

Rockwell Collins The Tactical Data Links Provider Focus on Link 22



Rome, July 19
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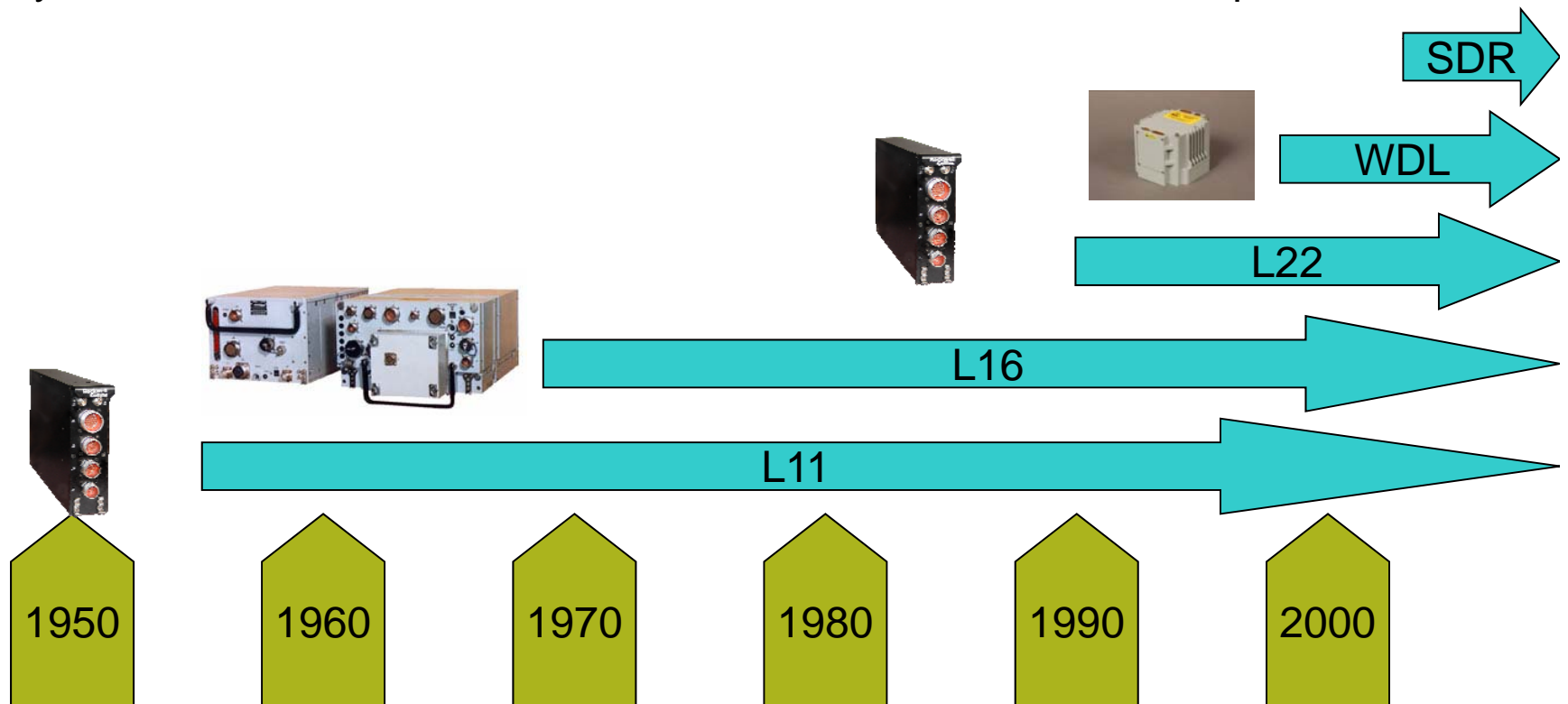
Proprietary Information

**Rockwell
Collins**

Rockwell Collins and Tactical data Links

Rockwell Collins has always been a leader in all Tactical Data Link Developments

- As early as 1955 Collins Radio developed Link 11 Modems and Radios
- Since the 70s has developed and delivered many types of Link 16 equipments
- Nowadays Rockwell Collins offers Link 22 SPC and Small volume Weapon Data Links



Link 11/TADIL A History

- **In the early 1960s the North Atlantic Treaty Organization (NATO) officially adopted Link 11 as a Tactical Data Link and defined it inside International STANdardization AGreement (STANAG) 5511**
- **It was also formally adopted and defined in the United States Joint Chiefs of Staff Publication 10 (JCS-PUB-10) as Tactical Digital Information Link-A (TADIL-A).**

