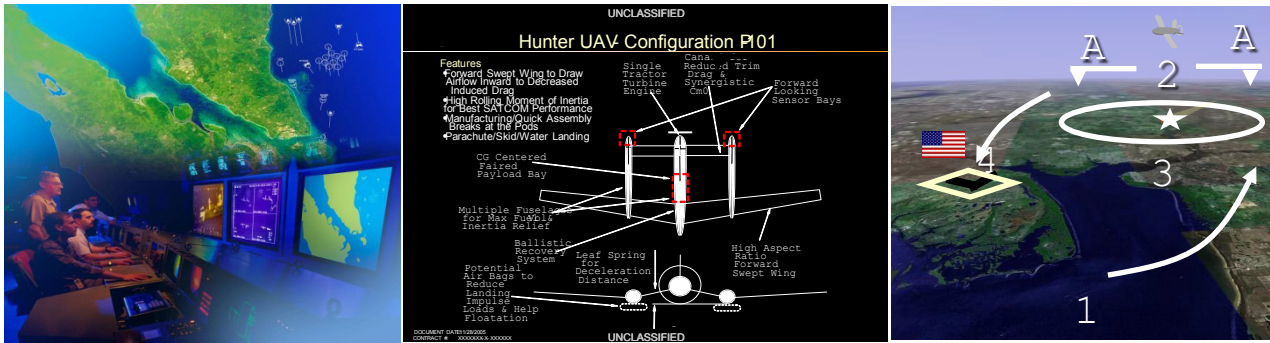


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Tier II UAS Communications Relay Payload Survey

28 November 2008

Advanced Tech Engineering, Inc.

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Key Communications Relay Payload (CRP) Requirements

3.2.6.3	Very High Frequency/Ultra High Frequency Communications Relay	Compliance	Comments
3.2.6.3.0-1	The Communications Relay Payload (CRP) shall be capable of providing radio relay (unit to unit voice and data), including repeating of secure transmissions, between ground units on their tactical frequency (Very High Frequency/Ultra High Frequency (VHF/UHF), (FM)). (T)	Yes	1, 2 and 3 Ranked Candidates
3.2.6.3.0-2	The Communications Relay Payload (CRP) shall be capable of providing radio relay (unit to unit voice and data) between ground units on their tactical frequency (VHF/UHF, (FM)) and Frequency hopping waveforms. (O)	Yes	1, 2 and 3 Ranked Candidates
3.2.6.3.0-3	The CRP shall be compliant with SINCGARS and EPLRS waveforms. (T)	Yes	1, 2 and 3 Ranked Candidates
3.2.6.3.0-4	The CRP shall be capable of voice communication (UHF, VHF (FM)) between the AVO/MPO and the tactical ground unit via the AV datalink. (O)	TBD	In Trade. CDL supports FD analog voice

CRP Candidate Survey (updated 11/28/08)

No.	VHF/UHF CRP)Candidates	Rqmt Comp.	Status
1	GD C4S HMS & RAYCO EPLRS MicroLite	No	Waiting for additional tech and program info. GDAIS continuing discussions with GDC4S
2	Modified HARRIS PRC-152 & RAYCO EPLRS MicroLite	Yes	Demonstrated capability using two AN/PRC-152s on Army Shadow UAS. Will require separate EPLRS radio. Requires EPLRS MicroLite to provide EPLRS capability. NDA completed 10/28. GDAIS continuing discussions with Harris
3	L3 NOVA MACR & RAYCO EPLRS MicroLite	Partial	L3 Nova developed MACR prototype via SBIR ~ 2 years ago. Prototype demo'd SINGARS relay capability; L3 Nova pursuing funding and or teaming to update design. NDA approved 11/3.
4	Raytheon PSC5D with EPLRS MicroLite	Yes	Increased SW&P compared to candidate 1-3. Provides robust, increase op range performance. Rayco PSC-5D capability demo'd in airborne environment. Requires EPLRS MicroLite to provide EPLRS capability. NDA completed 10/22. GDAIS continuing discussions with RAYCO
5	ITT RT-1523 (SINGARS) with Raytheon SideHat	No	Eliminated due to SW&P constraints & learned that initiative commenced two years ago is kaput. ITT has not returned numerous request for info
6	RCI ARC-210 & RAYCO EPLRS MicroLite	No	Eliminated due to SW&P constraints
7	Raytheon ARC-231 & RAYCO EPLRS MicroLite	No	Eliminated due to SW&P constraints
8	Thales LMAR	No	Eliminated. Does not provide CRP capability
9	Thales MMAR plus RAYCO EPLRS MicroLite	Yes	Thales MMAR is based on existing AN/PRC-148 JEM modules; Prototype demo'd on Zephyr UAV. Repackaged MMAR available early 2009. Requires EPLRS MicroLite to provide EPLRS capability. NDA in process.
10	Motorola AN/PRC-153	No	Eliminated. Does not cover the full 30-512 MHZ VHF/UHF band
11	Thales Tactical Repeater (2 AN/PRC-148s)	No	Eliminated due to SW&P & design not suited for Airborne ops

• *Survey identified 11 possible CRP candidates*

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Preliminary CRP Rankings (11/28/08)

Rank 1= hi 5= low	VHF/UHF CRP Candidates	Rqmt Comp*	SW&P*	Link Range*	Growth *	Status
1	Thales MMAR plus RAYCO EPLRS MicroLite	Yes	1	2	1	Thales MMAR is based on existing PRC-148 JEM modules; Prototype demo'd on Zephyr UAV. Repackaged MMAR available early 2009. May be available to support GD's Spiral-1 flight demo. Interested in either GD buy or acknowledged teammate options. Approximate S&W: 5.6" H x 5" W x 9.7" D; 6 lbs; NDA in process.
2	Modified HARRIS PRC-152 & Plus RAYCO EPLRS MicroLite	Yes	1	2	3	Demonstrated capability using two PRC-152s on Army Shadow UAS. Will require separate RAYCO EPLRS radio. NDA completed 10/22. GDAIS continuing discussions with RAYCO
3	Raytheon PSC5D with EPLRS Microlite	Yes	3	1	3	Rayco PSC-5D CRP capability demo'd in airborne environment. Provides robust, increase op range performance. Increased SW&P compared to 1 & 2 ranked options. Requires EPLRS MicroLite to provide EPLRS capability. NDA completed 10/22. GDAIS continuing discussions with RAYCO
4	L3 NOVA MACR & RAYCO EPLRS MicroLite	Partial	2	-	1	L3 Nova developed MACR prototype via SBIR ~ 2 years ago. Prototype demo'd SINGARS relay capability; L3 Nova pursuing funding and or teaming to update design. NDA approved 11/3.
5	GD C4S HMS & RAYCO EPLRS MicroLite	No	2	3	1	May have SINGARS capability in Sept 09. Waiting for tech and program info. GDAIS continuing discussions with GDC4S

* Based on available data as of 11/28/08; 1 = Best; 3 = Worse

All solutions will require varying levels of modification and integration to comply with current CRP requirements. All candidates are not OTS, fully integrated solutions.

