Software Based Communications — BUILDING THE BATTLESPACE INTERNET

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Network & Information Systems

OMG
SBC Workshop
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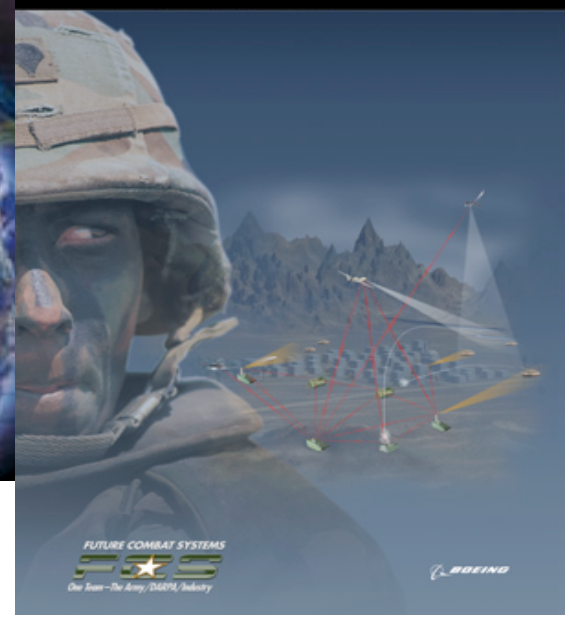
Networking the Battlespace
via Software-Based Communications

JTRS GMR

AMF JTRS

FAB-T

Future Combat System



Communications Transformation Key to Integrating Battlespace

Today


Communication


Launch


Bombers


Surveillance


Fighters


Transport

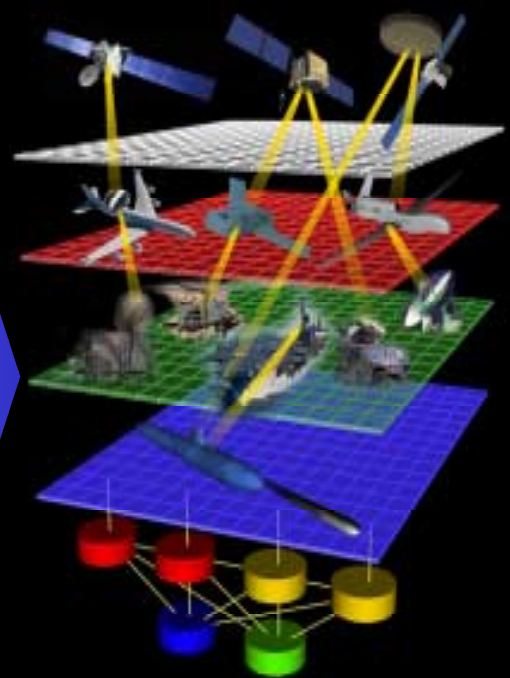

Helicopters


Weapons


Command & Control

JTRS

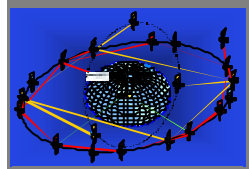
Networked Battlespace



Integrated Battlespace of the Future (JV 2020)