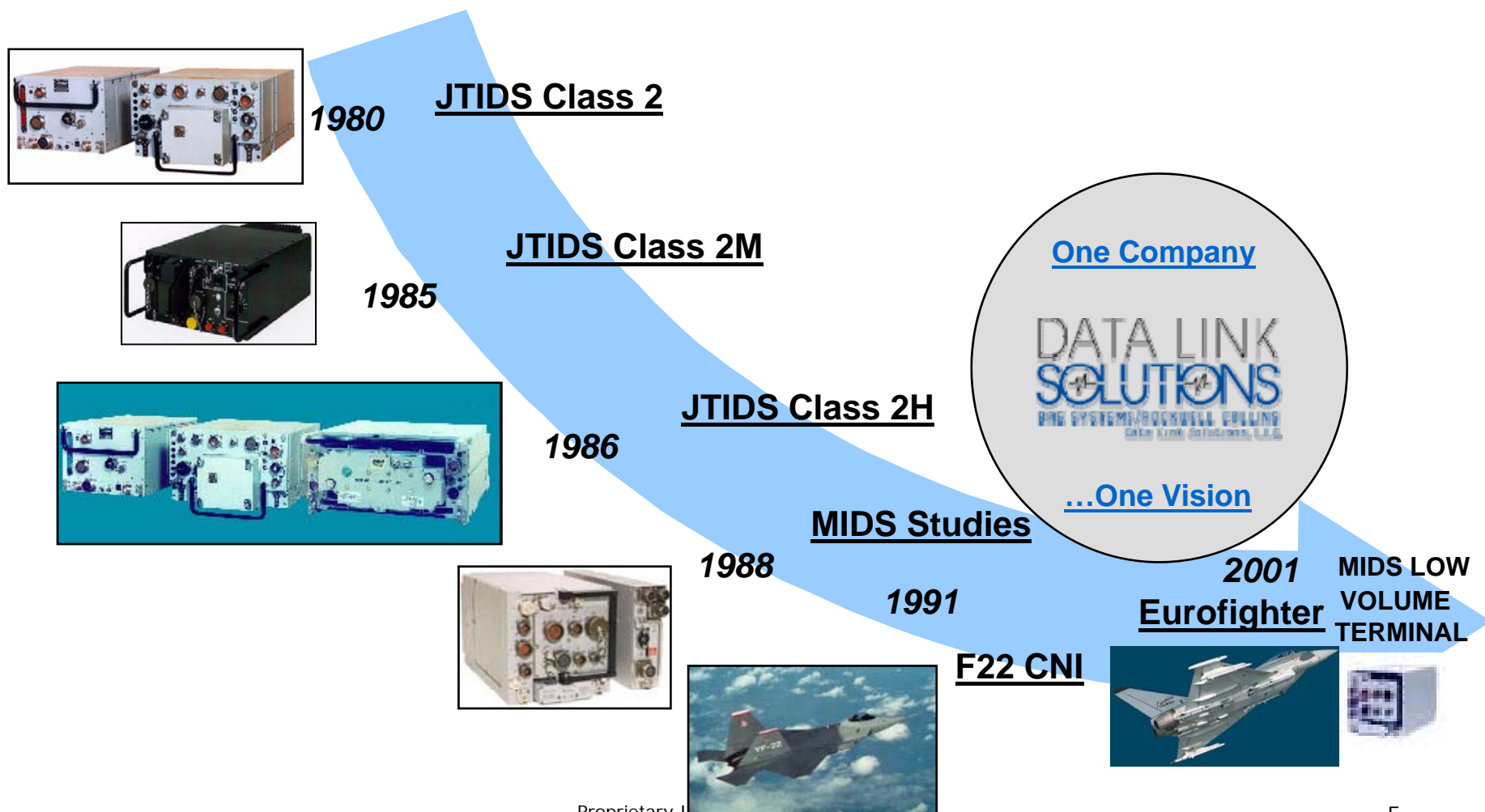
Tactical Data Link Background

- Developer of
 - Link 11
 - Ground & Naval Tactical Data Systems
 - Airborne Tactical Data Systems
 - Link 16
 - JTIDS Class 2/2H
 - MIDS / FDL (Fighter Data Link)
 - MIDS / LVT (Low Volume Terminal)
 - Link 22
 - National Data Links
 - Weapon Data Links
- World Leader In
 - Data Links (Link 11, 16),
 - Avionics Products/Systems,
 - Air, Ground & Naval Communications,
 - Flight/Cockpit Management Systems,
 - Aircraft Integration.