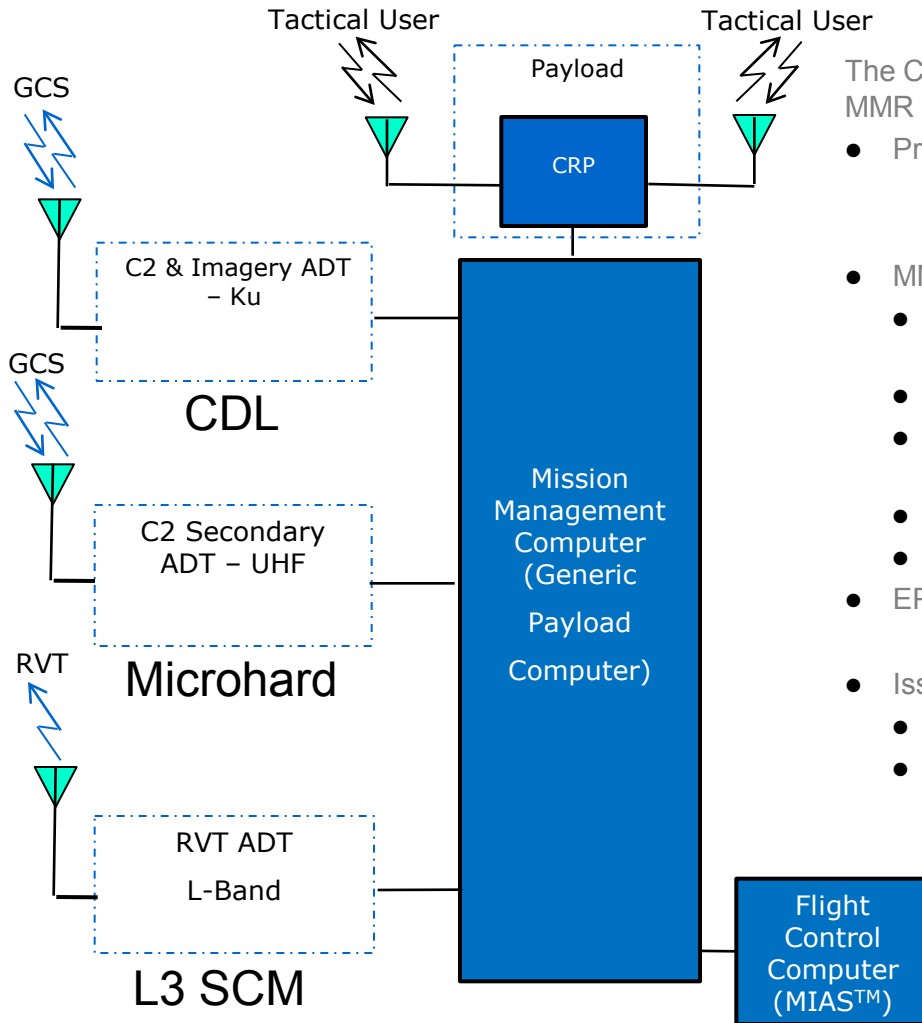
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CRP Requirement Compliance Summary (Updated 11/28/08)

Last Update: 11/28/08		Ranked 1		Ranked 2		Ranked 3		Ranked 4		Ranked 5	
Requirements		Thales MMAR plus RAYCO EPLRS MicroLite		Harris PRC & Rayco MicroLite		Rayco PSC-5D & MicroLite		L3 Nova MACR		GD C4S HMS	
3.2.6.3	Very High Frequency/Ultra High Frequency Communications Relay	Compliance	Comments	Compliance	Comments	Compliance	Comments	Compliance	Comments	Compliance	Comments
3.2.6.3.0-1	[1250] The Communications Relay Payload (CRP) shall be capable of providing radio relay (unit to unit voice and data), including repeating of secure transmissions, between ground units on their tactical frequency (Very High Frequency/Ultra High Frequency (VHF/UHF), (FM)). (T)	Yes	Prototype demo'd on Zephyr UAV. Repackaged MMAR available early 2009	Yes	Capability demonstrated on Shadow UAS	Yes	Capability demonstrated on Airborne environment. Largest SW&P footprint compared to the other three options	Yes	MACR prototype demonstrated SINGGARS relay capability. Prototype does not presently support the full VHF/UHF 30 MHz to 512 MHz op band. L3 Nova has compliant design but, is looking for investment and / or teaming to develop	Yes	Compliance is dependent on availability of SFF-B HW, SRW and technical maturity
3.2.6.3.0-2	[1255] The Communications Relay Payload (CRP) shall be capable of providing radio relay (unit to unit voice and data) between ground units on their tactical frequency (VHF/UHF, (FM)) and Frequency hopping waveforms. (O)	Yes	See comment above	Yes	See comment above	Yes	Capability demonstrated on Airborne environment	TBD	See comment above	TBD	Unknown. Information not available at survey completion
3.2.6.3.0-3	[1260] The CRP shall be compliant with SINGGARS and EPLRS waveforms. (T)	Yes	SINGGARS capability demonstrated on Zephyr UAV; EPLRS capability demonstrated on various UAS platforms	Yes	SINGGARS capability demonstrated on Shadow UAS; EPLRS capability demonstrated on various UAS platforms	Yes	SINGGARS.EPLRS would be provided via MicroLite	Yes	SINGGARS.EPLRS would be provided via MicroLite	SINGGARS 9/09	It's unlikely that both SINGGARS and EPLRS waveforms will be available prior to DT/OT
3.2.6.3.0-4	[1265] The CRP shall be capable of voice communication (UHF, VHF (FM)) between the AV/O/MPO and the tactical ground unit via the AV datalink. (O)	Unknown	Unknown. Information not available at survey completion	Unknown	Unknown. Information not available at survey completion	Unknown	Unknown. Information not available at survey completion	Unknown	Not with prototype. Information not available at survey completion	TBD	Unknown. Information not available at survey completion

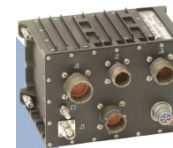
Ranked 1 Thales MMR & RAYCO EPLRS MicroLite



The CRP consists of multiple radios to meet CRP requirements: One MMR and one EPLRS MicroLite

- Provides VHF/UHF 30 – 512 MHz operation
 - SINCGARS & EPLRS (T)
 - Frequency Hopping (O)
- MMR
 - MMR prototype demo'd on Zephyr UAV. See press release next slide
 - Repacked MMR available for demos early 2009
 - Potential interface to support MPO / AVO voice communication to tactical user via primary data link (O)
 - MMR based on AN/PRC-148 JEM modules
 - Transmit power: 5 W (Med link range performance)
- EPLRS MicroLite ML-I or DH500
 - Has flown on or currently flying on multiple UASs
- Issues
 - Responsibility for CRP Design & Integration
 - MMC / PIU Functionality to configure CRP and provide AVO and MPO to Tactical User links (O)

CRP = MMR



+ EPLRS
MicroLite



Thales Press Release

Thales Contributes to UAV World Endurance Record Advancing Battlefield Communications Capabilities for Warfighters

CLARKSBURG, Md., November 14, 2008 – A solar-powered plane, funded jointly by the U.K. Ministry of Defence and the U.S. Department of Defense (U.S. DoD), recently set an unofficial world endurance record for a flight by an Unmanned Aerial Vehicle (UAV). Thales Communications, Inc. provided the Communication Relay System that enabled users, more than 300 miles apart, to communicate using their organic radios.