NCO

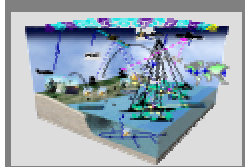
Transformational Programs


Transformational Communications

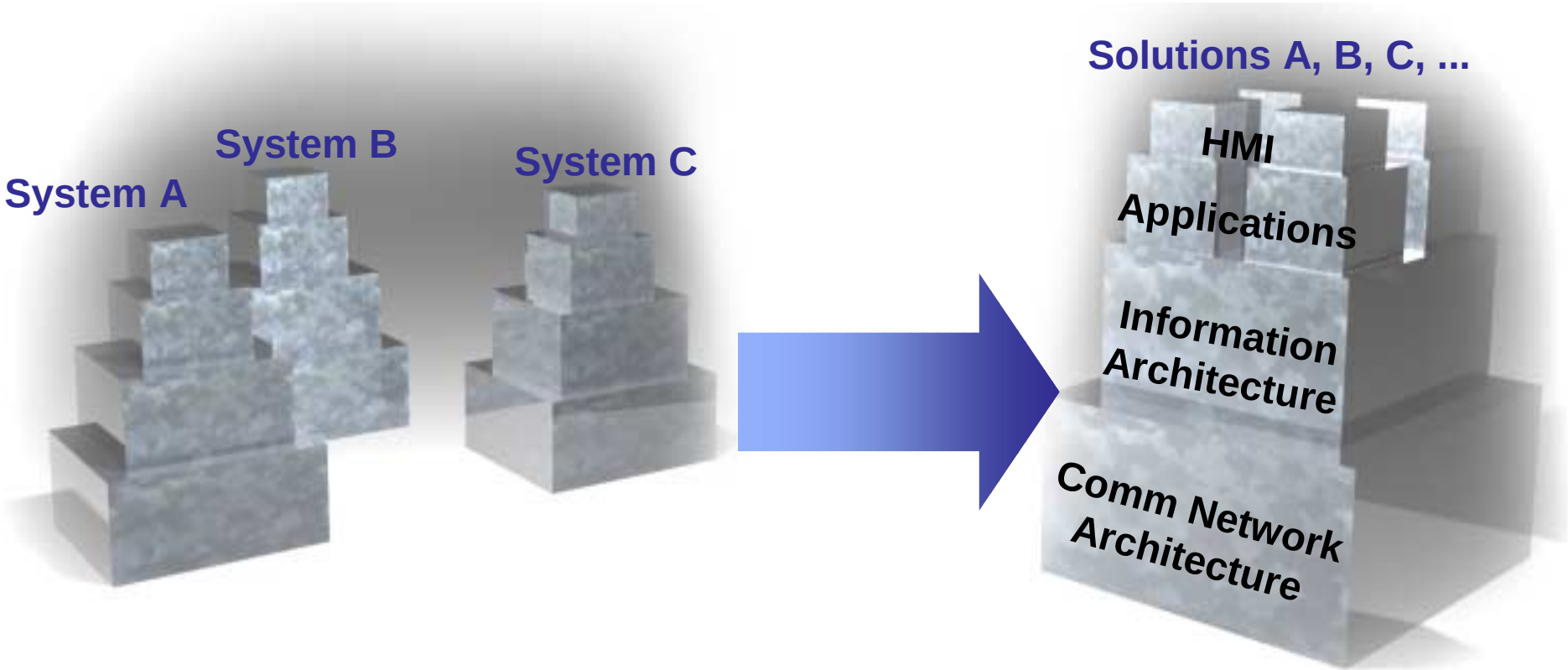

C2C


JTRS


FCS


FORCEnet

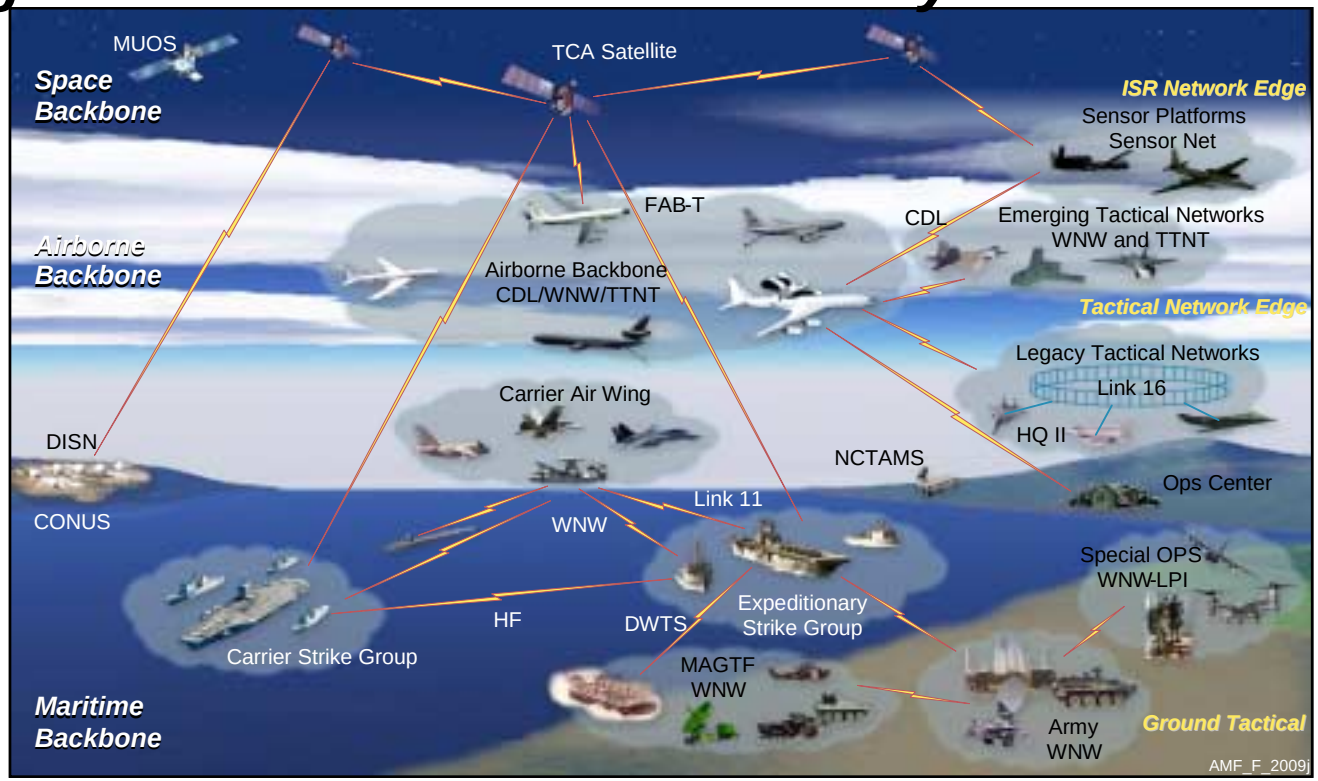
Common Information & Communications Architecture Approach