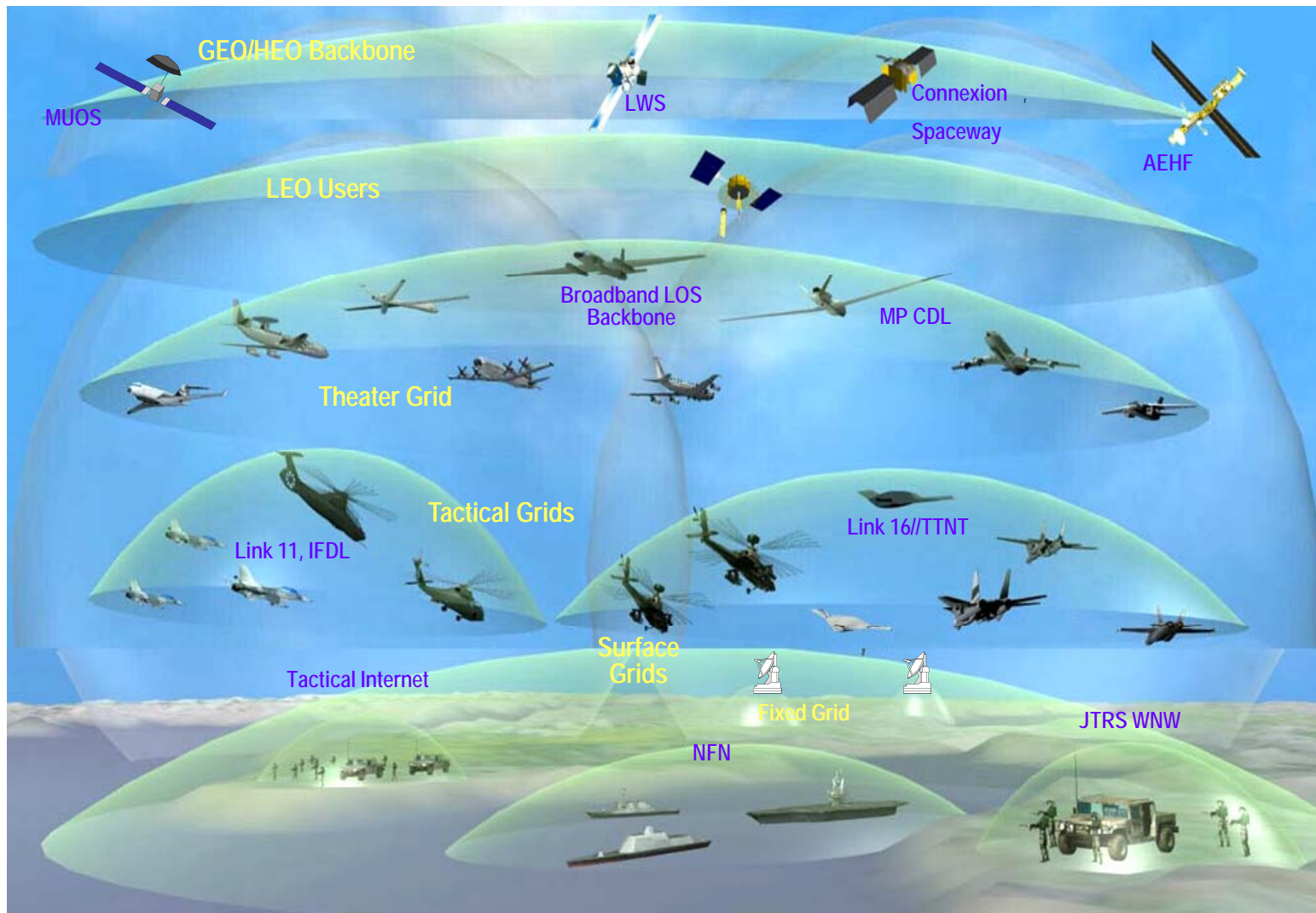


***Over 50 Years of Tactical
data Links Experience***

Long History of Success on Link-16



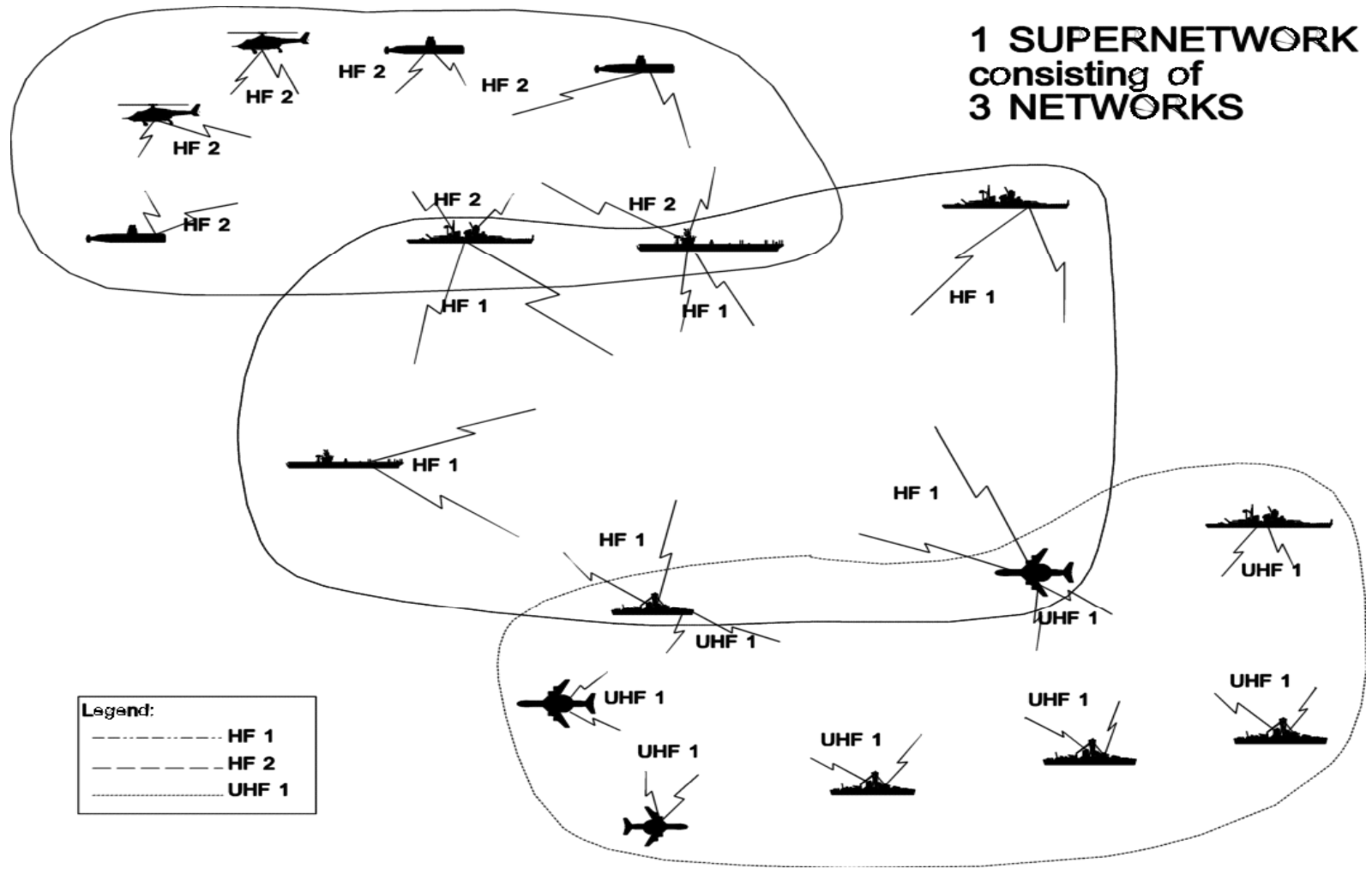
Tactical Data Link



Link 22 Definitions

- Evolved as NILE (NATO Improved Link Eleven), Link 22 is a hybrid between MIDS Link 16 and Link 11
- BLOS Time Division Multiple Access (TDMA) or Dynamic TDMA (DTDMA)
- Tactical data communication system utilizing Fixed Frequency or Frequency hopping techniques in the HF (2-30 MHz) and/or the UHF (225-400 MHz) bands.
 - ECM Resistant
- A Link 22 unit may operate up to four networks simultaneously, each on different media, as part of a Super Network with any participant on any network able to communicate with any other. With the addition of data forwarding to other links the age of network centric warfare is upon us. Network Management and Super Network Management are facilitated within the design of Link 22, which given its potential to dynamically react to altering loads and conditions, points the way to the future.

