Increasing the Utility and Mobility of the Raven SUAS in Mounted Formations

CPT KENDALL HAMM
SSG RYAN MACLEOD

Author's Note: *Just as this issue was going to press, the Army publicly announced the planned divestiture of the Raven system.[1] Given this announcement, the purpose of this article remains twofold and unchanged: to provide an example of critical thinking that led to tactical innovation and to share lessons laterally. The operation of unmanned aerial systems (UAS) at the company level will continue to be a force requirement indefinitely, although the platform will change. Our hope is that this article spurs creative thinking and for Soldiers across the force to see any system, UAS or otherwise, and think "How can I make this equipment/system/standard operating procedure better?"*

The RQ-11B Raven small UAS (SUAS) is the infantry company commander's organic aerial intelligence collection platform. The Raven adds value with a range of approximately 10 kilometers and provides both an infrared and daytime sensor capability. Even with these capabilities, many commanders have no love lost on the Raven due to its size, user interface, reliability, and two-person crew requirement, all of which feel a bit clunky when compared to the most current commercial off-the-shelf (COTS) technologies. To compound these factors, it was routine throughout the global war on terrorism for infantry battalions and companies to have consistent dedicated manned or unmanned intelligence, surveillance, and reconnaissance (ISR) platforms, ranging from AH-64 air weapons teams (AWTs) to MQ-1 or MQ-9 Predators/Reapers, or even multi-layered combinations.

The costs to employ the Raven and lack of need to do so led many commanders to assess the cost/benefit trade off of employment as unfavorable, so many a Raven remained in the container express (CONEX).

A Soldier in the 1st Security Force Assistance Brigade prepares to launch an RQ-11B Raven during training at Fort Irwin, CA, on 17 August 2023. (Photo by MAJ Jason Elmore)

However, routine direct support of AWT or unmanned ISR at the company level should not be expected in future large-scale combat operations (LSCO). Self-reliant maneuver units should use all of their organic capabilities to maximize their own (as well as the battalion's and brigade's) understanding of the operational environment, which will allow more efficient employment of higher-level assets and buy decision space for commanders at all echelons.

Other articles have provided excellent descriptions of integration of the Raven at the company level and the potential value added to all warfighting functions.[2] This article will provide a technical how-to guide for configuring a Raven crew and fieldcrafting a commander's real-time viewer internal to a Stryker or MaxxPro Mine Resistant Ambush Protected (MRAP) vehicle as well as discuss mobile launch techniques and benefits. Training the Raven crew to operate from inside a vehicle lowers the time associated with setup for each flight, keeps the crew mobile versus static, and allows the range of the sensor to be as dynamic as the mounted formation. Fieldcraft improvisation for this real-time viewer can give the commander an instantaneous view of the Raven's sensor in a vehicle that doesn't allow him or her to look over the shoulder of the operator, closing the performance gap between the Raven and other COTS technologies. Using these techniques, infantry commanders can become more comfortable with Raven employment and maximize their company's organic strengths and opportunities within the intelligence warfighting function.

Materials Required

• RQ-11B Raven, complete kit in flying condition with Panasonic Toughbook (omnidirectional antenna preferred)
• Trained two-person Raven crew
• Vehicle with operational 12V or 24V inverter
• 81mm mortar ammunition can/PVS-14 Basic Issue Item (BII) can
• 1 light duty ratchet strap/other tie down equipment
• Packing spacers (4-6 empty water bottles)
• Standard office computer monitor, the smaller the better to ensure it fits in the mortar/BII can. (If your unit has a tablet, this may be a better option if it can be configured to display a video feed from the Panasonic Toughbook.)
• Monitor AC (alternating current) cord, 3-5 feet
• DVI (digital visual interface) cord, 3-5 feet
• 550 cord, 5 feet
• 100 mph tape, 2 feet
• Optional: depending on monitor/tablet used, you may need additional DVI to HDMI (high-definition multimedia interface) splitter cables, etc.