Ensuring Interoperability

The Integrated Battlespace Network

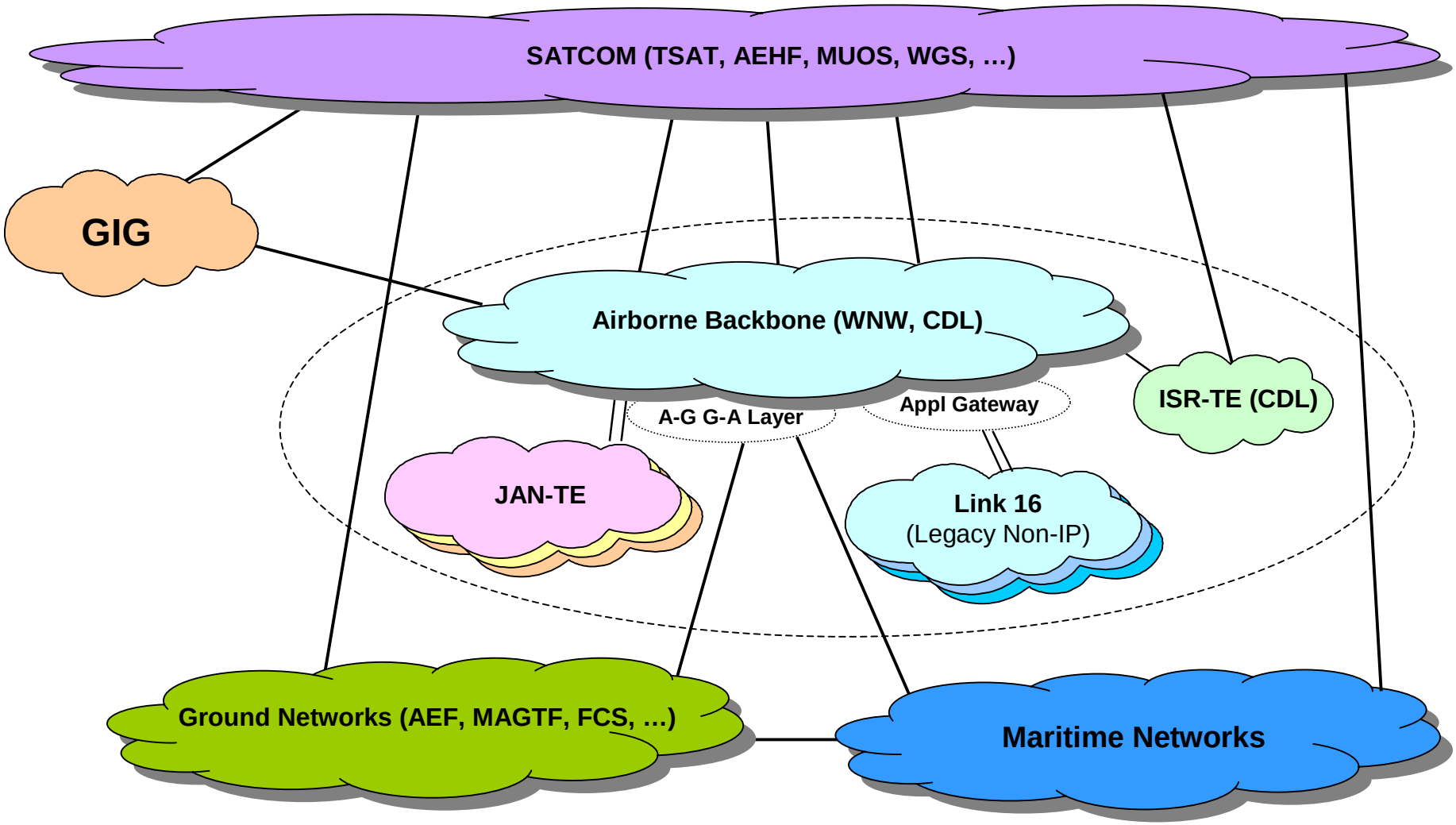
Brings the Internet model to military communications



Key Features

- **Multiple waveforms form heterogeneous mobile extension to GIG**
- **Provides interoperability through the capacity to communicate with legacy systems**
- **Relay and translation nodes ensure Tactical Users have access to required information**

Top Level Airborne Network Architecture



Family of Terminals Concept

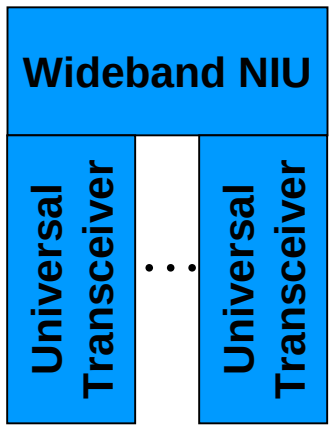
Small FF Terminals
(JTRS HMS, Cluster 2)

Integrated NIU
Transceiver
RF

- Handhelds
- Manpacks
- Sensors

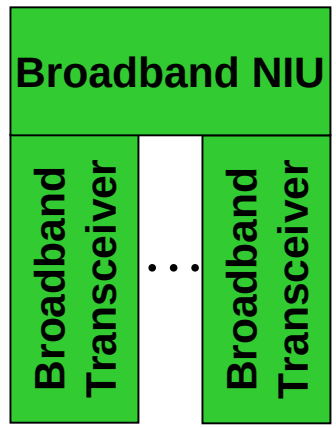
RF BW: < 30 MHz
Frequency: 2 – 2000 MHz
Throughput: ~ 10's - 100's kbps

Wideband Terminals
(JTRS GMR, AMF, MIDS-J)

