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BRITEdge 11-1

LIMITED OBJECTIVE EXPERIMENT

by

Bill Roeting and Charles Menza

15 July 2011

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Prepared for: U.S. Air Force Headquarters (A2Q)

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NAVAL POSTGRADUATE SCHOOL
Monterey, California 93943-5000

Daniel T. Oliver
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Leonard A. Ferrari
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This report was prepared by:

W. H. Roeting
CAPT USN (Ret)
Test Director and Principal Investigator

Charles Menza
LT COL USAF
Headquarters Air Force

Reviewed by:

Dan Boger, Chairman
Department of Information Sciences

Released by:

Karl A. van Bibber
Vice President and
Dean of Research

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Table of Contents

Purpose and Description	1
Equipment	1
LOE Objectives with Results and Findings	7
Conclusions	8
LOE Participants	8
Attachment 1: The TASE200 Gimbal	9
Attachment 2: VORTEX Transceiver	11
Attachment 3: Compact Multi-band Data Link (CMDL)	13
Attachment 4: Rover 4 Receiver	15
Attachment 5: ROVER 5 Handheld	19
Attachment 6: Tactical ROVER	21
Attachment 7: Acronyms	23
Initial Distribution List	25

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BRITEdge 11-1
Limited Objective Experiment

Purpose and Description

The BRITEdge 11-1 Limited Objective Experiment (LOE) was conducted at the Davis Monthan Air Force Base (DM AFB) Test Range from 8 through 10 March 2011. This report summarizes the results of a limited objective experiment to demonstrate the capability of ROVER technology to provide real-time full motion video surveillance of the US – Mexican border in support of US Customs and Border Protection (CBP) agents.

Equipment set-up, integration, ground testing, and other LOE preparations were performed on the 8th and 9th of March with the actual training and testing taking place on the 10th.

Equipment

The BRITEdge 11-1 LOE featured the following equipment:

1. An Avwatch Cessna 206 (C-206) modified with an FAA approved cargo bay area equipped with the TASE 200 Gimbal EO/IR sensor. Attachment 1 provides the performance specifications for the TASE 200 Gimbal electro-optic/infrared (EO/IR) sensor. The C-206 also carried a communications rack in the rear seat area to support a variety of communications equipment described later within this report.



Avwatch C-206 modified with an FAA approved cargo bay area underneath the fuselage of the aircraft. The cargo bay area carried the TASE 200 Gimbal EO/IR sensor.

2. An L3 Communications Vortex transceiver (Attachment 2) located on communications rack in the rear compartment of the C-206.



Adjacent picture shows the communications rack located in the rear compartment of the C-208 aircraft. Rack components:

1. **Top shelf:** Vortex radio with L, S, and C band amplifiers.
2. **Second shelf:** Networking equipment, video encoders, and remote relay system.
3. **Third shelf:** Power converters: 110 AC, 12V DC, and 28V DC.
4. **Bottom shelf:** Ku band amplifier, provided by L-3 Communications.

3. An A-10 from the Air National Guard and Air Force Reserve Command Test Center (AATC) carrying a Litening Pod and EO sensor equipped with an L3 Communications CDML transceiver (Attachment 3) operating in C band. The Litening Pod manufacturer is the Northrop Grumman Corporation (NGC).



The adjacent photo shows an A-10 from the AATC test squadron carrying an NGC Litening Pod with an electro-optical sensor. The L-3 Communications CMDL radio is used to transmit video in C band to the ROVERs on the ground.

- An L3 Communications ROVER 4 (Attachment 4) mounted within the tailgate area of the Border Protection SUV connected to a Panasonic Toughbook laptop to display from both the A-10 and C-206, respectively.



The adjacent photo shows the SUVs used for the BRITEdge 11-1 LOE. The white CBP SUV on the far right housed the ROVER 4 transceiver connected to a Panasonic Toughbook that displayed the FMV from both the Listening Pod and C-206.

- The L3 Communications ROVER 5 (Attachment 5) used as a handheld full motion video (FMV) display device.