The Zephyr UAV, developed by international defense and security technology company QinetiQ, stayed aloft, non-stop, for 82 hours and 37 minutes, exceeding the current world record for unmanned flight, which is 30 hours and 24 minutes (Global Hawk, 2001). The flight trial, which was funded by the U.S. DoD, took place at the U.S. Army's Yuma Proving Ground in Arizona, in the harsh conditions of the Sonoran Desert. Zephyr was flown on autopilot and via satellite communications to a maximum altitude of more than 60,000 feet. Thales's repackaged AN/PRC-148 Joint Tactical Radio System Enhanced Multiband Inter/Intra Team Radios (JEM) constituted the Zephyr's Communication Relay System.

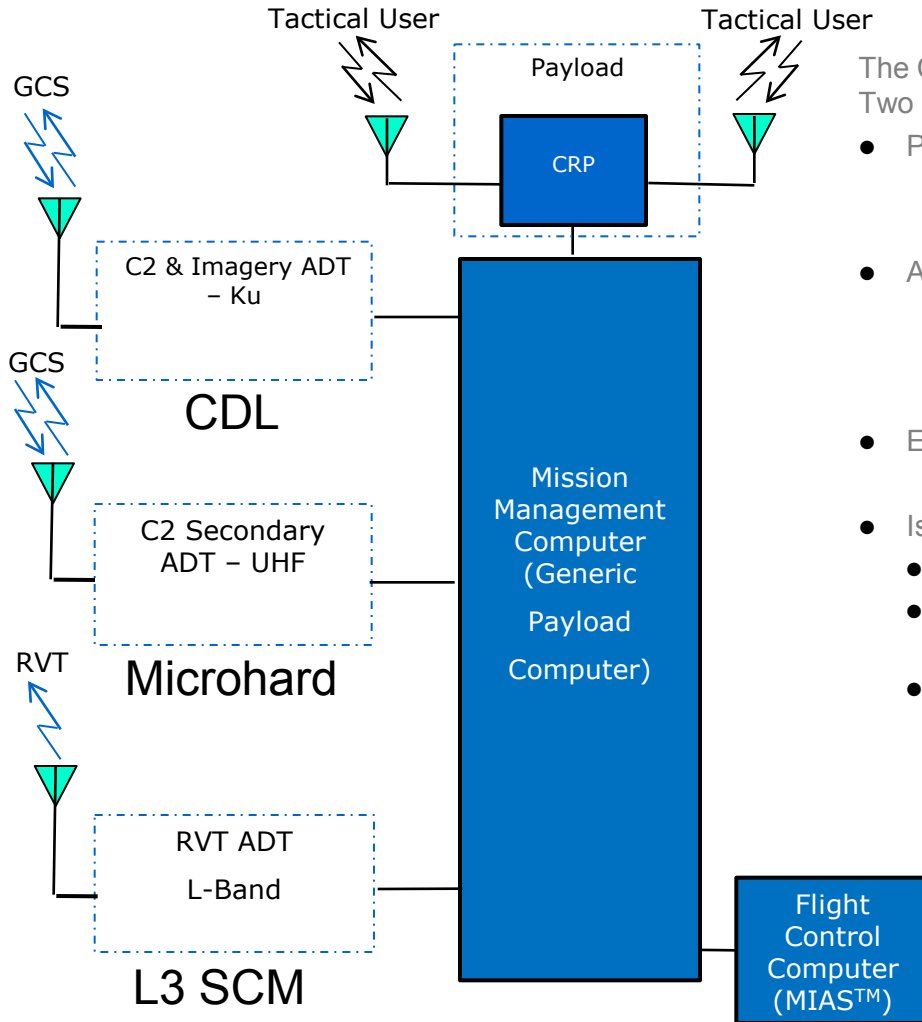
Zephyr is part of a U.K./U.S. Joint Capability Technology Demonstration program, which is designed to rapidly field urgently-needed technologies, e.g., battlefield communications and reconnaissance, to U.S. warfighters in the field. For this program, Thales developed, integrated, tested, and provided a relay communications system that would support Single Channel Ground and Radio Airborne System (SINCGARS) capability. The system consisted of a four-radio solution (AN/PRC-148 JEM) capable of providing two retransmission demonstration systems at less than five pounds including radios, retransmission cables, and antennas.

"Our expertise in tactical communications solutions for size-, weight-, and power-constrained environments goes beyond the radio and enables us to provide solutions across a myriad of operational domains, including airborne systems," said Lewis Johnston, Vice President of Thales Communications, Inc., in charge of Advanced Programs. "Our technology has been proven in the low-temperature, high-altitude, long-endurance operational setting where reliability is key."

Based on the battle-proven AN/PRC-148 MBITR, Thales's AN/PRC-148 JEM is the smallest, lightest, and most widely-fielded tactical handheld radio in the world. It is a Software Communications Architecture-compliant platform that hosts all of today's key waveforms. The AN/PRC-148 JEM provides a strong evolutionary path for advanced capabilities via simple software upgrades, like new waveforms (e.g., DAMA IW SATCOM, Mobile Ad Hoc Networking, Project 25), increased data rates, situational awareness dissemination at the squad level, crypto modernization, and rifleman radio capabilities. There are more than 165,000 AN/PRC-148s on order/delivered globally.

Ranked 2

Harris PRC-152 & RAYCO EPLRS MicroLite



The CRP consists of multiple radios to meet CRP requirements:
Two PRC-152s and one EPLRS MicroLite

- Provides VHF/UHF 30 – 512 MHz operation
 - SINCGARS & EPLRS (T)
 - Frequency Hopping (O)
- AN-PRC-152 VHF/UHF 30 -512 MHz
 - Demo'd and proven capability on Shadow UAS
 - See 20071126 Final C_L Report
 - Transmit power: 5 W (Med link range performance)
- EPLRS MicroLite ML-I or DH500
 - Has flown on or currently flying on multiple UASs
- Issues
 - Responsibility for CRP Design & Integration
 - Some modification required to OTS PRC-152s (see report) to fully automate VHF/UHF capabilities
 - MMC/PIU functionality to configure CRP and provide AVO and MPO to Tactical User links (O)

