PROFESSIONAL FORUM

The Raven SUAV

Working with Army Aviation

CAPTAIN JOHN C. WAGNER

Army aviators move over. Our infantry brothers now have their own air force in the form of the Raven, a hand-launched SUAV (small unmanned aerial vehicle). Weighing in at approximately four pounds and with a wingspan of only 4.4 feet, the Raven is a down-sized version of the Pointer SUAV which first began operational service with the U.S. Special Operations Command (SOCOM) in Afghanistan. The Army has operated approximately 180 Raven systems in Iraq since June of 2004 and plans to field 65 more Raven systems at the battalion level to fill wartime needs.

The entire Raven system weighs in at only 30 pounds but yields an impressive bit of technology. The Raven can carry a high resolution day color camera or a thermal camera for use at night and in overcast conditions. It navigates via GPS waypoints or operator input and is capable of operations at altitudes up to 3,000 feet and at distances of 12 kilometers from its base control unit. With a reported top speed of 90 kilometers per hour, its normal mission profile is 500 feet above ground level at 40 kilometers per hour for approximately one hour. The Raven system is composed of three aircraft bodies, spare parts, a control station, and a video camera for recording imagery. Two Soldiers typically operate the system and can have the Raven airborne in minutes.

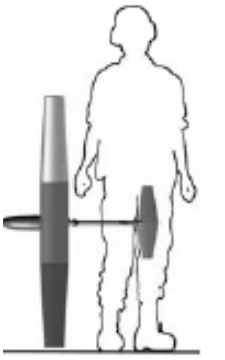
The Raven UAV performs a number of reconnaissance and security missions including area and route reconnaissance, forward operating base security, and counter-mortar fire operations. The Raven is particularly useful for missions where stealthy observation is a necessity because it is extremely difficult to detect when flying at altitudes over 300 feet. If a closer look is desired, the operator can cut the throttle and glide the Raven over the objective for a detailed inspection of the site. This technique is particularly useful prior to conducting a raid on an insurgent hideout. For example, commanders can use the Raven's real-time imagery to detect suspicious conditions on the objective just prior to conducting the raid. Armed reconnaissance helicopters can then be called in once the raid has begun to provide local security to the ground force.

Sergeant Jeremiah Johnson

Sergeant First Class Robert Bowman of the 1st Brigade, 25th Infantry Division (Stryker Brigade Combat Team) launches a Raven unmanned aerial vehicle in Mosul, Iraq, December 14, 2004.

While the Raven system is designed to provide an infantry battalion its own autonomous aerial observation platform, the Raven's effectiveness is increased when used in conjunction with traditional Army Aviation assets such as the OH-58D Kiowa Warrior and AH-64 Apache reconnaissance/attack helicopters. The Raven SUAV can also hand over target information to larger UAVs, such as the Army's Shadow or Hunter UAVs which are typically controlled at higher echelons. By working in concert with other airspace users, the Raven system maximizes its effectiveness and frees up overtaxed manned aviation assets from performing time consuming and resource intensive missions best performed by SUAVs.

For example, an infantry battalion can use its Raven SUAV as



Raven SUAV

Features:
Small Size
Light Weight
Hand Launched
Auto Navigation
Auto Land
RS-232 Interface

Payloads:
CCD Color Video
2 CCD Switcher
IR Camera
GPS (P-y Code)
Altimeter
Compass Heading

Demonstrated Performance:
Maximum Range: 12 km
Duration: 50 Minutes (Rechargeable)
Duration: 80 Minutes (Primary)
Battery Usage: 350 gm/flight hour

Current Missions:
Light Infantry MOUT
Dismounted Urban Warfare

its Counter-Mortar Quick Reaction Force. In Iraq a typical response time for an OH-58D quick reaction force was 20-30 minutes. A pre-assembled Raven can be launched within minutes of a mortar attack. Using previous points of origin and eyewitness reports, the Raven operator can begin a search for the attackers before reconnaissance helicopters arrive. Once the insurgents are detected, the Raven operator can use its stealth to track them until a target handover is possible with a reconnaissance/attack helicopter team or ground force. A Raven SUAV increases the likelihood of detecting the insurgent mortar team before blending back into the urban sprawl of Iraq's cities. In this case, the infantry battalion commander has a responsive counter-mortar option at his disposal via integration of the combined effects of multiple aerial and ground systems.

"Failure to conduct airspace coordination prior to SUAV operations may contribute to a mid-air collision resulting in severe injury or death." (TTP for the Raven SUAV, Draft, 4 June 2004)

Of course, for Army aviators the first concern that comes to mind when operating with battalions flying the Raven SUAV systems is airspace command and control. There has already been one reported mid-air collision between a Raven SUAV and an OH-58D and several reported near misses. Because Raven SUAV and Army helicopters frequently operate in the same airspace and at the same altitudes (0-500 feet above ground level), potential collisions between Raven SUAV and helicopters are serious concerns. Raven operators receive training in A2C2 (Army Airspace Command and Control) requirements and are required to submit SUAV ROZs (restricted operating zones) to be included in the Air Coordination Order (ACO). Raven operators routinely submit their ROZ request through their fire support officer (FSO) or aviation liaison officer for inclusion in the ACO. In addition to establishing Raven ROZs, procedural control measures must be developed and enforced.