Adjacent picture shows CBP agents using the ROVER 5 to view FMV from the Sniper Pod as well as FMV from the C-206.

6. An L3 Communications Tactical ROVER v2.5 (Attachment 6) intended to integrate onto a JTAC's tactical vest. An eye monocle attached to a pair of tactical glasses provides FMV viewing. Other display devices may be used as well.



Adjacent photo shows the Tactical ROVER v2.5 with an eye monocle attached to a pair of tactical glasses. The black antenna is for C-band reception. The gray adaptor on top of the C-band antenna was a test article to convert the C band antenna to a Ku band antenna for Ku band FMV reception.

7. Small briefcase sized, 2-axis stabilized, tracking C-Band antenna.



Adjacent photo shows the 2-axis stabilized C-band antenna mounted on top of the CBP SUV. It was attached to a ROVER 4 to collect FMV from the CMDL radio on the Sniper Pod carried by the A-10 and FMV from the Vortex radio on the C-206.

LOE Objectives with Results and Findings

1. Classroom train approximately six Customs and Border Protection (CBP) using the ROVER 4, ROVER 5, and Tactical ROVER v2.5.
 - a. **Results:** Successful – Formal classroom instruction with hands-on training with the ROVER 4, ROVER 5, and Tactical Rover was conducted by Mr. Janos Opra from L3 Communications and assisted by Lt Col Chuck Menza for the hands-on portion of training. Four CBP personnel and one AATC person received the instruction and training. The classroom instruction and training lasted approximately four hours.
 - b. **Finding:** Classroom instruction and hands-on training was easily assimilated and well received by the students.
2. Provide CBP personnel with field operational experience using the ROVER 4, ROVER 5, and Tactical ROVER. First-hand experience was accomplished by receiving FMV from the CMDL transceiver on the Listening pod carried on the A10 as well as from the Vortex transceiver onboard the C-208.
 - a. **Results:** Successful – All personnel who received formal classroom instruction and hands-on training successfully set-up and operated the ROVER 4, ROVER 5, and Tactical ROVER.
 - b. **Finding:** CBP field agents indicated that both the ROVER 4 and ROVER 5 would be best suited for vehicular use in a Command and Control (C2) capacity while the Tactical ROVER would be best suited for dismounted CBP agents.
3. Determine the tactical range between a ROVER 4 using a 2-axis stabilized, tracking C-Band antenna and the Listening pod on the A10.
 - a. **Results:** Unsuccessful – The 2-axis stabilized, tracking C-Band antenna was unable to track the A-10. Most participants hypothesized that the speed of the A10 was too fast for the C-Band antenna to track.
 - b. **Finding:** The 2-axis stabilized, tracking C-Band antenna did track the C-208 but, no distance testing was performed.
4. Determine if the digital C-Band 466 waveform could be received by the ROVER 4, ROVER 5, and Tactical ROVER.
 - a. **Results:** Successful

- b. **Finding:** Digital C-Band was received and displayed using the ROVER 4, ROVER 5, and Tactical ROVER.
5. Field test the Tactical ROVER Ku Band antenna down converter to C-Band.
- a. **Results:** Successful
 - b. **Finding:** The Tactical ROVER Ku Band antenna down converter to C-Band was successfully tested but only at close range < 4 miles.

Conclusions

The CBP agents saw significant value in ROVER 4 and ROVER 5 for use in the mobile vehicle to support command and control (C2), and for the Tactical ROVER being used by dismounted agents patrolling the border. Follow-on testing is expected using an updated version of Tactical ROVER to provide tactical users with a transmit capability and also support the Digital Video Broadcasting – Terrestrial (DVB-T) waveform that is presently used by the CBP.