CRP = Two PRC-152

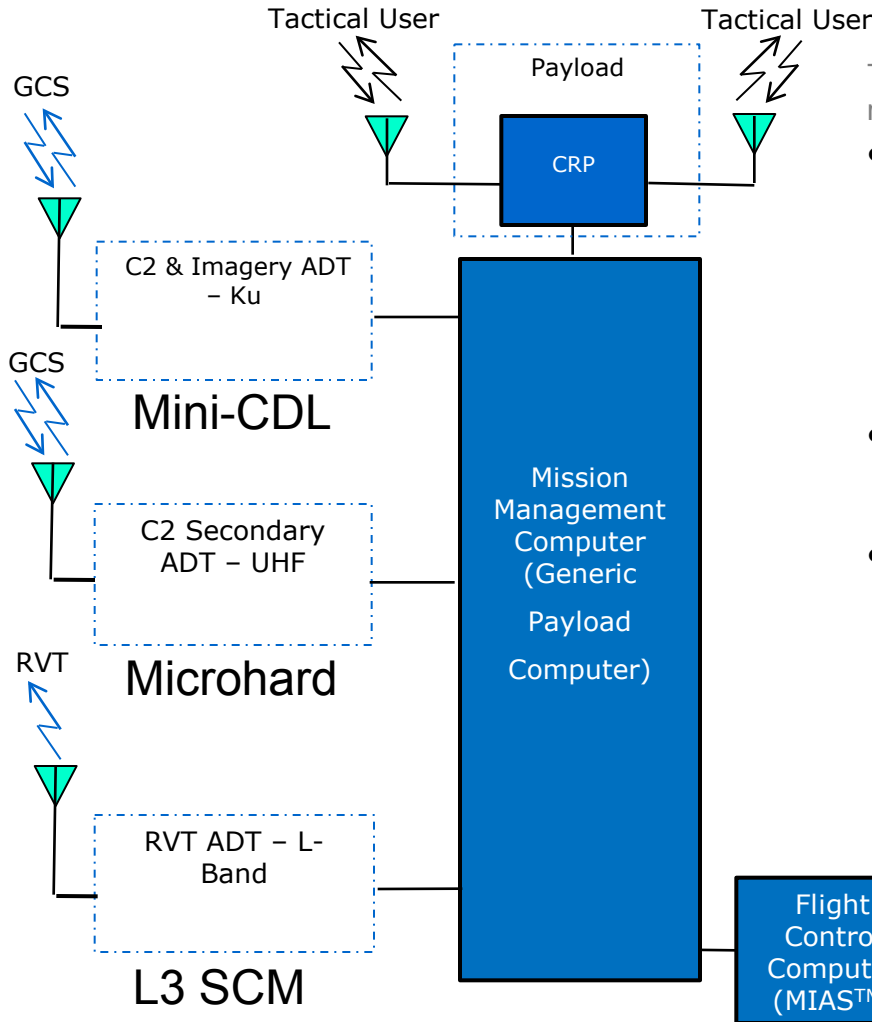


+ EPLRS
MicroLite



Ranked 3

RAYCO AN/PSC-5D & EPLRS MicroLite



The CRP consists of multiple radios to meet CRP requirements: AN/PSC-5D and EPLRS MicroLite

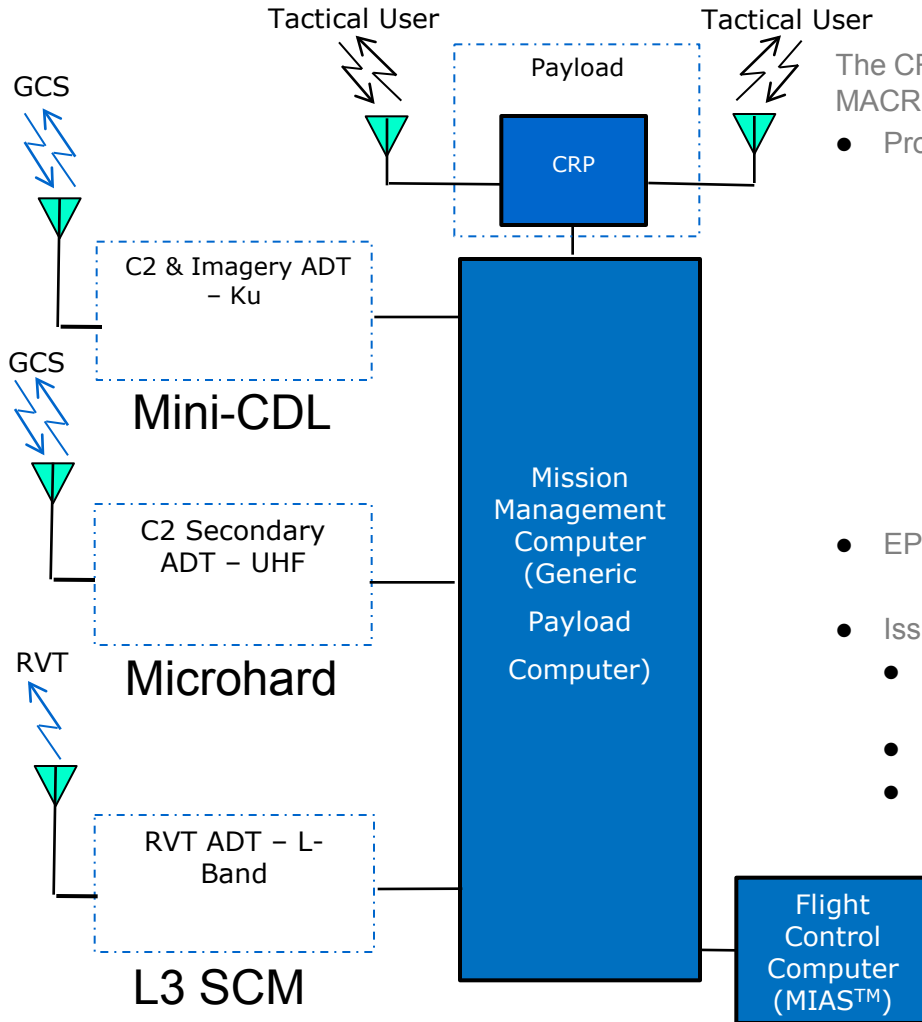
- Provides VHF/UHF 30 – 512 MHz operation
 - SINGARS & EPLRS (T)
 - Frequency Hopping (O)
 - Greater range performance Vs top two ranked candidates
 - Transmit power: 20 W (Long link range performance)
- EPLRS MicroLite ML-I or DH500
 - Has flown on or currently flying on multiple UASs
- Issues
 - Responsibility for CRP Design & Integration
 - MMC / PIU Functionality to configure CRP and provide AVO and MPO to Tactical User links (O)
 - SW&P

CRP = Two PSC-5D

+ EPLRS
MicroLite



Ranked 4 L3 NOVA MACR+ & RAYCO EPLRS MicroLite



The CRP consists of multiple radios to meet CRP requirements: MACR+ and EPLRS MicroLite

