Distributing UAV video to those who need it is a critical requirement met by our packaged system solution.
Small unit operations are benefitting from the increasing availability of hand-launched micro-unmanned aerial vehicles (UAVs). There are currently no cost-effective C4ISR systems to distribute this video to the tactical users.

Procuring a C4ISR system is usually no easy matter. Too often customers spend substantial time and resources, only to find themselves behind schedule and over budget with a system that does not meet their requirements. Harris Corporation’s new, simplified approach to C4ISR systems procurement uses pre-engineered system configurations that provide fast, cost-effective solutions to today’s most critical operational needs, such as the distribution of micro-UAV video.

Instead of designing a unique system for every customer, Harris has developed a comprehensive family of preconfigured systems. Each system is fully integrated and includes all equipment, cables, software, and manuals, with training and installation available. Every system has undergone extensive testing and can be relied upon to meet its objectives.

This executive summary describes the Micro-UAV Video Distribution System and outlines the advantages of our packaged C4ISR system solutions:

- **Low Risk** – Field proven and comprehensively tested systems
- **Fast Delivery** – Complete systems can be delivered in a matter of months to meet urgent operational needs by eliminating long system definition and development phases
- **Cost-Effectiveness** – Customers’ development costs are minimized
- **Simplified Procurement** – Systems can be purchased as off-the-shelf items
- **Phased Implementation** – Packaged systems form building blocks that enable the acquisition of capability in a spiral fashion, protecting current investment and supporting future goals
- **Flexibility** – Packaged systems are readily customized and integrated by in-country partners

All this from Harris, a company with over 50 years of large-scale international communications systems experience, the most comprehensive range of tactical communications products, and world-class systems engineering and integration capabilities.

* C4ISR = Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance

Contact Harris now to discuss your C4ISR systems needs: www.harris.com/systems
Small, unmanned aerial vehicles (micro-UAVs) are increasingly being utilized to provide real-time tactical reconnaissance data to support the missions of small units such as platoons and squads. The video from these micro-UAVs can provide leaders with an understanding of threat size and location, so that they can take appropriate action to counter the threat. These small UAVs also can be used by federal forces such as border security units to locate and track people illegally entering the country.

Typically launched at platoon level, the micro-UAVs provide video to a small ground station. The information derived from this video must be conveyed to the squad leaders (or border security personnel) whose teams are about to engage the threat. This time-critical information often must be sent via voice reports over combat net radio or public safety radio, requiring ground station personnel to divert attention from their primary duties to describe the video information in words.

At the other end of the radio link, the squad leader or border agent is distracted, listening to the verbal description rather than observing the situation on the ground. Portable viewers exist that allow a user to receive video directly from the UAV, and these units could be provided to each squad leader and border security force. These UAV video receivers, however, can have one or more of the following limitations for small unit operations:

- The receiver may not support the waveform for the particular micro-UAV in use
- As UAV-video waveforms change (e.g., the change to encrypted waveforms), the handheld receiver must be upgraded, if possible
- Encrypted waveforms may require keys that must be distributed to the portable receivers
- Some receivers are large and would be a burden for a squad leader to carry
- The UAV video receiver has only one function and is an additional item for the squad leader or border agent to carry
- UAV video receivers can be expensive, since they are usually designed to operate in multiple bands with many waveforms to support the growing number of UAV systems

The optimal solution would provide real-time video to the squad leader with a design that is immune to changes in the UAV platform, is not single function, and is small and inexpensive. Additionally it should provide the capability to forward the platoon video to the company level for enhanced situational awareness.