LOE Participants

1. HAF A2Q
 - a. Lt Col Chuck Menza – LOE Lead
 - b. Mr. Larry Gagliano – ROVER Technician
2. AATC
 - a. SMSgt Nickolas Lowe – AATC JTAC
 - b. Lt Col Thomas "Narly" McNurlin – A-10 driver
3. Customs and Border Protection
 - a. Ms. Emily Keplar – CBP SW UAS Operations and Intelligence Officer
 - b. Mr. John Fitzpatrick – Associate Chief, Southwest Border
 - c. Mr. Larry Clement – UAS Operations Corpus Christi
 - d. Mr. Brendan Lenihan – Border Patrol Tactical Agent
 - e. Mr. Steven Campos – Border Patrol Tactical Agent
4. Naval Postgraduate School
 - a. Mr. Bill Roeting – Data collection and analysis
 - b. LCDR Lee Brewster – JTAC instructor observer
5. L3 Communications
 - a. Mr. Janos Opra – ROVER technician and instructor
6. Avwatch Inc.
 - a. Mr. Chris Kluckhuhn – President and Pilot
 - b. Mr. Robert Griffin – Systems Engineer and Integrator
7. AFSOC
 - a. Mr. Steve Bishop – Observer

Attachment 1

The TASE200 Gimbal

is a scaled up version of the TASE gimbal. It includes the 324x256 FLIR Photon II IR Camera, and an FCB-EX980 Sony Block Camera. The TASE200 Gimbal provides another powerful payload solution for the system integrator. TASE200n shown with FLIR Tau 640 camera.



Key Features

- 5 inch diameter turret. Overall package size is 5 x 5 x 7.7 inches. Weight 1060g
- Provides both EO and IR cameras in single gimbal package
- Mounting and electrical interfaces identical to TASE
- Gimbal includes inertial sensors and Global Positioning System (GPS) receiver for standalone operation. Control and stabilization implementation leverages off of the Piccolo autopilot design
- Gimbal Developer's Kit provides bench test cables, Universal Serial Bus (USB) joystick, video card, and basic gimbal control software.

Specifications

Mechanical

- Size: 127 x 127 x 196 mm (5.0 x 5.0 x 7.7 inches)
- Turret Diameter: 127 mm (5.0 inches)
- Camera Payload Volume: 39 in³
- Weight: 1060 grams (2.34 lbs)

Environmental

- Operating Temperature: -20°C to +70°C (Calibrated Range)

Gimbal Performance

- Rotation limits: continuous pan,
- +23° / -203° tilt
- 200°/sec slew rate
- 0.05° pointing resolution

Interface

- Command: RS232 and CAN
- Video Out: NTSC Analog (PAL Available)

Electrical

- Supply Voltage: 9 - 20 Volts
- Power: 14 W (typical) 22 W (max)

Attachment 2

VORTEX Transceiver

VORTEX

VORTEX is the **next generation** of compact, highly-capable, multi-use transceivers. With simultaneous dual-band transmission, VORTEX transforms **sensor-to-shooter networking** via increased levels of collaboration and interoperability. A VORTEX-to-VORTEX dual-band link provides **high reliability** through spatial and frequency redundancy.



Product Description

Designed for air, surface and maritime use, the VORTEX transceiver provides real-time full-motion video and other data, for situational awareness, targeting, Battle Damage Assessment (BDA), surveillance, relay, convoy overwatch operations and other situations where eyes on target are required. VORTEX can transmit and receive analog and/or digital data simultaneously. VORTEX is interoperable with ROVER, CDL, virtually all UAVs, targeting pods and

other waveforms. VORTEX can simultaneously transmit common data to multiple platforms using two different channels in one or two different bands. VORTEX is able to receive in two different channels in one or two different bands from a single source. This band and channel diversity provides link redundancy, better reception and resiliency to platform shading, multipath interference, line-of-sight blockages and RF interference.