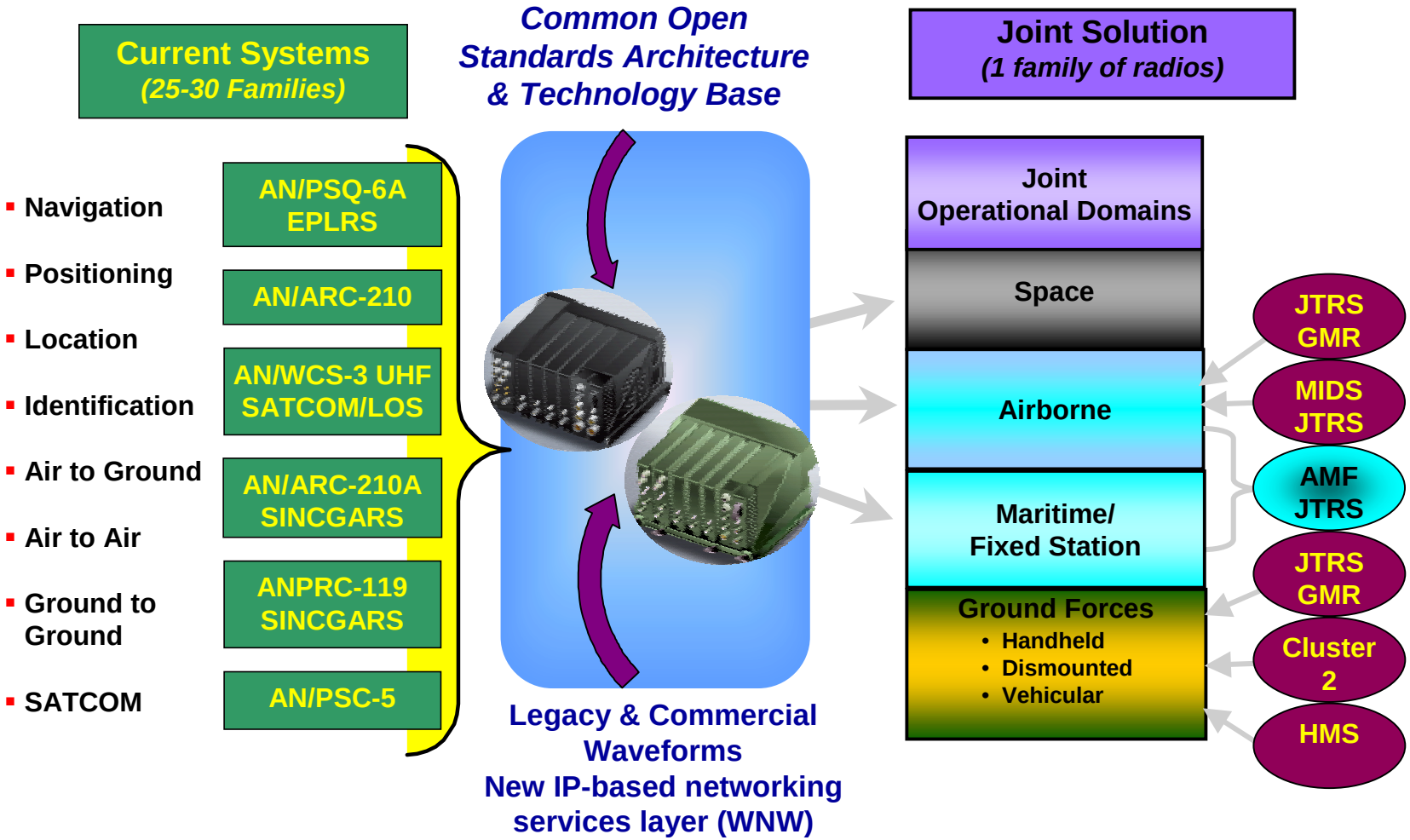


RF BW: 30+ MHz
Frequency: 2 – 2000 MHz
Throughput: ~ 10 - 20 Mbps

Broadband Terminals
(e.g. FAB-T, HC3, CDLS)



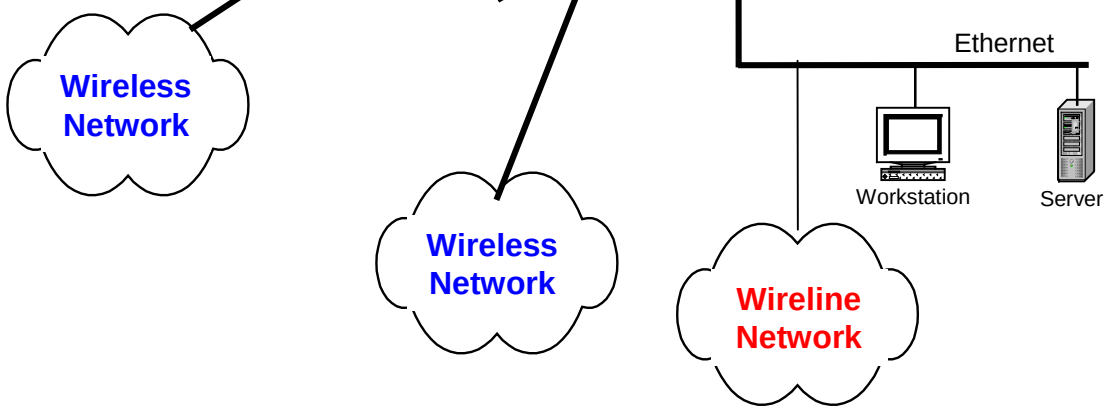
The JTRS Programs Provide One Joint Solution for Multiple Radio System Needs