Link22 Networks



Link22 SPC Development and Status

- Rockwell Collins has developed HF FF, UHF FF waveforms
 - Data Terminal Sets are **now** capable of L11 **AND** L22



MDM-2202
(1/4 ATR standard chassis)



MDM-2002
(19" standard rack)



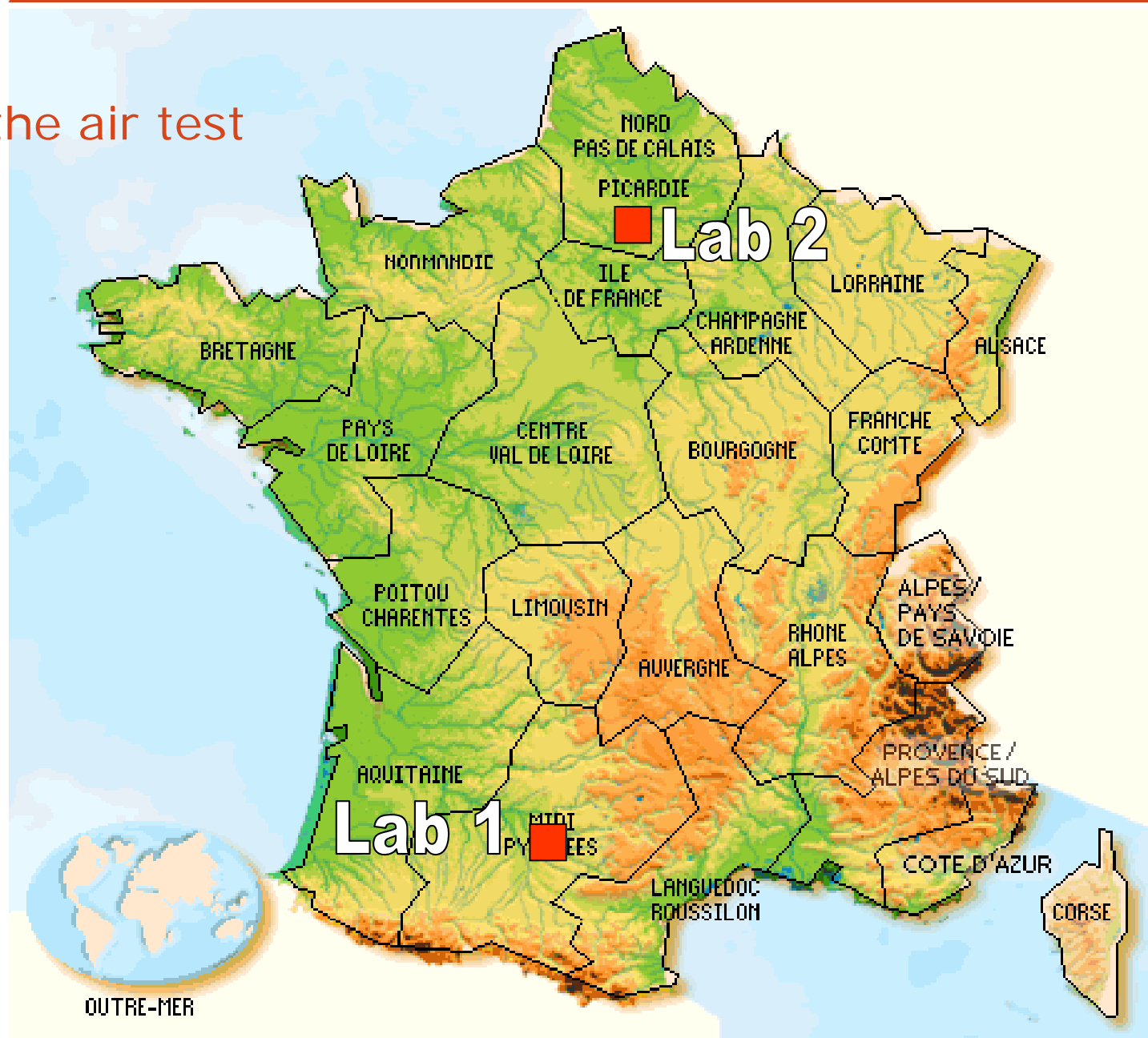
MDM-2402
(VME type card set)

- Rockwell Collins has performed
 - Interoperability tests at WTD-81 in December 2006
 - Over the air test in June 2006
- Rockwell Collins is currently integrating L22 SPC in Rockwell Collins and THALES Communication equipment