Specifications

Performance Characteristics

Transmit and Receive Bands

- Ku-band: 14.4–14.83 and 15.15–15.35 GHz 1.0 MHz steps
- C-band: 4.4–4.9 and 5.25–5.85 GHz, 1.0 MHz steps
- S-band: 2.2–2.5 GHz, 0.5 MHz steps
- L-band: 1.71–1.85 GHz, 0.5 MHz steps
- UHF: 400–470 MHz, 1 kHz steps

Data Rates

- CDL: 200 kbps to 45 Mbps
- Tactical: 1.6 Mbps to 6.4 Mbps
- VNW (FSK): 50 kbps to 5 Mbps
- Legacy ROVER 455 k and ROVER 466ER
- Analog FM

Video

- NTSC/PAL
- H.261 (decode only)
- H.264 (MPEG-4 part 10)
- MPEG-2 (legacy compatible) and MPEG-4 part 2
- Motion JPEG

Encryption

- Type 1 encryption available
- Triple DES
- AES

FEC (Forward Error Correction)

- Rate 1/2 convolutional
- Reed-Solomon (247, 231)
- Rate 1/2 convolutional with concatenated Reed-Solomon
- Turbo product code

External Interfaces

- IPv4
- 10/100 Base-T Ethernet
- RS-232 (2 user-channels, 1 GPS console)
- RS-422 (2 full-duplex user-channels)
- Headset connection
- SMA (1 video output, 1 video input)
- Remote LED indicators
- Dual external SSPA and transmitter control
- Dual interfaces for external directional antenna control
- Dual DC bias RF receive (for external LNA)

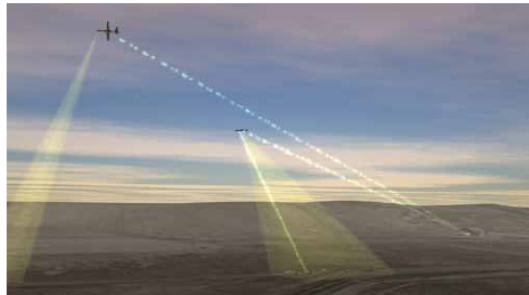
Physical Characteristics

- Size:** 4.75" (w) x 3.7" (h) x 8.6" (d)
- Weight:** < 10 lbs
- Power:** 9–32 VDC, approx. 45 watts
- Immersion:** 1 meter of water for up to 30 minutes
- Shock:** 20 G, 11 msec (terminal sawtooth peak), (operating)
- Altitude:** < 70,000 feet (operating)
- Temperature:** -20°C to +70°C (operating)
-20°C to +85°C (non-operating)

Compression and Waveforms

	MJPEG	Analog	H.261	MPEG-4 Part2	MPEG-2	H.264 (MPEG-4 Part 10)
VNW	X			X	X	X
FM Analog		X				
ROVER 455k			X*			
ROVER 466ER				X		
CDL					X	
Tactical					X	

*H.261 is decode only.



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640 North 2200 West, P.O. Box 16850, Salt Lake City, Utah 84116-0850, U.S Toll Free: 800-874-8178
International: +801-594-2000, Fax: 801-594-3003, E-mail: CSW.Products@L-3com.com, www.L-3com.com/csw

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Attachment 3

Compact Multi-band Data Link (CMDL)

CMDL is on the leading edge of **miniaturized, high-performance,** wide-band data links. Operating in Ku, C, L or S-band, with both analog and digital waveforms, the CMDL provides users **maximum flexibility** and performance. It is interoperable with **military and commercial** products including: Tactical Common Data Link (TCDL) terminals, the complete line of ROVER products, and COFDM receivers.



Key Features

- Full-duplex, quad-band modem
- Compact, low SWaP
- Mission selectable RFE and antenna, with selectable digital and analog waveforms, and data rates up to 45 Mbps
- Interoperable with CDL terminals, all ROVER products and COFDM receivers
- Forward error correction and encryption

Product Description

The CMDL is ideal for UAVs, targeting pods, rotary and fixed-wing platforms, and other airborne terminals that are coordinating with ground forces outfitted with ROVER, TCDL and COFDM equipment. Band and configuration are determined through selection of RFE, antenna and mission computer interface. Configurations include duplex and transmit-only. CMDL provides the ability to transmit and receive sensor data, imagery, streaming video, discrete data, and command and control data. It enhances air and ground coordination, reducing time-on-target for close air support, and providing situational awareness, targeting, surveillance and battle damage assessment. Applications include ISR, direct action, convoy protection and other time-critical operations where eyes-on-target are essential.