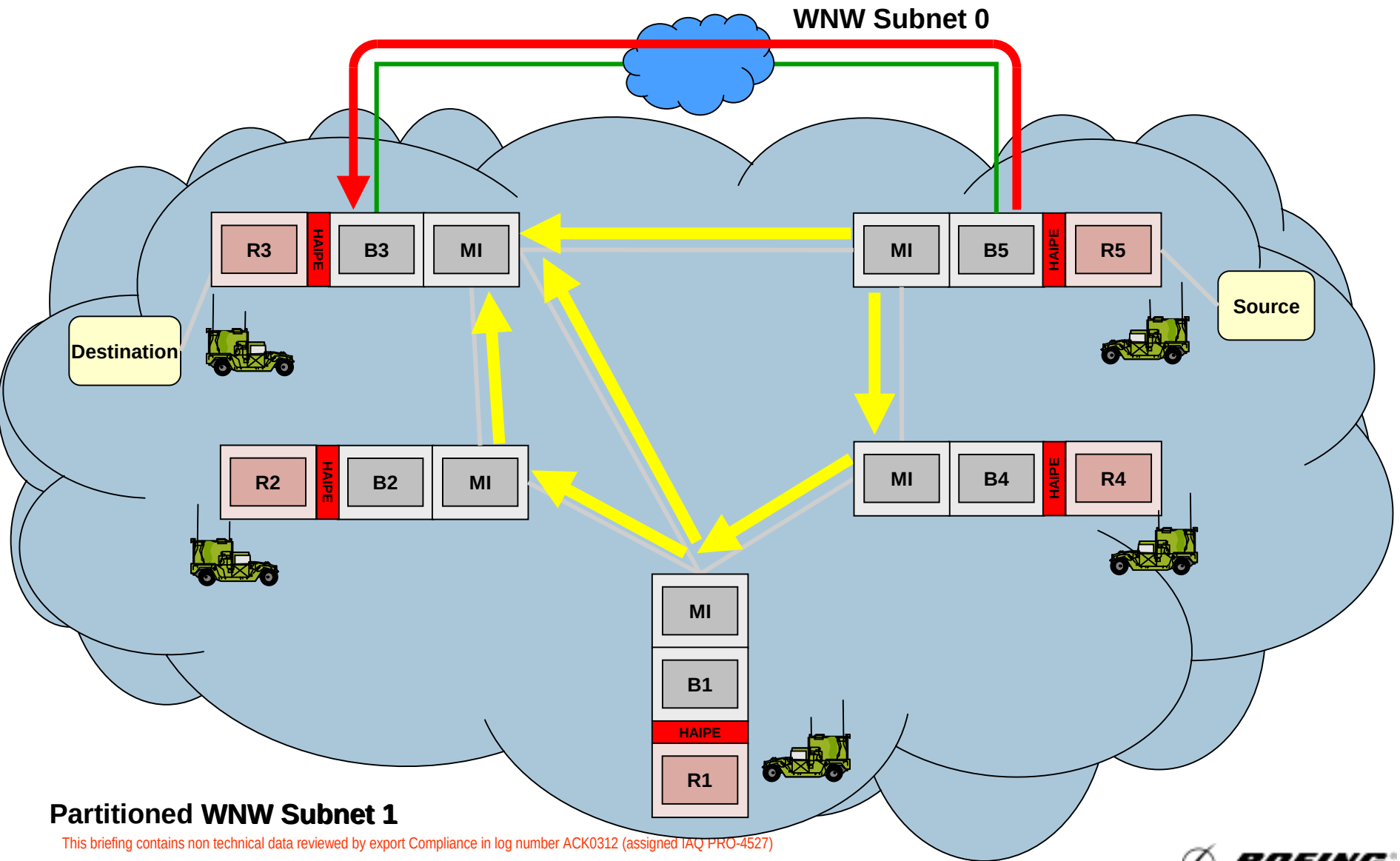
Networking Trail Blazing
Wideband Network Waveform

- IP transit network … battlespace network element of GIG
- Communications on the move for large-node mobile networks
- Internet-like multimedia services … voice, video and data
- Bandwidth-adaptive data rates, up to wideband
- Environment-adaptive signaling modes
- Flexible addressing … unicast, multicast, broadcast
- Assured service … self-forming, self-healing, QoS network
- High assurance network security architecture
- Scalable network services … RF, platform LAN, GIG WAN

JTRS is a Wireless Router



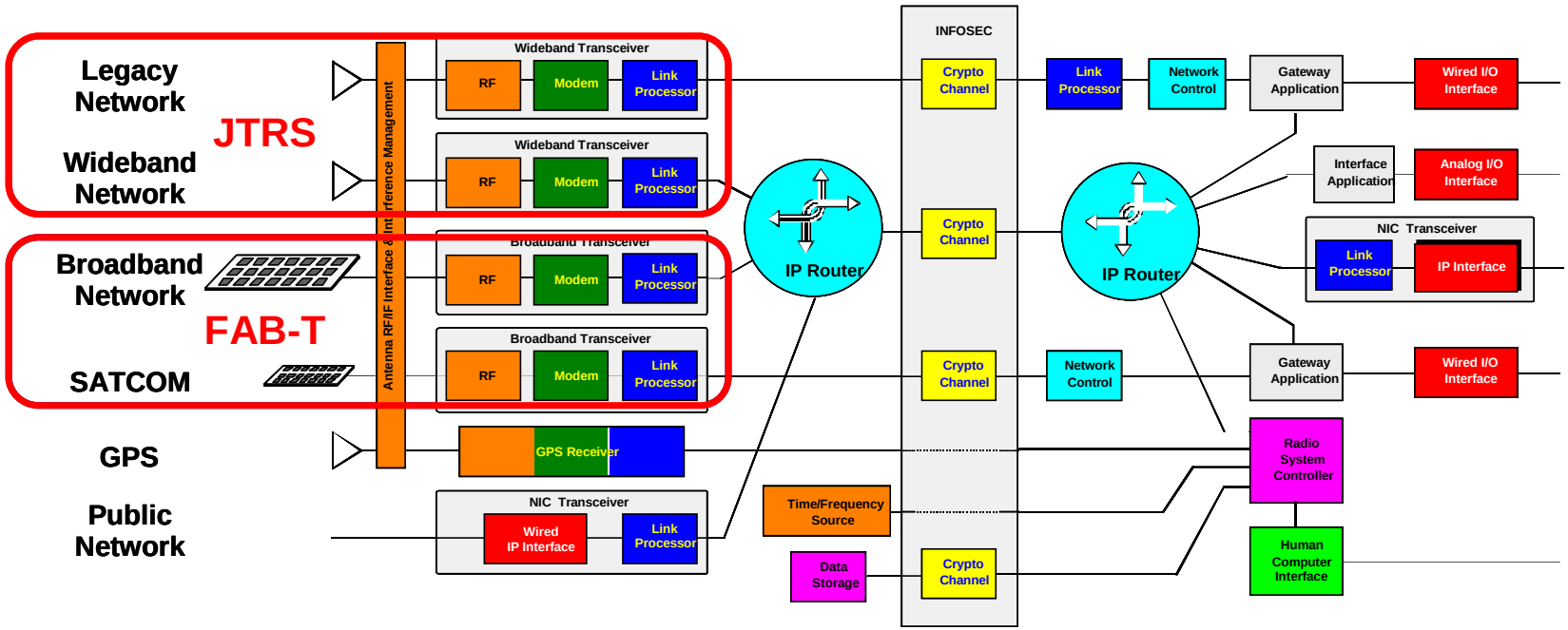
WNW Mobile Ad Hoc Routing Operations



JTRS GMR FCS Deliveries

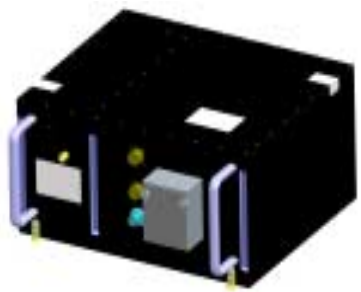
- **50 Units Delivered**
  - **Wideband Network Waveform (WNW) and SINCGARS Waveforms**
- **Capabilities**
  - **Multi channel operation**
  - **JTRS-to-Legacy radio interoperability**