The recommended method for establishing unit A2C2 procedures that accommodate the Raven SUAV is to form an A2C2 working group. Recommended A2C2 working group members include the following: G3/S3 Air, the brigade UAV (Shadow) platoon leader, senior aviation leaders from each supporting aviation brigade/battalion, combat control tower (CCT) personnel (for units operation in controlled airspace), and senior Raven operators from each unit. A common procedural control is for Raven SUAVs to operate between 300 and 500 feet AGL. Helicopters remain below 300 feet AGL and fixed wing traffic is above 500 feet AGL. This method is generally successful at airspace de-confliction among users, but fails to account for the limitations of the Raven's imaging systems in certain scenarios. The Raven's camera is unable to zoom in or out on its target requiring the Raven operator to adjust the Raven's flight level to account for this limitation (i.e. fly lower to zoom in and higher to zoom out). In order to observe significant detail on a target, a Raven operator must occasionally fly below the coordinating altitude of 300 feet AGL. Additional control measures are implemented when

dipping below the coordinating altitude. Battalion TOCs (tactical operation centers) monitoring the operation of their Raven SUAV conduct the necessary coordination to clear the airspace surrounding the target area before allowing their Raven operator to descend below the coordinating altitude. In order to do this safely, control measures must be in place ahead of time to ensure all aircraft in the battalion area of operations are monitoring a common frequency and are aware of the Raven's location. In Iraq, Joint Operation Areas Restricted Operating Zones (JOA ROZ) are commonly established over areas where combat operations involving division aviation assets are likely to occur. The JOA ROZ is disseminated throughout theater and provides a contact frequency for aircraft desiring to transition through the ROZ. It is the transitioning aircraft's responsibility to contact the JOA ROZ controlling agency when entering the controlled airspace. The controlling agency, normally a brigade or battalion TOC, monitors the contact frequency and informs the transitioning aircraft of any UAV and fires operations in the JOA ROZ. While this method of control is extremely flexible, it requires a close working relationship among all airspace users within the JOA and a thorough understanding of the JOA ROZ procedures for transitioning aircraft.

"Technology will undoubtedly reduce or combat workload, enhance our ability to see over the horizon and reduce the threat of casualties to our aircrews. Yet the ability of the human eye to see and the brain to detect and discriminate remains better than any sensor." (BG Michael Vane, deputy chief of staff TRADOC, Defense Information and Electronics Report July 2002)

Army aviators need not worry about their significance on the modern battlefield. Despite the Raven's enormous capability, it has its limitations. The Raven's small size and limited speed makes it difficult, if not impossible, to recover from downwind objectives in winds greater than 20 knots. Heavy precipitation and fog obscure the day camera and degrade the performance of the thermal camera. In cold weather operations, snow and ice may obstruct the camera view completely. In hot environments such as Iraq and Afghanistan, the batteries' already limited endurance is further reduced. The Raven must also remain in constant line of sight of the ground control unit; otherwise the control signal may be lost. For this reason the Raven is susceptible in urban areas with tall buildings and obstructions. Access to a rooftop launch and control point is ideal in this situation. A significant limitation is the limited field of view of the Raven's camera. As mentioned earlier in this article the Raven's camera is unable to zoom in without adjusting altitude. The thermal camera is further limited because the operator must select the Raven's front look or side look camera prior to launch. At night the front look capability is used for area and route reconnaissance, and the side look camera is generally used for reconnaissance of a specific observation site that the Raven operator plans to orbit.

Of course, the Raven's most significant limitation is that it is unmanned. A manned reconnaissance helicopter with a proficient crew is able to cover more distance, stay aloft longer, benefit from a larger field of view, and attack targets with its weapons when appropriate. A manned platform is able to react more quickly to changes in the mission environment and is able to interpret the changing conditions common to everyday life in Iraq and Afghanistan.

The Raven SUAV is just one system Army aviators will encounter on today's contemporary battlefield. By establishing adaptable control measures, Army aviators and their unmanned counterparts can safely collaborate on their respective strengths. It is clear that Army aviators are going to work with and among UAVs in all shapes and sizes in the future. The ability of Army aviators to operate with UAVs will continue the remarkable successes Army Aviation is experiencing every day against insurgent forces in Iraq and Afghanistan.

Captain John C. Wagner's last operational assignment was with the 4th Squadron, 2nd Armored Cavalry in Iraq, where he served as an assistant S-3, Battle Captain, and Aviation Liaison Officer. CPT Wagner conducted the initial planning, supervision, and integration of Raven operations into the regiment's daily operations in June 2004, while serving as an Aviation Liaison Officer, with the 3rd Squadron, 2nd Armored Cavalry in Diwaniyah, Iraq. He is currently a student at the Aviation Officers Career Course, Fort Rucker, Alabama.