Link 22 over the air test

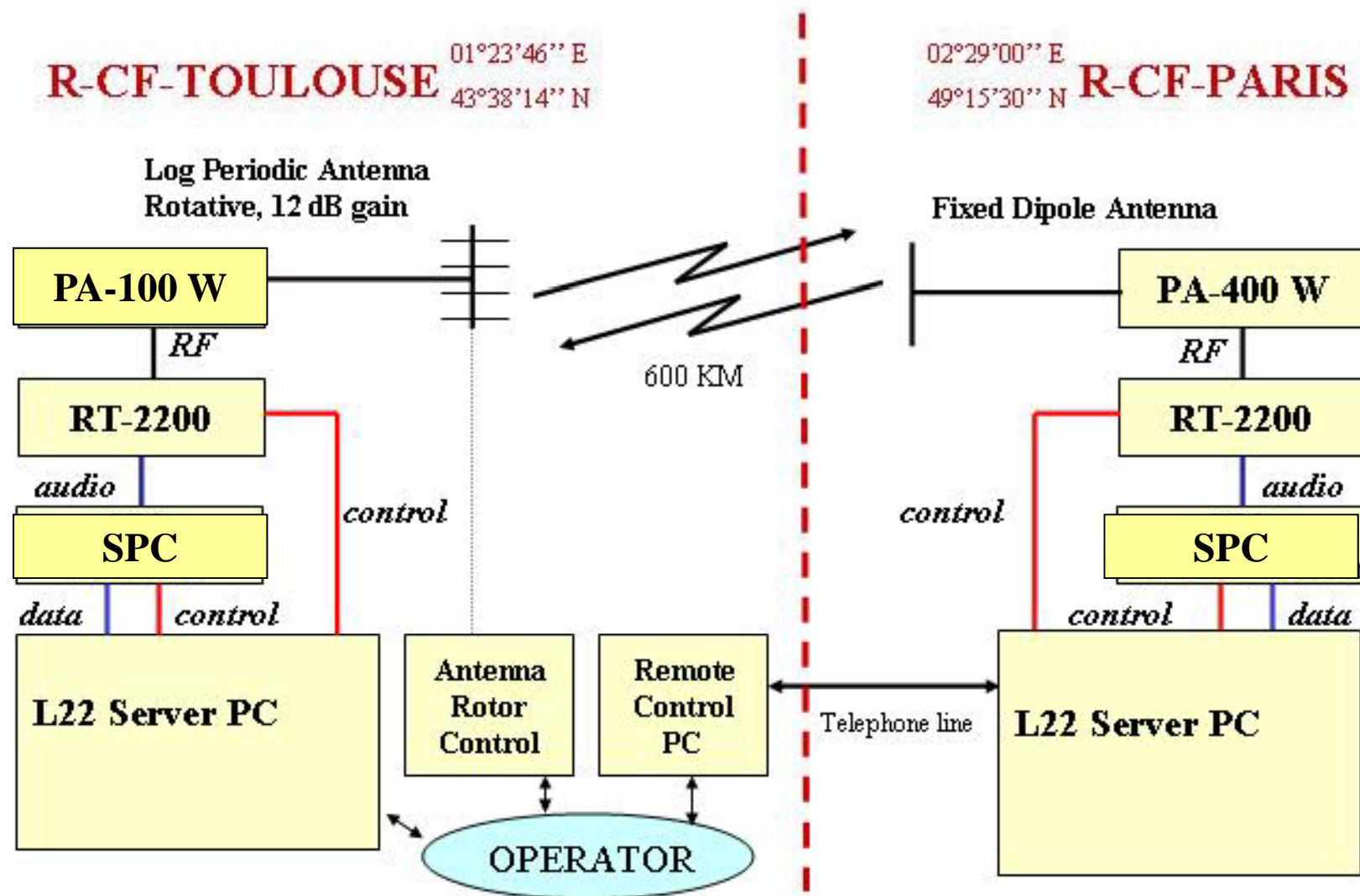
- Rockwell Collins performed its own “over the air test” in June 2006.
- Those tests have been realized using
 - Rockwell Collins labs in Paris & Toulouse (600 km / 360 miles)
 - Frequencies allocated to Rockwell Collins

Over the air test



Over the Air HF TEST BED

Test configuration



Test Bench



SPC – MDM-2002

Over the Air test results

- Frame Synchronisation Rate

$$FSR = \frac{\text{FrameTx'd} - \text{FrameRx'd}}{\text{FrameTx'd}} * 100 \quad (\text{in}\%)$$