Implementing the Networked SDR



Reusable, Upgradeable Software Implementation

Modular, Upgradeable Hardware Implementation

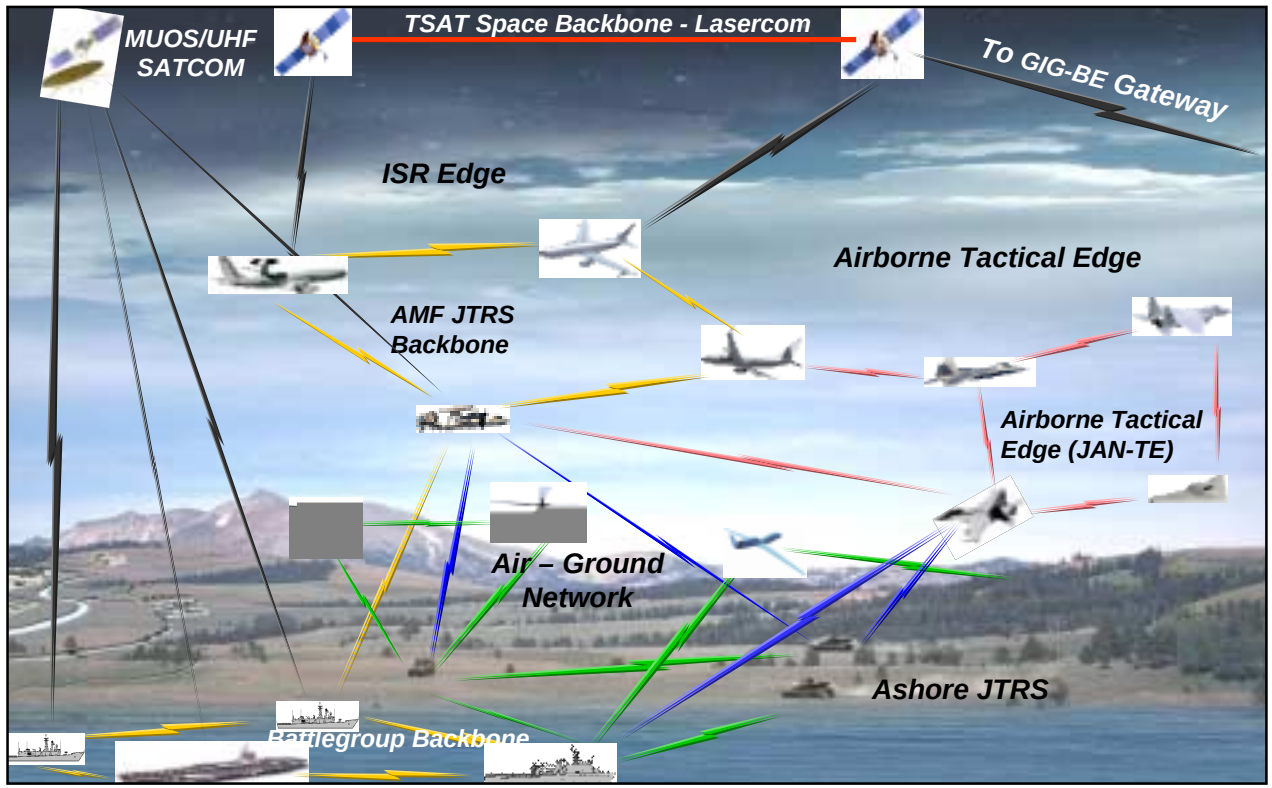


JTRS GMR Trail Blazing

- SCA-compliant SDR architecture, with full waveform portability spanning GPP high-level language to FPGA VHDL code
- 2-2000 MHz multi-channel, multi-JTR, simultaneous waveform operation modular radio supporting all JTRS waveforms
- Extensible heterogeneous network architecture, providing waveform routing, bridging and retransmission capability
- Transformational mobile ad-hoc wideband network waveform (WNW), delivering internet capability to the mobile battlespace
- Highly portable legacy waveforms, implemented for portability, including EPLRS, Link-16, HF, and SATCOM
- Multiple Independent Levels of Security (MILS) in a networked software defined radio with simultaneous waveforms