Specifications

Performance Characteristics

Frequency Bands

- L-band: 1.71–1.85 GHz, 0.5 MHz steps
- S-band: 2.20–2.50 GHz, 0.5 MHz steps
- C-band: 4.40–4.94 GHz, 1.0 MHz steps
5.25–5.85 GHz, 1.0 MHz steps
- Ku-band: 14.40–14.83 GHz, 1.0 MHz steps
15.15–15.35 GHz, 1.0 MHz steps

Encryption

- Triple DES
- AES
- Type 1 (future release)

Interfaces

- 10/100 Base-T Ethernet
- RS-422 antenna control (future release)
- RS-232 NAV/GPS data
- RS-170 video
- Limited discrete I/O (platform, RFE and antenna status)

Current RFE Options

Band	Transmit/Receive	PA	Configuration	Power Consumption
Ku	Duplex	15 watt	External	120 watt
C	Transmit only	20 watt	External	115 watt
S	Transmit only	1 watt ¹	Internal to modem	—
L	Transmit only	1 watt ¹	Internal to modem	—

Notes

¹ For S-band and L-band an external RFE can be added for higher power output and/or duplex operations.

Physical Characteristics

Modem SWaP

- Size: 5.4" L x 4.2" W x 1.5" H
- Weight: 1.7 lbs
- Power: 30 watts
MIL-STD-704E, +28VDC (input power)

Environmental

- Altitude: 50,000 ft
- Vibration: 4.72 gRMS, 0.5 – 2000 Hz per MIL-STD-810F
- Shock: 20 G, 11 msec (terminal sawtooth peak)
- Temperature: -40°C to +70°C

Waveforms

Supported Features		Tactical ^F	CDL ⁴	466	FM Analog	COFDM ⁵ (DVB-T)
		Frequency Band	L	X		X
	S	X		X	X	X
	C	X		X	X	X
	Ku	X	X			
Video	Analog				X	
	MPEG 2	X	X			X
	MPEG 4	X	X	X		X
	H.264	X	X			X
Networking	IPv4	X	X	X		
	IPv6		X ²			
Encryption	Type 1	X ²	X ²	X ²		
	Triple DES	X	X	X		
	AES	X	X	X		X

Notes

- ^FFuture release.
- ²Tactical data rates include 1.8, 3.2 and 6.4 Mbps.
- ⁴CDL compatible data rates include 200 and 400 kbps, and 2.0, 10.71, 21.42 and 44.73 Mbps.
- ⁵Transmit only.

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640 North 2200 West, P.O. Box 16850, Salt Lake City, Utah 84116-0850, U.S Toll Free: 800-874-8178
International: +801-594-2000, Fax: 801-594-3003, E-mail: CSW/Products@L-3com.com, www.L-3com.com/csw

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Attachment 4

ROVER 4 Receiver

The ROVER 4 Receiver is a **portable** receive-only terminal that displays sensor data from **multiple airborne platforms**. Supports Ku-band digital, C-band digital, C-band analog, S-band analog, and L-band analog signals.





ROVER 4 Receiver

Key Features

- **Multi-band reception**
 - Ku-band digital
 - C-band digital
 - C-band analog
 - S-band analog
 - L-band analog
- **Included antennas**
 - Ku-band omni-Integral LNA with DC power via RF cable
 - C, L, S-band omni-Integral LNA with DC power via RF cable
- **Triple DES decryption**
- **Integrated MPEG-4/MPEG-2/H.261 decoder**
- **Digital video recorder with standard .wmv file format**
- **KLV metadata mapped to FalconView™**
- **Video display**
 - Ruggedized laptop via Ethernet
 - NTSC/RS-170 video port
- **Power**
 - BA-5590 form factor batteries (battery not included)
 - Battery eliminator that allows AC or DC input
 - Alternate laptop power supply
 - Allows laptop to be powered from any BA-5590 form factor battery
 - Extends laptop battery operation by 8-10 hours
- **Options**
 - Directional C-band antenna for increased range (currently available)