Recent Missions Highlight Raven

MAJOR OLIVER HASSE

Reconnaissance/Cordon and Search: Raven small unmanned aerial vehicles (SUAVs) are routinely used to conduct reconnaissance for future operations. A Raven will fly over a target house taking video and still imagery from different angles to allow the ground tactical commander to better prepare his forces to raid the house. Commanders look for the best ingress and egress routes, locations to emplace the security force, and possible escape routes for the targets. The Raven is also used as part of the "go/no-go" criteria for the mission, by viewing the remote video terminal prior to execution. The commander can also use the Raven during the raid to provide extra security around the target area.

Units can also gather file footage of villages and possible target areas. In areas of operation that have many small villages the Raven can provide aerial view of the village so a commander can access the file footage prior to conducting an operation. This imagery can also be compared to more recent images to provide any changes to the area.

Units also conduct mosque reconnaissance since U.S. forces do not enter the mosques. Units look for weapons being moved into and out of the mosques. If a mosque is suspected of hiding insurgent material, U.S. troops coordinate with the

A 300-plus pound Manta underwater magnetic influenced bottom mine was found in the back of a suspicious Suburban.

An image shows the layout of the compound where a VBIED was found in January 2005 in western Baghdad. The U.S. Soldiers were able to detain two insurgents during the mission.

Iraqi Army to search the mosque. The U.S. Army may provide external security for the mission while the Iraqi forces conduct the raid.

VBIED (Vehicle-Borne Improvised Explosive Device):

In late January 2005, scouts from the 1st Battalion, 156th Infantry were conducting area reconnaissance missions in western Baghdad. The ground scouts identified a suspicious large black vehicle in the courtyard. The scout platoon requested raven support that was 700 meters away to investigate the compound. The Raven provided positive identification of a Suburban and provided detailed information on the layout of the compound. The Raven remained on station while the ground scouts conducted a hasty cordon and search of the compound. The unit found the Suburban to be rigged as a VBIED, and two of the three insurgents were apprehended with assistance from the Raven. The vehicle had a 300-pound underwater mine, eleven 105mm rounds, and an undetermined amount of nitrate rigged for explosion. The house contained RPKs with ammunition, grenades, mortar tubes with mortar rounds and rockets. Seven Soldiers, including the Raven operators, were awarded Bronze Stars.

IED/Route Reconnaissance:

While conducting route reconnaissance, Raven operators can look for any suspicious digging in the vicinity of roads. Engineers (467th Engineers) conduct main supply route (MSR) IED sweeps with ground vehicles, and then a Raven can fly over the cleared area from a tactical halt to identify any new IEDs being emplaced.

Other battalions patrol main supply routes and note any digging in the vicinity of the road so a ground patrol can investigate the area and question the individual digging. Individuals attempting to emplace an IED usually flee the area with the arrival of coalition forces. Soldiers with the 2nd Battalion, 14th Infantry, 10th Mountain Division (Light) caught insurgents emplacing 155mm rounds along an MSR.

Immediate Raven Support:

While conducting reconnaissance missions, Ravens can be redirected to support an IED struck patrol. The Raven provides aerial coverage to the units that have been struck to search for possible secondary IEDs, and any threat (trigger men) that may influence the struck convoy or security forces that have cordoned off the area.

Troops in Contact:

Soldiers with the 1st Battalion, 116th Infantry conducted a ground patrol in a village five kilometers north of the forward operating base. The patrol came under small arms fire in the village and notified the battalion tactical operations cell. The Raven team diverted their ongoing main supply route IED emplacement reconnaissance and flew to the area with troops in contact. The tactical operations cell had live video feed of the Raven footage to provide guidance to the ground tactical commander. The Raven SUAV allowed the ground tactical commander to have situational awareness of adjacent alleyways and visibility of the village's roof tops, to facilitate the safe movement of ground forces. The Raven provided coverage until relieved by AH-64 helicopters.

BOLO ("Be on the look out" missions):

Raven operators are asked to conduct "Be on the look out"(BOLO) missions to find vehicles for the battalion and higher. These vehicles may be VBIEDs, vehicles carrying known insurgents, or a vehicle that is suspected to be carrying a kidnap victim. During the day the Raven operators are able to identify vehicles and provide this information to ground patrols or rotary wing assets to investigate the suspected vehicles.

Iraqi National Guard Training:

Ravens can conduct overflights of Iraqi patrols and check points. The overflights provide the Iraqi's with coalition coverage while still allowing to have an Iraqi face on the check point or patrol. The Raven can also view large gatherings or demonstrations. The battalion commander can then make an assessment if Iraq forces have control of the situation or if he needs to deploy a patrol to assist in keep good order.

Counter-Mortar:

Units use target pattern analysis to place the Raven on standby or in the air to investigate points of origin for mortar attacks. The Raven can acquire personnel at night with its infrared white hot mode. Any hot objects identified by the Raven after curfew can be investigated by ground patrols.

Targeting:

Although the Raven does not specify the grid location of the site it may be viewing, Raven operators can use the Falconview with digital imagery to find a good six-digit grid for a target. This data can than be used for ground forces, rotary wing assets or other UAVS to observe the target for prosecution.

Major Oliver Hasse is currently serving as the Raven Integration Training Officer with TRADOC Systems Manager - Unmanned Aerial Vehicle Systems at Fort Rucker, Alabama.