- Provides limited VHF/UHF 30 – 512 MHz operation
 - MACR prototype provides SINCGARS (T) half-duplex CRP capability; EPLRS (T) capability provided with MicroLite radio
 - Frequency Hopping (O) – Not available with MACR prototype
 - MACR does not require COMSEC
 - L3 says they have an alternative CRP compliant design
 - Transmit power: TBD W (TBD range application)
- EPLRS MicroLite ML-I or DH500
 - Has flown on or currently flying on multiple UASs
- Issues
 - L3 looking for additional investment and potential partnership to realize CRP capability; L3 says they have compliant design
 - Responsibility for CRP Design & Integration
 - MMC Functionality to configure CRP and provide AVO and MPO to Tactical User links (O)

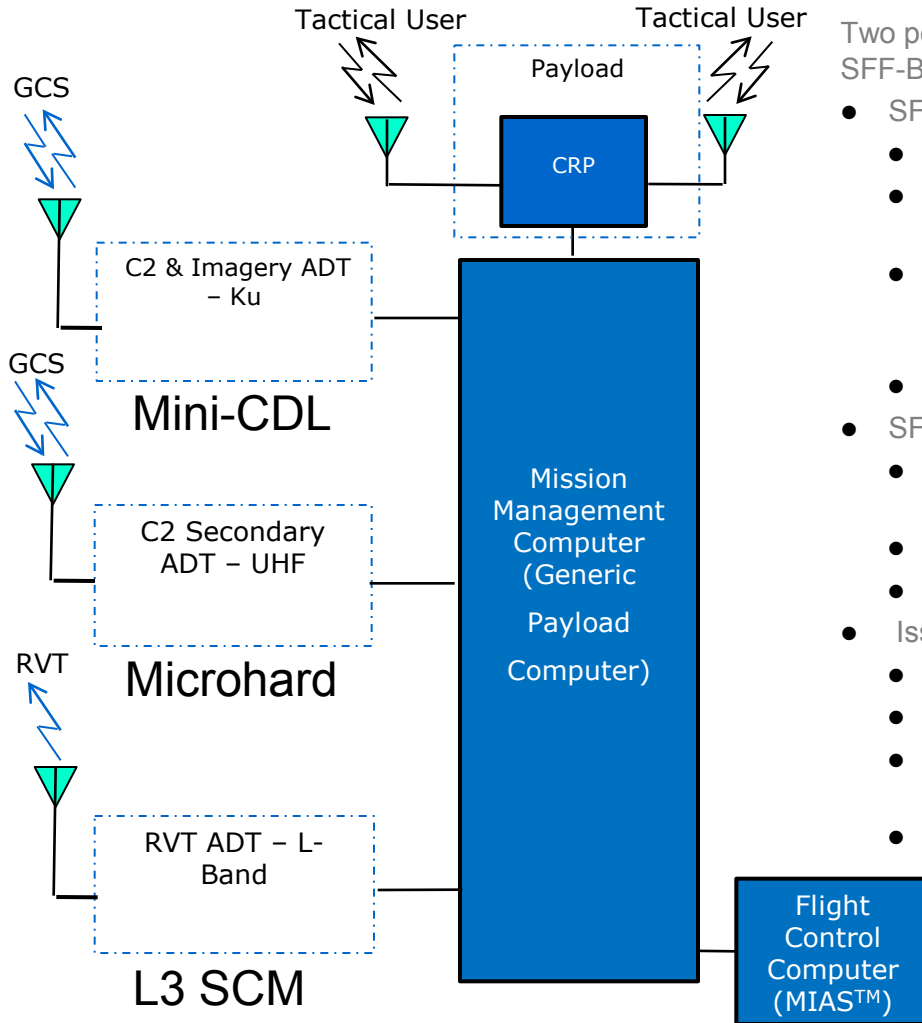
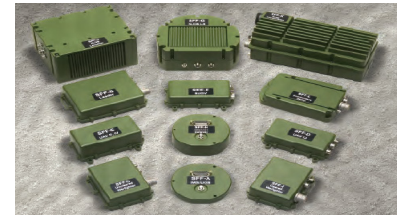
CRP = MACR



+ EPLRS
MicroLite



Ranked 5 GD C4S HMS SFF-A or SFF-B & RAYCO EPLRS MicroLite



Two potential configurations: SFF-A (single channel, half-duplex and SFF-B (two channel; Full-duplex)

- SFF-A (2x plus TBD Module)
 - Demo'd on FCS MAV with SRW Version 0.5;
 - Rehosting with ITT SRW version 1.0c ; Anticipate SQT testing in early 2009
 - Provided Textron (AAI is subsidiary) provided with two SFF-A with diplexer and additional processing to support Full-Duplex, CRP capability (Required functionality for STUAS)
 - Transmit Power: 2 W (Short link range performance)
- SFF-B
 - Anticipate contractor test in Sept. 09; Porting SINCGARS and UHF SATCOM
 - C4S believes EPLRS is falling out of favor with JTRS PO
 - Transmit Power: 5 W (Med link range performance)
- Issues
 - TRL and availability of SFF-B
 - Availability of EPLRS and SINCGARS waveforms
 - Lack of program and technical information provided to adequately assess capability, compliance and technical risk
 - MMC Functionality to configure CRP and provide AVO and MPO to Tactical User links (O)