Product Description

ROVER 4 provides real-time, full-motion video for situational awareness, targeting, Battle Damage Assessment (BDA), surveillance, convoy operations and other situations where eyes-on-target are required. ROVER 4 provides enhanced air and ground coordination, which shortens talk-on-target for time-critical operations. It has proven interoperability with data links in Ku, C, S and L-band with platforms such as Predator, Shadow, Dragon Eye, Litening Pod, and other Joint and Coalition assets. ROVER 4 is small, lightweight, and rugged. It comes as a complete, ready-to-use system housed in a rugged transit case, including antennas, cables, video displays, recording capabilities and a wireless access point.





Specifications

Physical Characteristics

Receiver

- Size: 3.8" x 5.5" x 15.5" (with battery)
- Weight: 8 lbs (excluding antennas, displays, battery, etc.); 10.25 lbs with battery
- Power: Single BA-5590 battery (not included)
 - 10–12 hour operation
 - Battery eliminator allows DC or AC input
 - DC NATO plug cable
 - DC vehicle accessory power plug cable
 - AC plug cable
 - 11–36 VDC
 - 95–270 VAC, 47–440 Hz
- Immersion: 3 feet of water, 30 minutes
- Shock: 9 G, 11 msec, half sine (operating)
- Altitude: < 15,000 feet (operating)
- Temperature: -20° C to +70° C ambient (operating)

Physical Characteristics

Laptop Power

- Lithium battery supplies 2–3 hour operation
- BA-5590 adapter for extended 10–12 hour operation
- Total equipment weight: Approximately 48 lbs



Optional C-Band Directional Antenna

Specifications

Performance Characteristics

Ku-band Digital

- 14.4–15.35 GHz, 5.0 MHz steps
- 10.71 Mbps, QPSK
- 3.2 Mbps, QPSK
- 2.0 Mbps, BPSK
- 1.6 Mbps, QPSK
- MPEG-4 and MPEG-2 video
- Receive CDL Rev F Annex B

C-band Digital

- 5.25–5.85 GHz, 1.0 MHz steps
- 455 kbps, FSK
- H.261 Video

C-band Digital (466 kbps with RS/Viterbi)

- 4.40–5.85 GHz, 1.0 MHz steps
- 466 kbps, FSK
- Reed-Solomon/Viterbi FEC
- MPEG-4 video

C-band Analog

- 4.40–5.85 GHz, 1.0 MHz steps
- FM demodulation
- NTSC/RS-170 video

L-band Analog

- 1.71–1.85 GHz, 0.5 MHz steps
- FM demodulation
- NTSC/RS-170 video

S-band Analog

- 2.30–2.5 GHz, 1.0 MHz steps
- FM demodulation
- NTSC/RS-170 video

Performance Characteristics

Antennas

- C, L, S-band omni
 - L-band gain: > 1 dBi from 0° to 60° above the horizon
 - C-band gain: > -1 dBi from 0° to 60° above the horizon
 - S-band gain: > 0 dBi from 0° to 60° above the horizon
- Ku-band omni
 - Gain: > 1 dBi from 20° to 60° above the horizon
- LNAs (supplied with antennas)
 - Powered via RF cable
- Optional C-band directional

Interfaces

- Ethernet 10/100 Base-T
- Coaxial TNC RF connector to antenna
- RS-485 (directional antenna controller)
- NEMA-0183 (GPS interface)
- RS-170 (NTSC Video)
- BA-5590 Battery Connector
- Front Panel
 - Four button control
 - Eight digit LED display

Software

- Control GUI
 - Pre-mission configuration
 - Automatic frequency acquisition
 - Software configurable
 - Waveform
 - Band and frequency
 - Video protocol
- Video display software
 - MPEG-2
 - MPEG-4
 - H.261
 - Analog

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640 North 2200 West, P.O. Box 16850, Salt Lake City, Utah 84116-0850, U.S. Toll Free: 800-874-8178
International: +801-594-2000, Fax: 801-594-3003, E-mail: CSW.Products@L-3com.com, www.L-3com.com/csw

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ROVER 5 Handheld

The ROVER 5 Handheld is a **portable transceiver** device that transforms **sensor-to-shooter networking** with the highest levels of collaboration. It transmits **time-sensitive targeting** data and displays sensor data from multiple airborne platforms.