Harris provides a tactical solution for these requirements. The Micro-UAV Video Distribution System (MVDS) has the added advantage of being a multi-purpose solution that can be deployed as a standalone system or integrated as an upgrade for current users of the Harris RF-7800S Secure Personal Radio.
MVDS provides the following capabilities:

- Interoperability with any UAV system that provides an analog output at the ground control station
- Video dissemination to the squad leaders via the RF-7800S radio, which is already a standard in many countries
- Support for voice and video data distribution on the platoon-squad leader net
- Transmission of video from the ground station at platoon to the company operations center for common situational awareness
- Support for distribution of virtually any analog video source (NTSC or PAL)
- Optional capabilities include providing squad situational awareness to the platoon

The Harris Micro-UAV Video Distribution System provides commanders:

- **Distributed Real-Time Intelligence** – Real-time video picture of the area of operations (AO) from unmanned aerial vehicles is rapidly made available to front-line users
- **Enhanced Situational Awareness** – Next echelon commanders see the same picture of the battlefield
- **Expandable System** – Video distribution is not confined to UAV video feeds; video from other sources can be disseminated by MVDS and additional distribution is possible using Harris networked radios
- **Support for Any UAV Ground Station** – MVDS digitizes analog video that is available at the ground control station; UAVs can transmit with any waveform—even encrypted waveforms
- **Existing Capability** – The system is available now, utilizing Harris’s integrated off-the-shelf hardware and software
Enhancing Unmanned Aerial Vehicle utility

The Micro-UAV Video Distribution System (MVDS) uses the advanced networking communications capabilities of the new Falcon III® tactical family of products including the RF-7800S Secure Personal Radio (SPR), the RF-7800M Multiband Networking Radio (MBNR), and the RF-7400E Tactical Video Gateway (TVG). Although specifically designed to distribute and manage the ever increasing number of UAV video streams on the battlefield, MVDS is an IP-based communications system that can distribute and manage video from a wide range of sources.

In a typical scenario, a micro-UAV and ground control station are deployed at platoon level to maximize time over the area of operations (AO) in support of combat team/squad-level operations. An analog video stream from the ground control station is fed into the Harris MVDS, where it is digitized and processed for transmission. The processed stream is then fed to a pair of radio networks, which securely transmit it simultaneously to both higher and lower echelon units.

The higher level (company) site can receive video streams from multiple deployed MVDS systems. Commanders at this level are able to view, analyze and record the video streams. Optionally, they can aggregate multiple video streams onto a higher capacity radio link for forwarding to higher-level echelons through an RF-7800W high capacity line-of-sight (HCLOS) IP networking radio. For details of that capability, refer to the separate Harris publication describing the Tactical Video System for UAV Video Distribution and Management.

Key Benefits of the Harris Solution:

- **Use of Open Standards and Interfaces** — By digitizing the analog video from the ground control station, the system converts what can be proprietary waveform data into standards-based video that is easily viewed, stored and manipulated.

- **IP-Based Communications** — This architecture allows networked distribution of video information across Harris tactical radios and existing customer communications infrastructure.

- **Customized Off-the-Shelf Availability** — The Micro-UAV Video Distribution System is a Harris packaged system based on ruggedized military equipment. It is available for delivery now and can be readily customized as required.

- **Scalability** — The Harris integrated radio networking waveforms allow commanders to provide vital real-time video intelligence to on-the-ground soldiers who can act on it immediately. Coverage can be expanded by simply deploying multiple instances of MVDS echelon-level kits.
Know what is beyond the next hill with the Harris Micro-UAV Video Distribution System
The Micro-UAV Video Distribution System equipment is ready for delivery

A standard MVDS contains sufficient equipment for video collection from one platoon and dissemination to three squads and one company.

The standard MVDS is delivered with:

- One squad kit, which includes three RF-7800S SPR Leader Radios and associated display units and audio headsets to support three squad leaders.
- One platoon kit, which includes the Tactical Video Gateway and radios necessary to transmit one UAV video stream down to multiple squads and up to one company unit.
- One company kit that supports receiving, viewing, analyzing and storing multiple video streams received from the platoons

The platoon-level RF-7800S SPR radio broadcasts the video stream to multiple squads. The RF-7800M MBNR radio provides the bandwidth for video distribution to the company through an Adaptive Networking Wideband Waveform (ANW2) mobile, ad hoc IP data network.