CRP = SFF-A or
SFF-B

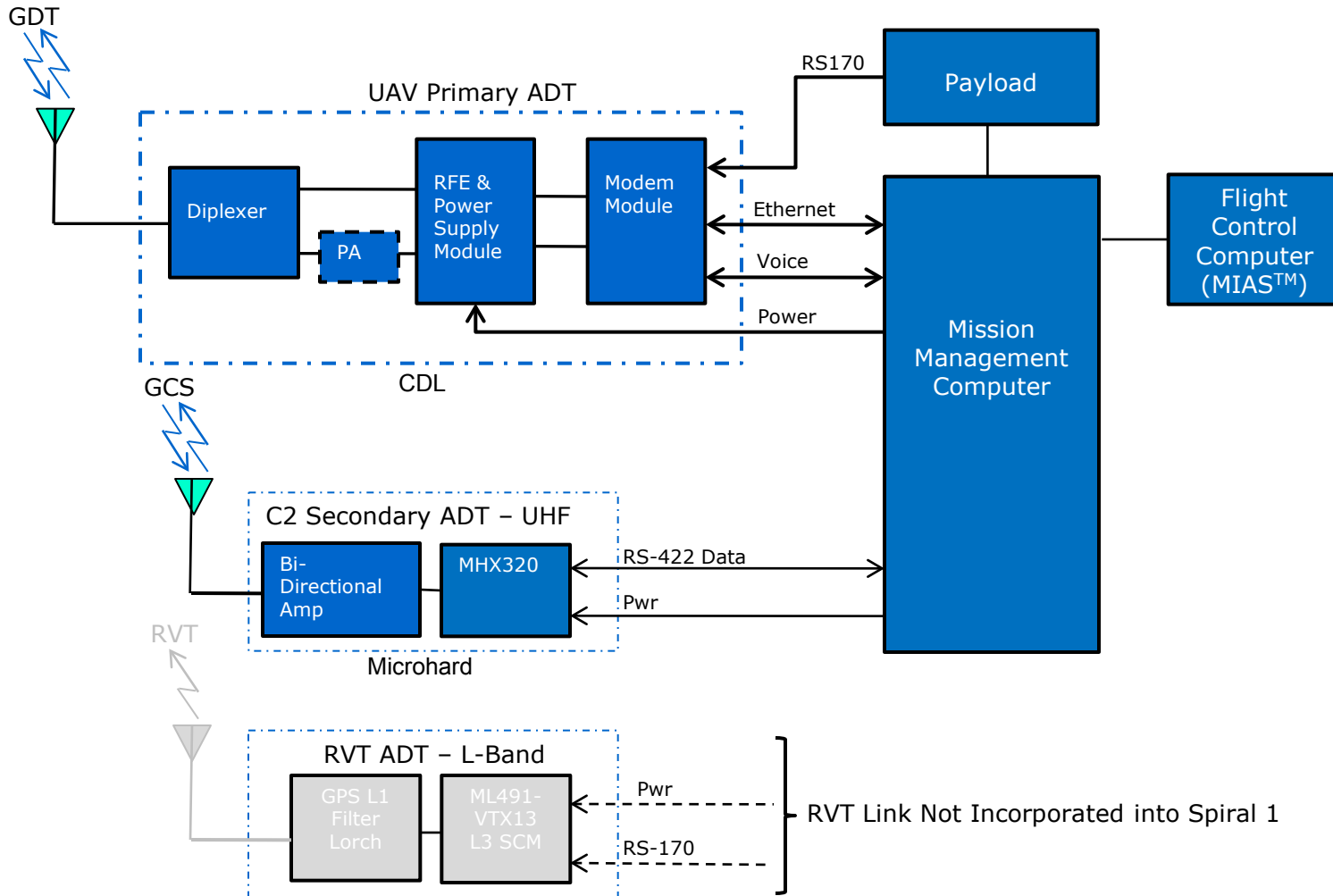


+ EPLRS
MicroLite



UAV Comms Spiral-1 System

Integrated Primary C2 and Imagery ADT: Mini-CDL Increment 2
Secondary C2 ADT: Microhard
RVT ADT: L3 SCM / Lorch – Not incorporated into Spiral 1



Recommended Near Term Tasks

- *Pursue further refinement of the top 3 ranked candidates*
 - *Top two candidates, Thales MMR and Harris AN/PRC-152s provides lowest SW&P, med to low link range performance, and high to minimal growth capability, respectively*
 - *The third candidate, Raytheon PSD-5C presents larger SW&P as compared to the top two candidates. However, provides greater link range performance. Candidate provides minimal to no growth capability*
 - *Cannot down select until Final PBS is released*
- *Down select Spiral-1 demonstration candidate*
 - *Thales repackaged MMAR available early 2009. May be available to support GD's Spiral-1 flight demos. Excludes Raytheon EPLRS*
 - *Harris AN/PRC-152s may be integrated to support demo. Excludes Raytheon EPLRS*
- *Commence requirement analysis*
 - *Define specific CRP MPP, GCS functions and interfaces*
 - *Define payload interface unit (PIU) requirements*
 - *Define CRP link requirements*

CRP Path Forward / Recommended Tasks

- *Commence Design Trades*
 - *Down select CRP candidate (VHF /UHF and EPLRS units)*
 - *Perform aperture trades and coordinate with Comms IPT*
 - *Perform PIU hardware trades*
- *Commence Detailed Design*
 - ...
 -

Characteristics of Selected Tactical Radios (1 of 2)

Radio	Output Power	Range	Frequency	Waveforms	Manufacturer
Handheld radios					
AN/PRC-148 JEM	5 Watts	5 miles (environment dependent)	30-512 MHz	AM, FM, HAVEQUICK VII, SINGARS SC, ANDVT (PSK); P25	Thales
AN/PRC-152	5 Watts	5 miles (environment dependent)	30-512 MHz	AM, FM, HAVEQUICK VII, SINGARS FH, ANDVT (PSK), P25, HPW	Harris
PRC-153 (Integrated Intra Squad Radio)	1-5 Watts	1 km	136-520 MHz	VHF/UHF	Motorola
Manpack Radios					
AN/PRC-117F (COTS)	20 Watts	SATCOM/DAMA = 5,000 miles LOS = 50 miles	30-512MHz	(VHF) SINGARS, LOS 30 to 512MHz, CTCSS, (UHF) SATCOM DAMA, IW [™] , HAVEQUICK, Maritime Frequencies, HPW	Harris
AN/PRC-150	20 Watts	1 to 150 miles or more (environment dependent)	2 to 60 MHz	LSB, USB, AME, CW, VHF-FM	Harris
AN/PSC-5D	20Watts	SATCOM/DAMA = 5,000 miles LOS = 10 Km (terrain dependent)	30-512MHz	(VHF) SINGARS, CNR, LOS 30 to 512MHz, CTCSS (UHF)SATCOM DAMA, IW [™] , HAVEQUICK, Maritime Mode, LMR, JSTARS Interoperable Waveform	Raytheon

Characteristics of Selected Tactical Radios (2 of 2)

Radio	Output Power	Range	Frequency	Waveforms	Manufacturer
Airborne Radios					
AN/ARC-210	10- 23 Watts	LOS and SATCOM	30- 512 MHz	HAVEQUICK I & II, SATURN, SINCGARS (V), ESIP, SATCOM DAMA, IW *, Link 4A, Link 11, JPALS data link capable, among others	Rockwell Collins
AN/ARC-201D (Airborne SINCGARS)	10W	40 statute miles at 1200' AGD	30 – 87.975 MHz	SINCGARS	ITT
AN/ARC-231	125Watts (Power Amplified)	SATCOM/DAMA = 5,000 miles LOS = 50 miles	30-512MHz	(VHF) SINCGARS, CNR, ATC, LOS 30 to 512 MHz, CTCSS, (UHF) SATCOM, DAMA, IW *, HAVEQUICK, Maritime Mode, LMR	Raytheon
Ground Radios					
EPLRS	100 W (max)	Ground to ground: 10 Km Ground to air: 40 Km	420-450 MHz	EPLRS	Raytheon
SINCGARS	5 W and 50 W (with an external Power Amplifier)	5W – 5-10Km (voice) 50W – 10-40Km (voice)	30 – 87.975 MHz	SINCGARS	ITT
AN/VRC-110 Vehicular adapter for PRC-152	20-50 Watts	20 miles (environment dependent)	30-512 MHz	AM, FM, HAVEQUICK I/II, SINCGARS FH, ANDVT (PSK), P25, HPW	Harris
AN/VRC-111 Vehicular adapter for PRC-148	20-50 Watts	20 miles (environment dependent)	30-512 MHz	AM, FM, HAVEQUICK I/II, SINCGARS FH, ANDVT (PSK), P25	Thales
AN/VRC-104 Vehicular adapter for PRC-150	20-150 Watts	1 to 2,000mi or more (environment dependent)	2 to 60 MHz	LSB, USB, AME, CW, VHF-FM	Harris