- Network Packet Loss Rate

$$NPLR = \frac{(\text{NPTx'd} - \text{NPRx'd_NoError})}{\text{NPTX'd}} * 100 \quad (\text{in}\%)$$

$$\%NP_OK = 100 - NPLR \quad (\text{in}\%)$$

- Bit Error Rate

$$BER = \frac{\text{Number of bit with error}}{\text{Number of bit received}}$$

On the Air Test Result

		SPC1 : TOULOUSE				SPC2 : CREIL			
MSN	Freq (MHz)	FSR	%NP	OK	BER	FSR	%NP	OK	BER
1	7,65	93,75	64,44		5,00E-02	100	97,22		5,20E-03
2	7,65	96,53	63,47		4,60E-02	98,61	96,67		2,80E-03
3	7,65	100	89,86		2,20E-02	100	99,44		2,30E-05
4	7,65	100	98,47		6,00E-04	99,31	91,81		1,00E-02
5	7,65	100	86,34		1,00E-02	84,72	62,22		2,40E-02
6	7,65	100	76,67		1,20E-02	100	62,78		2,30E-02
1	9,05	100	99,58		2,70E-04	100	99,31		3,30E-03
2	9,05	100	98,89		3,80E-04	100	99,58		4,50E-04
3	9,05	100	99,31		1,50E-03	100	99,58		1,30E-04
4	9,05	100	99,72		2,00E-04	100	98,19		5,30E-03
5	9,05	100	100		0,00E+00	99,31	95		9,90E-03
6	9,05	100	93,61		5,70E-03	100	94,17		7,20E-03

Compare to Test performed in 2000,
We could test all MSN successfully.

Over the air test (continued)

		SPC1 : TOULOUSE			SPC2 : CREIL		
MSN	Freq (MHz)	FSR	%NP OK	BER	FSR	%NP OK	BER
1	12,09	100	93,61	8,60E-03	100	97,5	6,80E-03
2	12,09	94,44	67,92	5,70E-02	95,14	77,5	3,30E-02
3	12,09	10,42	0	4,20E-01	18,75	0	3,70E-01
1	12,09	55,56	0	1,00E+00	56,94	0	4,80E-01
1	10,2	100	100	0,00E+00	100	100	0,00E+00
2	10,2	95,14	33,75	1,10E-01	98,61	59,06	5,50E-02
3	10,2	100	100	0,00E+00	100	99,06	5,20E-04
5	10,2	100	89,06	7,60E-03	98,61	89,06	1,90E-02
6	10,2	98,61	35,94	8,60E-02	95,83	47,5	5,40E-02

With poor channel performance,
we face the same problem as in 2000

Interoperability test at WTD-81

- In December 2006 Rockwell Collins, DRS and RACOM were invited to perform interoperability tests
- Tests were performed using NILE Reference System (with Software Network Controller –SNC- V9)
- SPC were tested in lab in HF FF and UHF FF

Interoperability test results at WTD-81

Test Results: Matrix Overview

➤ Depiction of Results for receiving SPCs. (Rx SPC is the Device of Interest [DOI])

Test Groups	Test Combinations (Rx SPC <- Tx SPC)		Test Objectives								
			HF								UHF
			MSN 1, MFR 1	MSN 2, MFR 1	MSN 3, MFR 1	MSN 4, MFR 1	MSN 4, MFR 2	MSN 4, MFR 3	MSN 5, MFR 1	MSN 6, MFR 1	MSN 1, MFR 1
			WF2 (36, 21)	WF2 (36, 30)	WF1 (48, 30)	WF1 (48, 39)	WF1 (48, 39)	WF1 (48, 39)	WF3 (72, 48)	WF3 (72, 57)	WF1 (96, 76)
1	A - A	[DRS] <- [DRS]									
2	C - A	[RACOMS] <- [DRS]									
	A - C	[DRS] <- [RACOMS]									
3	B - A	[RCF] <- [DRS]									
	A - B	[DRS] <- [RCF]									
4	B - B	[RCF] <- [RCF]									
5	B - C	[RCF] <- [RACOMS]									
	C - B	[RACOMS] <- [RCF]									
6	C - C	[RACOMS] <- [RACOMS]									

➤ Legend:



Passed
(Ratio & LRQ = ok)



Rcvd NPs w/ LRQ = 2



Lost NPs



Lost NPs & NPs w/ LRQ = 2



Reception not possible due to Tx SPC Failure

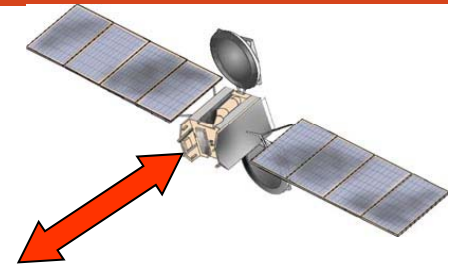


Test execution not possible due to missing parts.