Product Description

The ROVER 5 is a small, lightweight, rugged Software Defined Radio that provides a digital capability for full-motion video, situational awareness, targeting, Battle Damage Assessment (BDA), surveillance, convoy operations and other situations where eyes-on-target are required. ROVER 5 provides enhanced air and ground coordination which shortens talk-on-target for time-critical operations. Because ROVER 5 is a versatile Software Defined Radio, it is forward compatible through easily loadable upgrades for both radio and video codecs. ROVER 5 is designed to operate with encryption, and is CDL and STANAG compliant. It is backward compatible and interoperable with the thousands of ROVER III, eROVER and ROVER 4 units fielded to date, as well as the platforms they support, including Predator, Shadow, Dragon Eye, Litening Pod and other Joint and Coalition assets.



Specifications

Performance Characteristics

Transmit and Receive Bands

- Ku-band: 14.4–15.35 GHz, 1.0 MHz steps
- C-band: 4.40–4.950 GHz, 1.0 MHz steps
5.25–5.85 GHz, 1.0 MHz steps
- S-band: 2.2–2.5 GHz, 0.5 MHz steps
- L-band: 1.71–1.85 GHz, 0.5 MHz steps
- UHF: 400–470 MHz

Data Rates

- 200 kbps spread and unspread
- 400 kbps spread and unspread
- 455 kbps
- 466 kbps
- 1.6 Mbps
- 2.0 Mbps spread and unspread
- 3.2 Mbps
- 10.71 Mbps
- 21.42 Mbps
- 44.73 Mbps
- 50 kbps to 5 Mbps

Video

- Analog NTSC
- H.261 (receive only)
- H.264
- MPEG-2
- MPEG-4
- MJPEG

Modulation

- FM
- FSK
- BPSK (CDL interoperable)
- O-QPSK (CDL interoperable)

* Transmit function requires external PA and antenna.

Performance Characteristics (continued)

Encryption

- Triple DES
- AES
- Type 1

FEC (Forward Error Correction)

- Rate 1/2 convolutional
- Rate 1/2 convolutional with concatenated Reed-Solomon
- Turbo product code

External Interfaces

- 10/100 Base-T Ethernet
- USB 2.0 for file storage
- Configurable RS-232 (qty. 2) or RS-422 (qty. 1)
- RS-422 (qty. 2)
- Audio input/output
- External power connector
- BNC external video input/output

User Interfaces

- Menu-driven user interface
 - * Integrated touch screen LCD display
 - * Button control
- Display: 5.6 inch, sunlight readable

Physical Characteristics

- Size: 9.5" x 5.6" x 2.25" (with antenna)
- Weight: 3.5 lbs
- Power: Lithium-ion battery
 - * 2.5–3 hour operation (estimated)
 - * Power supplies allow DC or AC input
 - * 9–36 VDC (with power supply)
 - * 95–270 VAC, 47–440 Hz
- Temperature, operating: 0° C to +45° C

L-3 Communications | Communication Systems – West

640 North 2200 West, P.O. Box 16850, Salt Lake City, Utah 84116-0850, U.S Toll Free: 800-874-8178
International: +801-594-2000, Fax: 801-594-3003, E-mail: CSW/Products@L-3com.com, www.L-3com.com/csw

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10-DSD-041 Rev 0

Attachment 6

Soldier ISR Receiver (SIR) *Tactical ROVER*

The L-3 Communications' SIR is designed to integrate into **modular soldier systems** to provide secure digital and analog **multi-band reception** from a wide variety of manned and unmanned ISR assets.