This configuration is very flexible, and additional functionality and alternate equipment sets are easily incorporated, either at initial purchase or as a subsequent upgrade. In addition to micro-UAV-generated video, the system can accommodate video from other sources, such as the Harris MicroTerrain Observation System or the Tactical Reconnaissance Vehicle. In most cases, simply including additional Tactical Video Gateways will enable MVDS to capture, process, and distribute these kinds of video data.

The MVDS is easily scaled for use in larger deployments by acquiring additional squad, platoon, and company kits. Each company kit can accommodate up to four video feeds. One platoon kit can broadcast a video feed to an unlimited number of squad Leader Radios.

The system can typically be delivered within four months, as shown on the schedule.
Low-Risk System Characteristics:

- Pre-engineered system implementation
- Integration risks are eliminated
- Standard interfaces and protocols ease incorporation of future enhancements
- Leverages Harris Falcon III® radio technology
- Expandable, accommodating new teams and echelons, as required
- 4-6 months delivery, depending on modifications
Distributing micro-UAV video data in a scalable and cost-effective manner

The MVDS supports multi-echelon dissemination of video in a hierarchical deployment environment. Its primary function is to flow live streaming video down to lower echelon leaders who can directly take advantage of the intelligence, to determine the most effective course of action. In the example deployment illustrated on the facing page, live video received by a platoon-level UAV ground control station is transmitted down to individual squad leaders and up to company-level headquarters through two separate secure radio networks. In addition, simultaneous voice communications among the company, platoon, and squad levels through those two networks assures close coordination of any actions resulting from the video intelligence.

To support rapid setup in the widest possible range of applications, the MVDS equipment is delivered in lightweight, portable cases. It can easily be installed in a variety of vehicles, as well as at fixed locations. In addition, the flexible design of the Harris networking radio waveforms makes the system highly scalable. It supports wider video stream dissemination to additional units by simply adding equipment at the desired echelons.

Video received at the soldier/squad level is processed by the advanced RF-7800S Leader Radio and its associated video display. These are small, lightweight, battery-powered handheld devices that incorporate an advanced time division multiplexed waveform to support up to 256 kbps streaming video. The Leader Radio handles reception and decompression of streaming video that is transmitted by a companion RF7800S vehicle-mounted radio located at platoon headquarters. Furthermore, the RF-7800S radios provide simultaneous voice and video communication capability, allowing soldiers within the combat team to talk to their leader and with the platoon HQ.

At the platoon level, the RF-7400E-VG Tactical Video Gateway (TVG) inputs, processes, and disseminates the video stream provided by an existing UAV ground control station. The TVG digitizes, compresses, and formats the analog video source into an H.264-stream, which it outputs through both a USB and an IP interface to the vehicle-mounted RF-7800S (for transmission to the squad Leader Radios), and the RF-7800M multiband networking radio (for transmission to the company). Since the RF-7800S radio link supports secure broadcast of the digital video stream, it can be received and displayed by any number of squad members, based on the particular mission needs. While the standard MVDS squad kit supports three squads, additional quantities are easily accommodated.

At the company level in the example deployment illustrated, the RF-7800M MBNR receives the streaming video transmitted by the lower-echelon platoon unit, using the Harris Adaptive Networking Wideband Waveform (ANW2). Since ANW2 is a mobile, ad hoc networking (MANET) waveform, the MVDS allows additional Platoons to exchange voice and live video streams with the company in the ANW2 network. Thus, although the standard MVDS contains a single company kit, multiple kits can be used to expand system coverage.

Commanders at the Company HQ use the Falcon C2View video management application to view and record multiple received video streams. The C2View display and recording capacity is based on the storage and processing capability of the selected computer. Typical ruggedized laptops such as the Harris RF-3577 can support two to four simultaneous video streams.