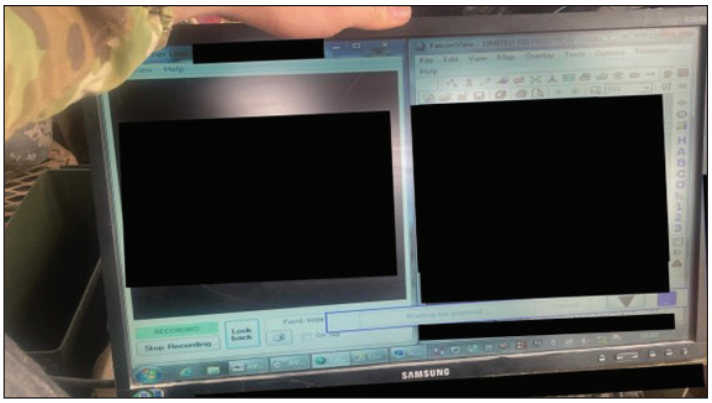
Crew Configuration

For the purposes of this article, the term "commander" will describe the leader who is currently utilizing the Raven asset for collection. This could be a company commander, first sergeant, executive officer (XO), platoon leader, platoon sergeant, or other leader within the company. The crew required is a standard two-person crew: a pilot and an alternate Raven operator. A third crew member may be utilized in a different vehicle to conduct mobile launches.

The pilot and alternate Raven operator should locate themselves in the commander's vehicle. The seating configuration of a MaxxPro or Stryker supports this given the commander is in the vehicle commander (VC) position. Existing articles recommend arranging the Raven in the XO's vehicle — this would be prudent placement in many scenarios.[3]

Hardware Assembly

To wire the Stryker or the MaxxPro for Raven use, start with the omnidirectional antenna, which is connected to the coax cable and ready for use. Using 550 cord, tie a clove hitch around the omni antenna



Example Commander's Real-time Viewer in a MaxxPro
(The 81mm ammunition can for monitor stowage is in the left of the picture, and the cables for the monitor are routed on the bottom of the screen to the Panasonic Toughbook and the inverter.)

and tape it off. Then, tape the omnidirectional antenna to one of the taller antennas on the vehicle. For a Stryker, the wire cutter in front of the vehicle commander's hatch may be preferable. Tie the free running end of the 550 cord to the antenna or other fixed object on the vehicle using either a clove hitch or bowline. If desired, the Raven's mast for static operations can be affixed to the top of the vehicle and the antenna affixed to the mast. The tie down ensures that if the antenna does come off somehow it is not lost. Route the cable from the base of the antenna through the top of the vehicle, parallel to other antenna wires. Once internal, this cable needs to terminate with the free running end readily accessible to the Raven operator's seat with approximately 2-3 feet of play.

The inverter's purpose is to invert the 24V direct current (DC) electricity from the MaxxPro batteries into 110V AC that is utilized in standard U.S. appliances. Plug the Raven's Panasonic Toughbook into the 110V AC outlet that is connected to the inverter and switch the inverter on. From this point on, the Raven operators configure their equipment in a similar fashion to if they were flying from a static location.

The commander's real-time viewer is a fancy name for a simple fieldcraft solution that allows the commander to use a standard computer monitor and view the output of the Raven Panasonic Toughbook without being immediately adjacent to the operator. The computer monitor is plugged into the Toughbook via a DVI or HDMI cable and plugged into the inverter via the AC adapter cable. This will mirror the image from the Toughbook onto the monitor. Smaller monitors tend to work best as space is limited in most vehicles.

An 81mm mortar ammunition can ratcheted to the radio console of the MaxxPro works well as a storage location for the viewer's screen when not in use. Ensure to pack the mortar can appropriately using packing materials or empty water bottles around the screen to prevent damage to the screen during driving operations, and also confirm that the can is appropriately tied down in the vehicle. It is not necessary to utilize the commander's real-time viewer in all Raven applications — rather, this is an additional option made available to commanders should they need to view the Raven feed in real time.

Mobile Launching and Operations on the Move

While not always needed, launching the Raven on the move is an option. Operators should learn how to do this at home station with their unit's Raven master trainer and then perfect this technique during a Combat Training Center rotation. Commanders should know that this is a capability for their operators and that the vehicle must have external roof access (turret or air guard hatch). Static (traditional) launching is still possible when the pilot is operating the Raven from inside the vehicle should the Raven team prefer to employ this technique instead.

Once on the move with the Raven overhead, the Raven operator's vehicle is now the center of the omnidirectional antenna's range. Whenever the operator's vehicle moves, the Raven's operational range "circle" moves with it. The Raven can fly ahead of the unit during movement or on flanks, as the operator desires.