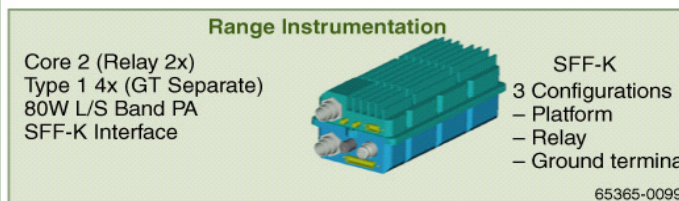
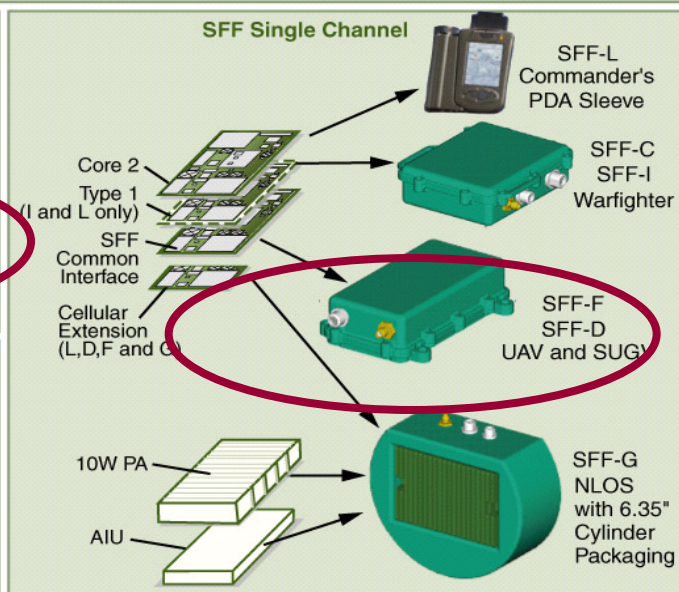
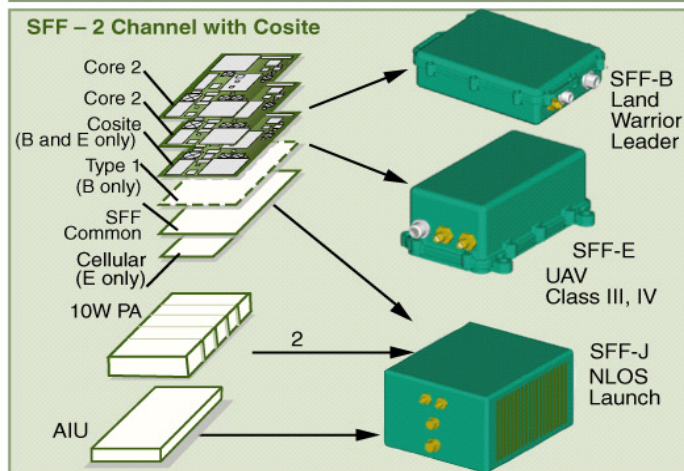
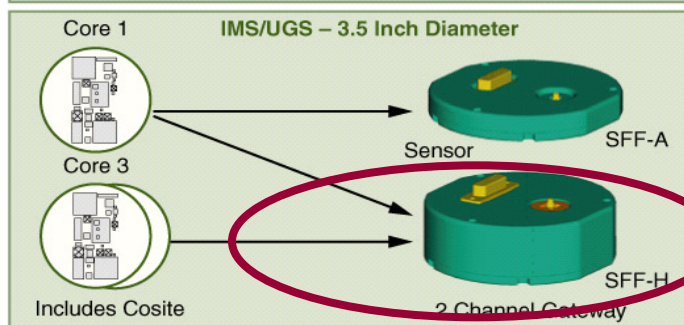
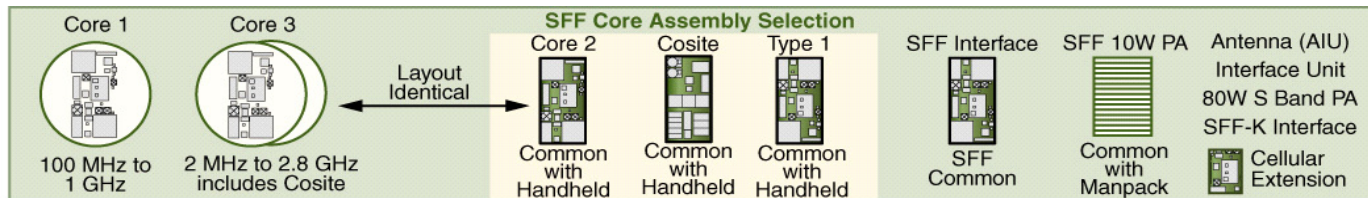
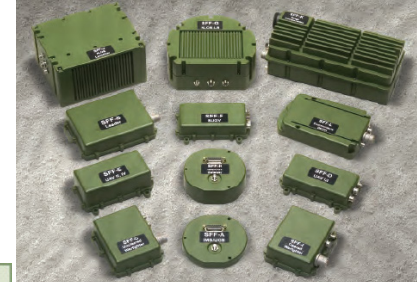
Issues

- *Undefined link performance requirements*
 - *Impacts CRP down select and aperture selection*
- *CRP will require frequency management / coordination with secondary C2 data link {[1530] The Secondary C2 DL shall reside in the UHF frequency band (225-400MHz).. (T)}*
- *Definition and development of MMP, GCS CRP functions and interfaces*
- *CRP Spiral-2 demo objectives and capability*