Optionally, the system supports maintenance of a common operational picture throughout the battle space through dissemination and display of situational awareness data using the RF-5410-FC FalconCommand™ battle management application.
RF-7600P-SS401 Micro-UAV Video Distribution System Equipment

ECHELON KITS X QTY IN STANDARD CONFIGURATION

<table>
<thead>
<tr>
<th>Kit Type</th>
<th>Configuration Details</th>
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</thead>
<tbody>
<tr>
<td>Squad x 3</td>
<td>RF-7800S-LR Leader Radio and Video Display Unit</td>
</tr>
<tr>
<td>Platoon x 1</td>
<td>RF-7400E-VG Tactical Video Gateway</td>
</tr>
<tr>
<td></td>
<td>RF-7800S-V001 Vehicle-Mounted SPR</td>
</tr>
<tr>
<td></td>
<td>RF-7800M MBNR</td>
</tr>
<tr>
<td>Company x 1</td>
<td>RF-7800M MBNR</td>
</tr>
<tr>
<td></td>
<td>RF-3577 Ruggedized Laptop PC, running Falcon C2View Video Management Application</td>
</tr>
</tbody>
</table>

OPTIONAL CAPABILITIES

- RF-5410FC FalconCommand™ Battle Management System
- RF-7800T-HH Handheld Situational Awareness Video Receiver (SAVR)
- Additional RF-7800M radios and tactical router to distribute video to battalion
- RF-7800S-PA020 20W Power Amplifier for extending video transmission range
Harris’s advanced video processing enables tactical radios to disseminate battlefield video

The wideband nature of the Falcon III® radios, along with our advanced video processing capabilities, enables Harris to provide an off-the-shelf Micro-UAV Video Distribution System (MVDS).

**Tactical Video Gateway**
With the ability of the RF-7400E-VG Tactical Video Gateway to convert either PAL or NTSC analog video signals into IP data, Harris can interface its radios to virtually any UAV system. The Tactical Video Gateway utilizes compression and frame rate selection algorithms that allow the digital data stream to be sized for the capability of the radio link. Thus, Harris radios from the soldier-borne Secure Personal Radio to the multiband RF-7800M can be utilized to distribute video data throughout the area of operations. Although not used in MVDS, additional capabilities include the ability to control pan/tilt/zoom cameras by remote operator commands and/or target-activated sensor cues.

**Multiband Networking Radio**
Mobile echelons that need to view and transmit multiple video streams will utilize the RF-7800M Multiband Networking Radio (MBNR). The RF-7800M enables the high-speed flow of real-time battlefield situational awareness information across a secure, mobile, tactical wireless network backbone—enabling the critical connection between squad level forces and up-echelon command management platforms. The MBNR incorporates the ANW2 waveform which can transmit data at rates up to 5 Mbps and an advanced, mobile, ad hoc networking (MANET) protocol. The MANET network automatically forms between the available nodes and self-heals as nodes go in and out of range. The result is that the micro-UAV video captured at the ground control station can be shared with the deployed units, even when on the move. The increased flow and timeliness of operational information and intelligence data from the field enables commanders to make faster, more informed decisions.

**Secure Personal Radio**
Soldiers using the RF-7800S Secure Personal Radio (SPR) will take advantage of the most advanced personal team radio in the world.

**The SPR Team Radio** is designed specifically to meet the unique demands of providing secure, conferenced voice, wideband data, and situational awareness communications at the soldier level. Much more than a standard push-to-talk voice radio, the RF-7800S provides key benefits in a package that weighs only 300 grams. Its small size and light weight allow the commando to focus on the mission, not his equipment load.