Potential Pitfalls

• Selecting Raven operators and prioritizing Raven training can be challenging while at home station, but these are critical to maximizing utility of the capability.
• Understanding the total air picture and establishing a Raven restricted operating zone (ROZ) are essential to reducing risk to both manned and unmanned aircraft.
• ROZ procedures and unit standard operating procedures can make impromptu Raven training difficult as many installations require 72-hour notice. Proactive early planning by live-fire and situational training exercise planners at battalion and brigade staff levels can build optional Raven employment into training scenarios ahead of time through Range Facility Management Support System (RFMSS) requests and staff generic Notice to Airmen (NOTAMs) through the brigade aviation element (BAE). This can allow commanders to elect to use the Raven if they feel the operation dictates.
• While the range will be reduced, the omnidirectional antenna seemed to be the best fit for Raven operations in a moving vehicle due to frequent changes of direction inherent to driving.
• The inverter uses a significant amount of power to invert the direct current to alternating current and is an additional load to the electrical system of the vehicle after the radios, Joint Capabilities Release (JCR), etc. Running the inverter for significant periods of time without the vehicle alternator running could cause batteries to die sooner than expected and is not recommended.
• Operators should preplan the loss of link (LOL) rally points to coincide with mounted route checkpoints and reset the LOL rally point in the Raven system often to allow for rapid recovery when on the move. If the Raven experiences loss of link and the LOL rally point has not been changed since launch, it is possible that the unit could be forcing the Raven to double back a significant distance to the original LOL point.

Practice Locations

Raven operations are executed best after being rehearsed. The National Training Center at Fort Irwin, CA, provides several scenarios to rehearse mobile launches and mounted Raven flights:
• Any mounted movement to contact;
• Forward passage of lines to breach Whale Gap into Siberia;
• Reconnaissance and occupation of support-by-fire positions around Razish; and
• Approaching the probable line of contact to confirm or deny enemy presence and optimize vehicle dismount point relative to enemy positions.

When practiced, these techniques can significantly increase the value provided by the RQ-11B Raven while simultaneously reducing the natural friction of employment. This will make the overall employment cost/benefit ratio more favorable for use and increase the infantry company commander's understanding of the operational environment. The ongoing war in Ukraine has demonstrated the incredible scope of influence SUAS can have on the modern battlefield, and the U.S. Army is iterating on newer unmanned vehicles.[4-5] In the meantime, it is imperative that we maximize our own SUAS opportunities in training and in practice.

Notes

[1] Jen Judson, "U.S. Army Spent Billions on a New Helicopter that Now Will Never Fly," *Defense News*, 8 February 2024, https://www.defensenews.com/air/2024/02/08/us-army-spent-billions-on-a-new-helicopter-that-now-will-never-fly/.
[2] Christopher J. Colyer, "Tactical Employment of the Raven SUAS," *Infantry* (April-June 2016): 64-65.
[3] Ibid.
[4] Ivan F. Ingraham, "Off the Shelf, Above the Fight: How Cheap Drones Are Completely Changing Warfare,"

Task & Purpose, 1 July 2022, https://taskandpurpose.com/opinion/drones-uas-warfare-ukraine-russia.
[5] Sam Skove, "Army Moves Ahead on Ukraine-Style Bomber Drones," *Defense One*, 4 October 2023, https://www.defenseone.com/technology/2023/10/army-moves-ahead-ukraine-style-bomber-drones/390918/.

CPT Kendall Hamm is currently completing a Master of Science in civil engineering at North Carolina State University. Most recently, CPT Hamm served as the company commander of Brave Company, 2nd Battalion, 23rd Infantry Regiment, 1st Stryker Brigade Combat Team, 4th Infantry Division. He has also served in the 4th Brigade Combat Team (Airborne), 25th Infantry Division and 3rd Battalion, 75th Ranger Regiment. His operational experience includes deployments to Syria and Afghanistan. He earned a bachelor's degree in civil engineering from the U.S. Military Academy at West Point, NY.

SSG Ryan Macleod is currently a drill sergeant in the 197th Infantry Brigade at Fort Moore, GA. He previously served as the mortar section sergeant for Brave Company, 2-23 IN. SSG Macleod has also served in 2nd Stryker Brigade Combat Team, 25th Infantry Division; 3rd Infantry Brigade Combat Team, 10th Mountain Division; and 2nd Squadron, 11th Armored Cavalry Regiment. His operational experience includes deployments to Afghanistan, Iraq, and Syria. His military education includes the Advanced Leaders Course, Infantry Mortar Leaders Course, and Master Combatives Trainer Course.