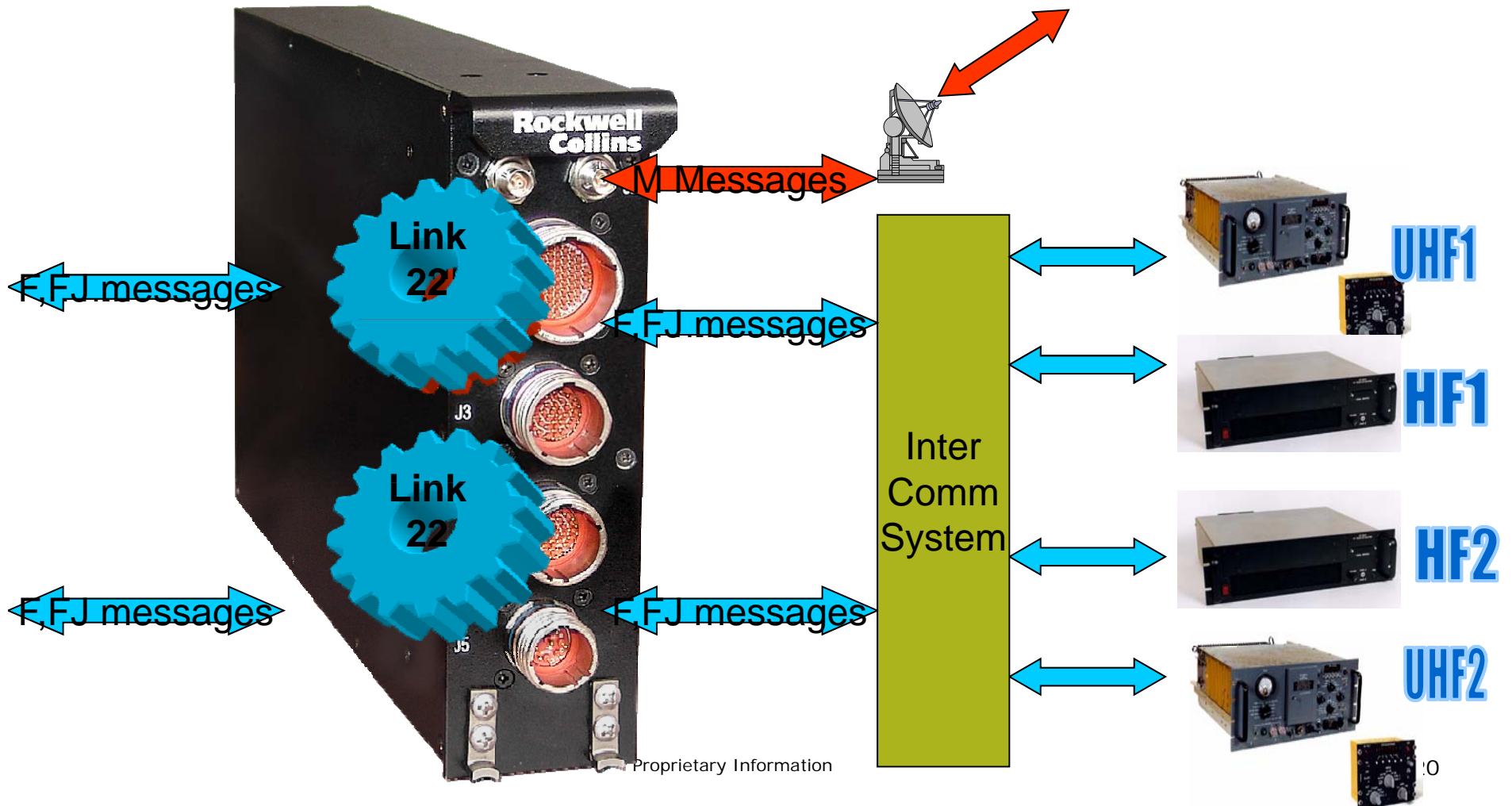
Tests performed with LUCID French DGA's L22 demonstrator

- R-CF has delivered in January 2007 quantity 3 SPCs to the French MOD for its LUCID Program
- Those SPCs have been tested on HF FF and UHF FF
- All operational aspects have been tested with Success
 - MSN transition
 - Short init
 - Probing
 - Late Net Entry (will be performed soon)
 - HF FF and UHF FF

Rockwell Collins L11/L22 Modems capabilities



L11/L22 MODEM



WDL Transition Outlook – Spiral development

- No/Minimum Launch Platform Integration
- Legacy Systems
- Existing Waveforms



V/UHF



Link 16