**The Leader Radio** augments the powerful Team Radio capabilities with the addition of a purpose-designed embedded processing module, enabling dedicated command application functionality in a lightweight, soldier-friendly package. The associated Video Display Unit connects to the VGA output of the Leader Radio, for applications such as the Micro-UAV Video Distribution System that display graphical or video imagery.
<table>
<thead>
<tr>
<th><strong>FEATURES</strong></th>
<th><strong>BENEFITS</strong></th>
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<tbody>
<tr>
<td><strong>Tactical Video Gateway (TVG) RF-7400E-VG</strong></td>
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<tr>
<td>Advanced Video Processing Algorithms</td>
<td>Multiple video frame rate and compression ratios are available to optimize the video quality over the radio channel</td>
</tr>
<tr>
<td>Standards-Based Interfaces</td>
<td>Accepts NTSC or PAL video sources and provides IP data packets in an H.264 standard format over both USB and Ethernet interfaces, which allows the video to be transmitted and viewed by a wide variety of equipment</td>
</tr>
<tr>
<td><strong>Multiband Networking Radio (MBNR) RF-7800</strong></td>
<td></td>
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<tr>
<td>5 Mbps High-Speed Waveform</td>
<td>Provides the necessary bandwidth for transmitting multiple video streams to the next echelon</td>
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<tr>
<td>Ad Hoc Networking</td>
<td>Keeps mobile nodes connected to the network to allow video distribution to units on the move Eliminates the need for extensive pre-planning of networks before a mission</td>
</tr>
<tr>
<td>Simultaneous Voice and Data</td>
<td>Allows real-time discussion of intelligence information contained in the transmitted video</td>
</tr>
<tr>
<td><strong>Secure Personal Radio (SPR) Leader Radio RF-7800S-LR</strong></td>
<td></td>
</tr>
<tr>
<td>Embedded GPS Receiver</td>
<td>Enhances soldier safety by automatically transmitting encrypted position information Team Leader can observe the team member locations using FalconCommand™</td>
</tr>
<tr>
<td>256 kbps High-Speed Digital Waveform</td>
<td>Provides the necessary bandwidth for transmitting real-time video</td>
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</table>
Harris has earned a worldwide reputation as the low-risk vendor of choice for tactical radios and systems. The Micro-UAV Video Distribution System leverages the program management principles and practices used in our custom development programs. Our responsive program management team and customer service organization will deliver and support a highly capable video distribution system appropriate for small unit operations.

An agile manufacturing process allows Harris to modify the build schedule and adapt our factory’s output to meet customer demands, providing accelerated delivery when required. The Harris factory is one of the highest-volume defense communications manufacturing facilities in the world. Harris has the commitment and capability to deliver, with 99 percent of our international programs rated by our customers as either meeting or exceeding expectations.

Unlike many other companies, Harris has “boots on the ground” experience, supporting our products from initial fielding to obsolescence. Harris still provides support to our customers for systems which have been deployed for over 20 years. The company is absolutely committed to customer satisfaction—and that is why our customers rate Harris an average of two times higher than our nearest competitor in our annual customer satisfaction survey.

Harris has extensive experience in providing logistics and sustainment support throughout the world and is a proven provider of advanced radio, sensor, and integrated systems to customers in over 150 countries. We have developed highly successful processes for fielding, maintaining, supporting, repairing, and upgrading equipment, no matter where it is deployed in the world.

Many employees in our product and technical service departments have prior military experience, and establish a close, personal bond with our customers. In addition to this personal level of support, we have two highly successful formal channels which include classic telephone and email support as well as web-based services. Our Premier website ([https://premier.harris.com/rfcomm/](https://premier.harris.com/rfcomm/)) offers customized access to:

- Computer-based training courses
- Manuals
- Frequently asked questions
- Department contact information
- Application notes
- Purchase of accessories and ancillaries

Additional capabilities include:

- Downloading and tracking software upgrades
- Warranty and maintenance support, including receiving RMA numbers and tracking status of returned goods

System training is another important consideration. If the user cannot adequately deploy and operate the system, it will likely sit on a shelf or in a warehouse, unused.

Harris trains approximately 5,000 students per year on the installation, operation, and maintenance of our equipment and systems. This training occurs in formal classrooms at Harris facilities, at customer locations, and in the field. Our students (our customers) routinely rate the training they receive as “meeting or exceeding expectations.”
The Harris Micro-Video Distribution System provides economic benefits over its entire life cycle:

**Low Risk** — Our customer knowledge, program management, technical expertise, and world-class customer support serve to reduce fielding risk.