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Back-Up

Communications Relay Payload JTRS HMS Radios



65365-0099g

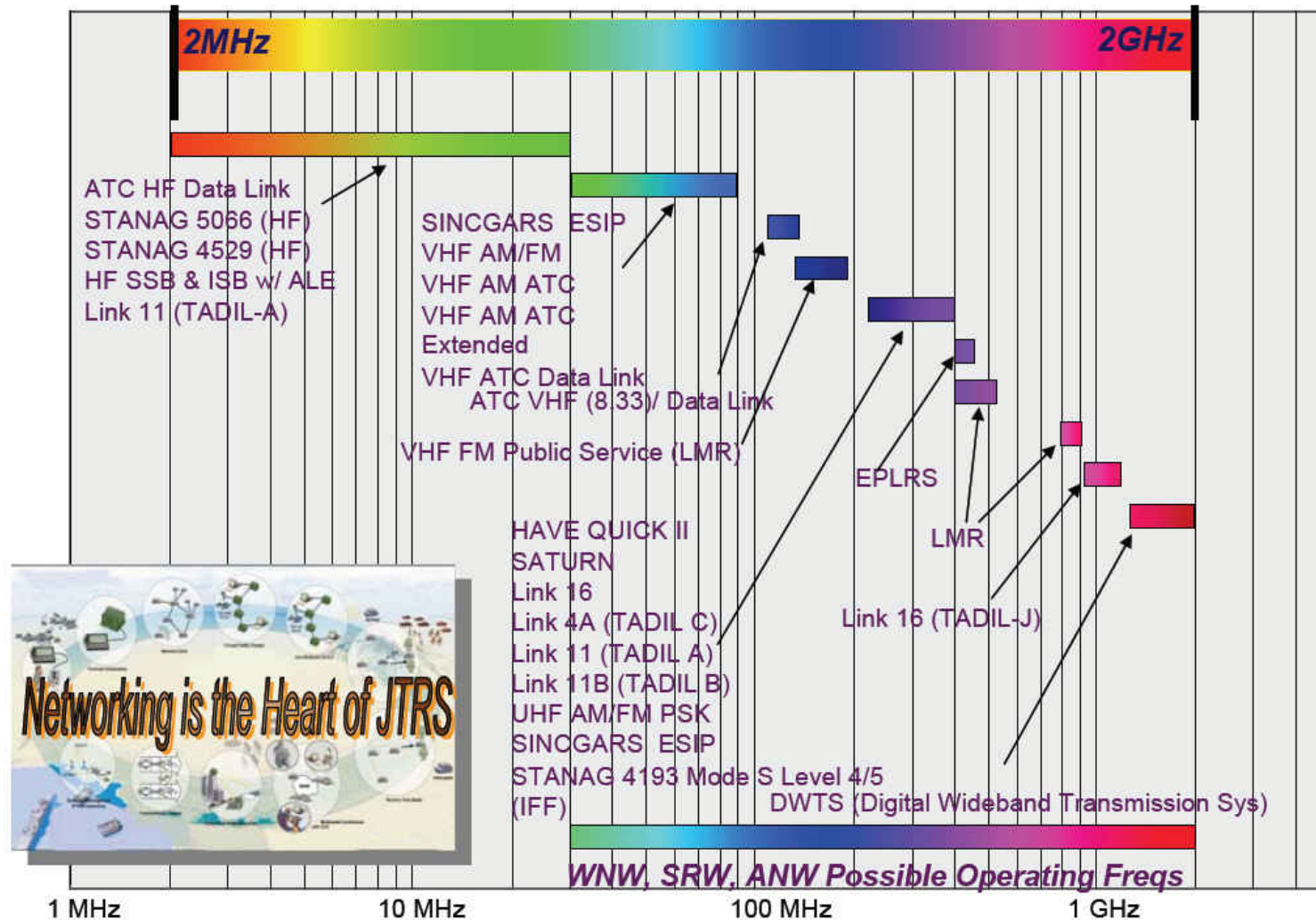
Source: MITRE Brief "JTRS Overview for CCEB Spectrum Task Force", 03 May 2006

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Each JTR Hosts Multiple Waveforms Operating in 2-2000 MHz Spectrum



Source: MITRE Brief "JTRS Overview for CCEB Spectrum Task Force", 03 May 2006
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Planned JTRS Waveform vs Hardware

Candidate CRP Radios

	WNW	SRW Type 1 Secret	SRW Type 2 SBU	JAN-TE	SINC	SINC w/ INC	LINK 16	EPLRS	MUOS	HF	UHF SATCOM DAMA
GROUND VEHICLE (4 ch)	X	X	*		X	X		X		X	X
MIDS-J (4 ch)				X			X				
SFF A/H (IMS/UGS 1/2 ch)			X								
SFF D (UAV 1 ch)			X								
SFF J (NLOS 2 ch)		X	X		X						
MAN PACK (2 ch)		X	X		X			X		X	X
ARC-210 (2 ch)	X	X	*				X		X		
SFF B (LW 2 ch)		X	X		X			X			
SFF C (LW 1 ch)			X								
SFF I (LW 1 ch)		X	X		X			X			
19" Rack (4 ch)									X		
HANDHELD (2 ch)		X	X		X			X			

* SRW SBU capability required for some applications

New Networking Waveforms

JROCM 039-06 of 20 March 06

Source: MITRE Brief "JTRS Overview for CCEB Spectrum Task Force", 03 May 2006

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VUHF Roadmap vs. AMF SFF Comparison

KEY REQUIREMENTS	KEY REQUIREMENTS COMPLIANCE					
	FY04	FY09	FY11	FY13	FY12	FY12
	RT-1851	GEN5	GEN6	GEN7	AMF	AMF-1
OPERATIONAL NEEDS						
Waveform/mode change time - 50 msecs	Yes	Yes	Yes	Yes	No	No
Radio turn-on to Ops time - 6 secs	Yes	Yes	Yes	Yes	No	No
IBIT time to complete - 50 secs	Yes	Yes	Yes	Yes	No	No
Average Power Dissipation <59 watts	Yes	Yes	Yes	Yes	No	No
ARC-210 Form factor	Yes	Yes	Yes	Yes	Yes	Yes
Compliance to SCA 2.2	No	No	Yes	Yes	Yes	Yes
Compliance to JTRS ORD 3.2	No	No	No	Yes	Yes	Yes
2 MHz to 2 GHz Frequency Range	No	No	No	Yes	Yes	Yes
2 half duplex channels per USN letter	No	No	No	Yes	Yes	Yes
ORD WAVEFORMS						
JPALS	No	Yes	Yes	Yes	Yes	No
TACAN	No	No	No	No	Yes	No
BEAM / BLT	Yes	Yes	Yes	Yes	Yes	Yes
CASS / DICASS	Yes	Yes	Yes	Yes	Yes	No
COSPAS / SARSAT	No	Yes	Yes	Yes	Yes	No
ADF	Yes	Yes	Yes	Yes	Yes	No
VOICE / DATA in VMF	Yes	Yes	Yes	Yes	Yes	Yes
KPP WAVEFORMS						
SINGGARS	Yes	ESIP	ESIP	ESIP	ESIP	ESIP
HAVE QUICK	Yes	Yes	Yes	Yes	Yes	No
UHF SATCOM	Yes	Yes	Yes	Yes	Yes	No
MUOS	No	Half Duplex	Yes	Yes	Yes	Yes
EPLRS	No	No	No	No	Yes	No
WNW	No	No	UHF	UHF	Yes	Yes
LINK 16 / TADIL-J	No	No	No	No	Yes	Yes
CERTIFICATIONS						
JITC	SATCOM	SATCOM	SATCOM	Yes	Yes	Yes
FCC	No	No	No	No	Yes	Yes
JTEL	No	No	Yes	Yes	Yes	Yes
DO-178B	No	No	No	No	Yes	Yes
NSA TYPE 1	Yes	Yes	Yes	Yes	Yes	Yes
SECURITY						
MSLS SECURITY ARCHITECTURE	NA	NA	NA	NA	YES	YES

Note: AMF-1 reflects latest direction per JPEO restructure of 01/2006.