Developed Foundational Elements … Mitigated Risks

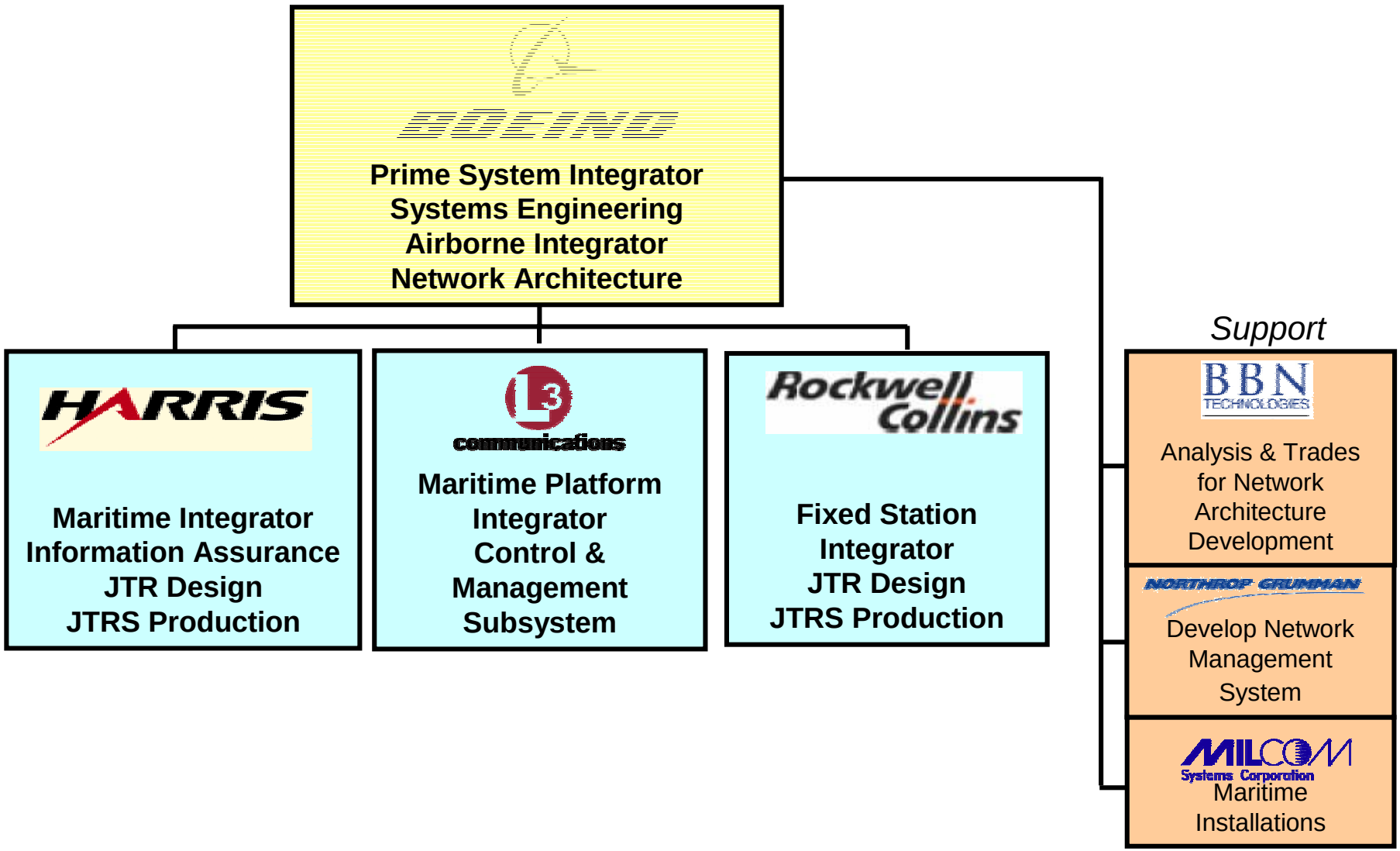
AMF JTRS is the Key Network Enabler for the Air Force and Navy



Key Features

- Provides interoperability through the capacity to communicate with legacy systems
- Waveforms will be “portable” between hardware platforms
- Includes relay and translation nodes to ensure Tactical Users have access to required information
- Provides a modular, multi-band, multi-mode networked communication system

The Boeing Team Provides the Broad Expertise Needed for the AMF JTRS Program

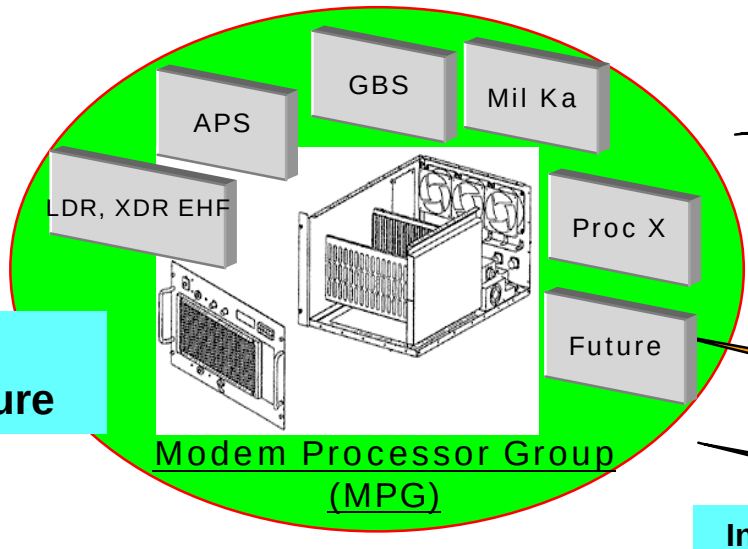


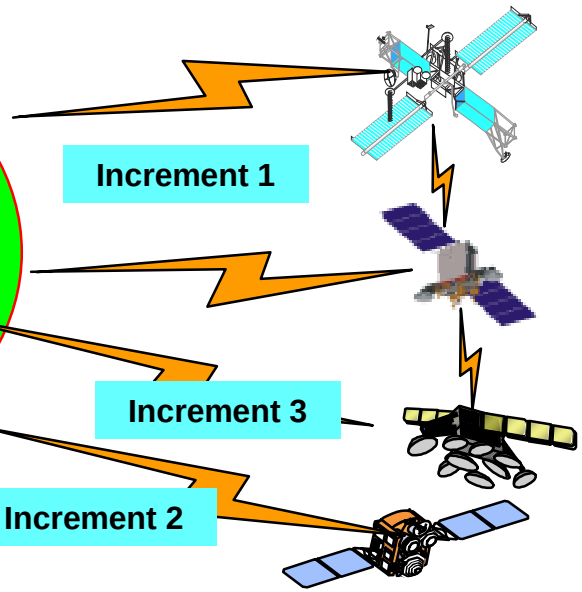
Family of Advanced Beyond line-of-sight Terminals (FAB-T) Program