Product Description

The Soldier ISR Receiver (SIR ver. 2.5) is an IP-based, multi-band, secure, digital and analog receiver designed for ease of integration and very low SWaP. The SIR is the smallest tactical ISR receiver in the market. With its variety of external interfaces the user can connect SIR to virtually any existing display device, computer, power source or Soldier System.

The SIR is interoperable with U.S. DoD Common Data Link (CDL)¹, STANAG 7085¹ and existing Frequency Modulation (FM) analog systems allowing for maximum interoperability across ISR manned and unmanned programs.



Performance Specifications

Performance Characteristics

Receive Bands

- Ku-band¹: 14.40–15.35 GHz, 1.0 MHz steps (Optional accessory)
- C-band: 4.40–4.94 GHz, 1.0 MHz steps
5.25–5.85 GHz, 1.0 MHz steps
- S-band: 2.20–2.50 GHz, 0.5 MHz steps
- L-band: 1.625–1.85 GHz, 0.5 MHz steps

Data Rates

- 455 kbps
- 466 kbps
- 1.6 Mbps
- 2.0 Mbps¹
- 3.2 Mbps
- 6.4 Mbps
- 10.71 Mbps¹
- 50 kbps–5 Mbps

Video

- Analog NTSC
- H.261
- H.264
- MPEG-2
- MPEG-4
- MJPEG

Physical Characteristics

Radio SWaP:

- Size: 3.0" x 8.85" x 1.5"
- Weight: < 2.0 lb
- Power: 3.5 watts

Performance Characteristics (continued)

Modulation

- FM
- FSK
- BPSK
- O-QPSK

Decryption

- Triple DES
- AES

FEC (Forward Error Correction)

- Rate 1/2 convolutional
- Rate 1/2 convolutional with concatenated Reed-Solomon
- Turbo product code

External Interfaces

- TNC for RF in
- 10/100 Base-T Ethernet
- USB video out
- External power connector
- RS-170

Software

- User on-screen display
 - Pre-mission configuration
 - Automatic frequency search/acquisition
 - Configurable
 - Waveform
 - Band and frequency
 - Video protocol
- Software programmable radio
 - Software upgradable

¹Compliant data rates and frequencies only available with optional Ku-band accessory.

L-3 Communications | Communication Systems – West

640 North 2200 West, P.O. Box 16850, Salt Lake City, Utah 84116-0850, U.S. Toll Free: 800-874-8178
International: +801-594-2000, Fax: 801-594-3003, E-mail: CSW.Products@L-3com.com, www.L-3com.com/csw

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Attachment 7

Acronyms

AATC	Air Force Reserve Command Test Center
AES	Advanced Encryption Standard
BDA	Battle Damage Assessment
CBP	U.S. Customs and Border Protection
CDL	Common Data Link
CMDL	compact Multi-band Data Link
COFDM	Coded Orthogonal Frequency Division Multiplexing
DES	Data Encryption Standard
DVB-T	Digital Video Broadcasting – Terrestrial
FEC	Forward Error Correction
FM	Frequency Modulation
FMV	Full Motion Video
GPS	Global Positioning System
GUI	Graphical User Interface
ISR	Intelligence, Surveillance, and Reconnaissance
JTAC	Joint Terminal Air Controller
LOE	Limited Objective Experiment
NGC	Northrop Grumman Corporation
SIR	Soldier ISR Receiver
SUV	Sports Utility Vehicle
SWaP	Space, Weight, and Power
TCDL	Tactical Common Data Link
USB	Universal Serial Bus

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Intelligence and Operations Coordination Center, Bldg 5
2430 S. Swan Rd.
Tucson, AZ. 85711

[Jeffrey Eggers](#)

AF/A2Q, ISR Innovations
1700 Air Force Pentagon (5E1012)
Washington DC 20330-1700

[Ken Johns](#)

AF/A2Q, ISR Innovations
1700 Air Force Pentagon (5E1012)
Washington DC 20330-1700

[Juan Carlos Arevalo](#)

AF/A2Q, ISR Innovations
1700 Air Force Pentagon (5E1012)
Washington DC 20330-1700