**High Performance** — The open architecture design allows the Harris MVDS solution to capitalize on technology refresh of components, allowing customers to maximize the value of their investments over an extended time period.

**System Sustainment and Supportability** — Sustainment issues are reduced by the use of rugged military equipment (with existing training and ILS packages) and the availability of Harris field service representatives.

**Life-cycle costs are reduced by:**
- Use of common equipment across units
- 24/7 support capabilities
- Available in-country training and training material
- Common equipment interfaces and programming
- Availability of installation and maintenance by in-country partners
- Availability of extended warranties beyond the standard 12 months
- Low-cost upgrade paths
Millions of people and hundreds of government agencies throughout the world rely on assured communications® solutions from Harris to deliver critical information to the right place at the right time. They know there is too much riding on the outcome to risk anything less. What sets Harris apart is our depth of expertise, breadth of experience, and focus on providing the most advanced products, systems, and services that meet or exceed the requirements of our customers.

Harris is one of the only companies in the world specializing in advanced technology for capturing, aggregating, distributing, and analyzing the full breadth of modern communications media, including voice, data, video, and imaging. We use this unique capability to provide systems and networks for customers in defense, intelligence, government, public safety, healthcare, broadcast, and energy markets.

Harris RF Communications Division (RFCD) is the leading supplier of tactical, secure voice and data communications products, systems, and networks to military, government, and commercial organizations worldwide. Over 50 years of international experience is leveraged into the design and deployment of Harris RFCD’s packaged C4ISR system solutions.

The Micro-UAV Video Distribution System is one more example of Harris responding to the needs of its customers.

I firmly believe that Harris RF Communications really listens to their customer base and lives by the creed: the customer is king. I truly feel that sense of partnership with Harris, and I’ve been dealing with Harris for years now. ✷ NATO Staff Member

Harris has internationally acclaimed products which have left everyone else in the dust. ✷ International Customer
Always connected. Never alone.

Our proven solutions provide:

- Voice, data, and video where it’s needed, when it’s needed
- Cost effectiveness over the life cycle of the system
  - No long, costly development cycle
  - Unsurpassed in-country support during and after delivery
- Scalability and growth options
- Configurable solution sets
- On-time delivery of quality systems
As your partner, Harris is committed to your success

Harris Corporation welcomes the opportunity to discuss the Micro-UAV Video Distribution System in more detail, and how it can be applied to your missions and applications. We believe that our packaged systems provide a significant value to you, our customer, in the following ways:

- The systems are available now, eliminating long and expensive development and procurement cycles.
- The use of the latest wideband Falcon III® tactical radios supports new operational capabilities, such as live tactical video and situational awareness, that have not previously been possible.
- Falcon III software-defined radio technology uses open architectures and standard interfaces, allowing the system to incorporate new capabilities and stave off obsolescence.
- Pre-engineered system designs emphasize commonality of equipment and resources to reduce life-cycle sustainment costs such as training, sparing, and maintenance.
- Harris systems engineers and in-country partners can readily customize the solution, as required.
- The systems are supported by our world-class customer service organization that operates in every part of the world and is second to none.

Harris Corporation is a $5 billion (USD) international communications systems company serving government and commercial markets in more than 150 countries. We are confident that our packaged C4ISR system solutions represent the best value with the lowest schedule, cost, and technical risks for meeting your complex operational challenges.

Our solutions leverage:
- Falcon III wideband radio technology
- Harris video processing and management technology
- Open standards and interfaces
- Focused program teams
- Over 50 years experience providing state-of-the-art military systems
- Product service teams that deploy to our customer
- Over 7,000 engineers and scientists throughout the corporation
Taking tactical UAV video to the edge with the Harris Micro-UAV Distribution System