Transforming Communications

FAB-T Overview

FAB-T Architecture





- **Software re-programmable SCA-based terminal**
- **Provides warfighters with SCA-compliant software waveforms**
  - **Increment 1 -- EHF (LDR/XDR)**
  - **Increment 2 -- Ka/Ku and CDL for AISR applications**
  - **Increment 3 – Lasercom, Processor Ka, Transformational Comm**

Network Centric Family of Terminals with HW/SW Commonality Providing Planned Incremental Warfighter Capability for Robust, Secure, Global Strategic & Tactical Communications

Aligning OSD & TC Visions with Warfighter Needs

Current EDM Airborne Platforms

B-2

B-52

RC-135

E-6B

INCREMENT 2

INCREMENT 1

RQ-4

MQ-1/9

Targeted Platforms

CAF

- B-2
- B-52
- B-1
- RC-135S/U/V/W
- E-8
- E-3
- EC-130 (Senior Scout)
- C-130H (Scathe View)
- MQ-1/9 Predator
- RQ-4 Global Hawk
- F-35 (JSF)
- F/A-22
- UCAV
- E-10A
- YAL-1
- GTACS (AOC, CRC, ASOC, TACP)
- DCGS-AF *

AMC

- VC-25
- C-32
- C-37
- C-20B
- UCC C-20H
- UCC A/C C-37
- C-40B
- UCC C-37 Leased A/C
- KC-10
- C-17 SOLL II (SOF)
- C-130 SOLL II (SOF)
- KC-135
- C-5, C-130, C-17 (Mobility)

AFSOC

- EC-130E-CS
- AC-130H
- AC-130U
- EC-130H
- MC-130E
- MC-130H
- MC-130P
- HC-130P/N
- CV-22
- MH-53

Navy - Marine Corps

- E-6 (TACAMO)
- EP-3E
- EA-6B
- KC-130
- VH-60 (VIP)
- VH-3D
- VXX (VIP)
- MV-22
- DCGS-N/MC

AFMC

Speckled Trout	1
C-135 (AFRL)	1

AETC

Keesler AFB	TBD

FAB-T Industry Team

BOEING

Prime Contractor
System Architecture/Network SW
Requirements Management
Terminal Core/Services SW

System Test
Platform/Site Integration
Operator Interface SW
Integrated Logistics Support

L3 communications

Modem Processor HW IPT Lead
MPG HW Int. and test
Modem/Processor HW
Antenna Dish/Pedestal - multiple
AEHF Modem SW
Increment 1 Antenna T&E
Ka/CDL Waveform
Terminal I&T support

ViaSat

Inc1 INFOSEC HW
Inc1 INFOSEC SW
IA System Eng Support

Rockwell Collins

A/EHF Waveform SW
A/EHF Waveform Int. and Test
MPG HW – CHIF/TFRS
Antenna Group RF Components
Increment 1 Data Set Manager
ILS Support
Misc Operator Equipment
AEHF Sys Engr Support

Support Subcontractors:

FMS Secure Solutions — NSA Certification Support

MC — ILS Support

RADANT TECHNOLOGIES, INC. — Radome

MinKom Solutions — Large Aircraft Aperture

Pratt & Whitney, A United Technologies Company — Pratt & Whitney Rocketdyne, Inc. — ILS Support

SI International — Ground Site Installation

This briefing contains non technical data reviewed by export Compliance in log number ACK0312 (assigned IAQ PRO-4527)

BOEING

Airborne Network Video

Airlift of supplies to combat air zone

- **Airborne assets**
  - E3 AWACS for Airborne Battle Management
  - RC-135 RIVET JOINT
  - F-18 with Link-16 and TTNT
  - C-17s (Globemaster 3 aircraft)
- **Ground asset: CAOC with GMR JTRS and GIG-BE reachback**
- **Common Operating Picture (COP)**
  - Enabled on all airborne platforms
  - Global assured connectivity
  - Allows for early threat detection and warning: SAM missile (SA-11) and enemy jammer
  - WNW reroutes through FAB-T to keep disjoint networks interconnected around jammer

Airborne Network Video

- **SEAD mission**
  - No manned strike assist available
  - X-45s available
  - Rapid geo-location by JAN-TE network
  - Battle damage assessment imagery passed via JAN-TE and CDL
  - Passed to WNW for network reachback
- **Blue Force Tracking data**
  - Routed via WNW & broadband reachback to CAOC
  - Enables clearing and assigning airspace
- **Voice communication**
  - Extended over WNW and broadband reachback
- **Airborne Network tied to advanced On-board Maintenance System (OMS) for Logistics support enroute**
  - Location of available parts and assets for delivery (30 min by V-22)
  - Back-fill of parts (will ship in 12 hours)
  - Re-fueling coordination

Airborne Network Video

- **Target track data**
  - **F-18 gets jammer location from AWACS over Link-16**
- **Jammer is neutralized**
  - **Network automatically reconfigures to use shortest routes**
- **Refueling is coordinated through airborne network**

Summary

- **Architecture supports intelligent migration into the GIG**
  - Strategies for integrating legacy systems into network
  - SDR allows incrementally deployed host terminals that will later on be enabled with emerging networked waveforms (e.g. WNW, MUOS)
- **Architecture designed to mitigate effects of integrating highly dynamic edge networks into larger networks**
  - Create persistent ad hoc backbone with platforms of opportunity that are in the air space, so no fixed infrastructure required
  - Stabilizes networked access for highly dynamic edge networks
  - Deployment of dynamic distributed gateways maximizes connectivity and robustness
- **Common architecture across multiple programs**
  - Provides interconnectivity into the Global Information Grid
  - Maximizing portability and reusability, to include high performance applications
- **Software based communications systems continue to be the key to transformation**
  - Initial expectations on complexity and technology readiness were overly optimistic
  - Need to add hardware architecture interface standards
- **Applying many lessons learned to Airborne Network**