine Corps Lt. Col. James Roudebush, leader of the Navy Tier 1 Unmanned Aerial Systems Integrated Product Team, which equips the Navy and Marines with small UAVs.

The T-Hawk will not serve on ships at sea. Rather, the Navy will deploy them with explosive ordnance disposal (EOD) specialists riding in Humvees and armored, rapid response trucks. With a flight time of about an hour, the MAVs will inspect suspected bomb sites in areas inaccessible by ground robots, said Brian Anderson, an analyst with the Navy's Joint EOD/Counter Radio-Controlled Improvised Explosive Device Electronic Warfare program, which prepares bomb-disposal teams across the military. "In the past, this picture may have been provided by an additional EOD technician being positioned downrange looking through binoculars," Anderson said by e-mail.

THE MAV IS BORN

In 1997, the Pentagon's Defense Advanced Research Projects Agency



A soldier prepares a Micro Air Vehicle for flight at Fort Bliss, Texas

U.S. ARMY

(DARPA) began exploring "micro air vehicle" technologies. DARPA quickly identified ducted-fan propulsion as a promising approach. In 2004, Honeywell and Allied Aerospace teamed up to fly a 29-inch-diameter, ducted-fan MAV at Fort Benning, Ga., with Honeywell providing the flight controls.

As it turned out, the year would be a better one for Honeywell than for Allied Aerospace. DARPA wanted a smaller MAV, and Allied was in charge of that effort. DARPA canceled that project in 2004, citing technical problems. DARPA

was determined not to give up. The agency approached Honeywell and said: "Provide us with a proposal to use your concepts to do a from-scratch design of a smaller vehicle," recalled Vaughn Fulton, Honeywell's senior program manager for unmanned air vehicles.

Honeywell developed and flew a series of demonstration vehicles under DARPA's MAV Advanced Concept Technology Development program. By 2006, the Army had seen enough. It awarded a \$45 million contract to Honeywell to build

demonstration MAVs for FCS.

Over the years, as engineers have developed smaller UAVs and the Army has requested a larger MAV, the word micro in MAV has become a misnomer. There are smaller UAVs, including the one-pound Wasp Block 3, a hand-launched plane used by Air Force combat ground controllers as a targeting aid. DARPA chose to call its project the Micro Air Vehicle, and Honeywell decided not to change the designation due to branding issues.

"We just kept it the same because people just started recognizing it as, well, Honeywell's MAV," said Michael Madden, vice president of sales for Honeywell's helicopter and surface systems. The Navy T-Hawk contract is the first production contract for Honeywell's MAV managers. The 17-pound craft carries one sensor at a time, either an electro-optical or infrared camera. Honeywell has placed these in modular pods for easy switching.

"You pop one off and put another one on," Madden said. "So it's literally a second" to make the conversion. An operator controls the T-Hawk by tapping a stylus pen on the screen of a Toughbook laptop computer to create GPS navigation points, while an inertial measurement unit built into the craft helps keep track of position and speed.

The T-Hawk can hover in front of an open doorway and even fly inside. But unless the T-Hawk has a detailed map of the building's GPS coordinates programmed into it, its movement indoors would be limited.

"You are not going to fly down a hallway and fly via stick and rudder," said Steve Flach, program director for advanced unmanned aircraft systems at AAI Corp., which makes the centerpiece of the MAV airframe for Honeywell.

In theory, a sophisticated collision avoidance system could make such tight-fit flights possible, but the technology has yet to be developed, Flach said.

FUTURE COMBAT SYSTEMS

When Army officials tested the smaller version of the MAV, managers of the FCS program decided they wanted it to carry day and night cameras, instead of one or

FCS program managers decided they wanted it to carry day and night cameras, instead of one or the other, and have the ability to designate targets with lasers.

the other, and have the ability to designate targets with lasers. The Army adjusted the contract with Honeywell to reflect the new requirements, and the vehicle's estimated weight stands at 41 pounds. Even with the extra weight, the Army says the larger MAV will still be portable. The most important addition would be the laser-designator to identify targets for laser-guided

munitions. The new MAV also would simultaneously carry a daytime electro-optical camera and nighttime infrared camera. Instead of a gasoline-powered engine, its 10-horsepower engine would be powered by jet fuel, which is standard for other UAVs.

Other changes have been driven by requests from the troops to make the MAVs more user friendly. In late 2006, the 25th Infantry Division had trained with the MAV at Schofield Barracks, Hawaii. Soldiers recommended a more stable video image, the laser designator, an electric refueling pump and an automatic engine tuning device, said Army Lt. Col. Win Keller, product manager for Future UAS. Pumping fuel manually with a syringe can take 10 minutes compared with a minute with the electric pump, Keller said.

In addition to the work done at

Schofield Barracks, the Army Evaluation Task Force at Fort Bliss, Texas, used the 17-pound MAV as a surrogate for the planned larger craft during FCS communications tests in February 2007 and August 2008. The task force is assessing four FCS projects, including the MAV, for early "spinout" fielding in 2011. Critics had complained that the benefits of FCS were too far off to justify the program's cost.

"We experimented with man-unmanned teaming, moving images from the [surrogate] into an Apache" helicopter, Keller said. "We experimented with new radios, new waveforms."

The first 41-pound version is scheduled to be ready in two years. Keller said each of 15 FCS brigades would receive 90 MAVs when core FCS fielding begins in 2015.

The Army's decision to go to the 41-pound version came as a surprise to some industry officials. FCS officials initially had planned for four classes of UAVs, with class 1 the smallest and class 4 the largest. In January 2007, the Army cut class 2 and 3 UAVs and bumped key class 2 features - jet fuel, electro-optical and infrared sight, and laser designation - to class 1, which is the 41-pound MAV. "Until last fall, we thought the 17-pound MAV would be the class 1," said Bob Ashton, business development manager for Aurora Flight Sciences.

TRADEOFFS

Even with all the MAV flights to date, Honeywell will have to challenge the status quo if it is to make a broader case for its vertical-lift UAV, said Steve Zaloga, a defense analyst with the Arlington, Va.-based Teal Group analysis firm. Fixed-wing aircraft, such as the RQ-11 Raven, have already gained a strong foothold among Army, Marine and special operations users, he said.

Winged and wingless "mini" UAVs have a mix of strengths and weaknesses. Honeywell officials like to point out that their T-Hawk does not have to be disassembled to be carried. That's true, but the system requires two soldiers to transport - one person to carry the laptop and antenna, and another to hold