



Air Land Integration

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Rockwell Collins – Building Trust Every Day

Virtual Machine based Joint Operations Center

Radar/Sensor interface

Comm Stations (Buffers)

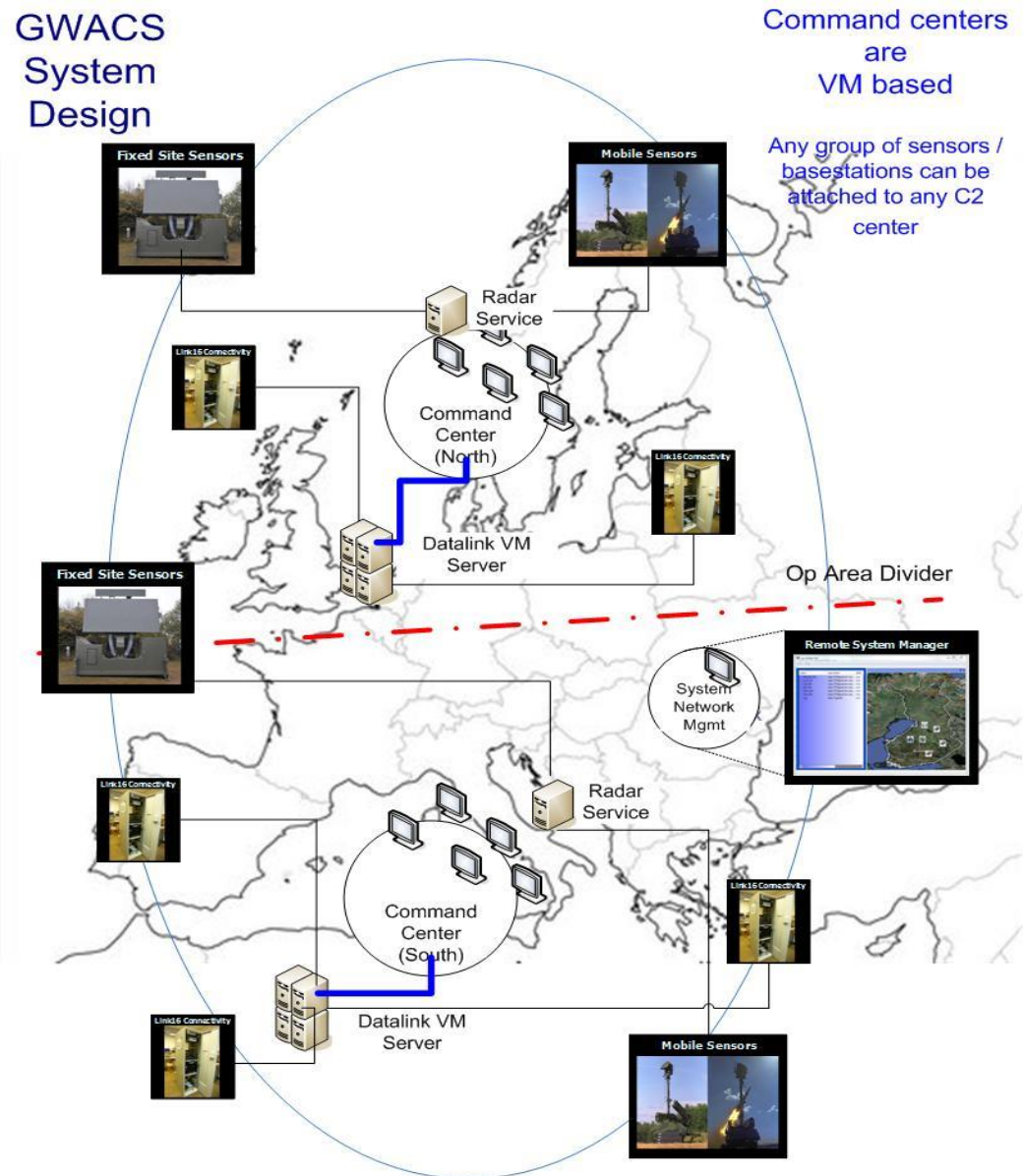
Command and Control VM

Effectors Interface

System of Systems
Manager

Embedded Training and
Simulation

GWACS
System
Design



Command centers
are
VM based

Any group of sensors /
basesations can be
attached to any C2
center

Op Area Divider



Key Components of a GWACS system

- Radar/Sensor interface
 - Creates realtime tracks from sensors surrounding a nation
 - Tracks from multiple Radars/Sensors correlated and made available on secure WAN or virtual machine backbone.
- Comm Stations (Buffers)
 - Remote Link-16 terminals & radios, often collocated with remote radars
 - Must be remotely controlled from Air Operations Center or JICO cell.
- Command and Control Software and Correlator
 - Enables Air Intercept Control function, Track Management, Mission Management, and other C2 functions
- Effectors
 - Ground Based Air Defense, artillery, or non lethal effectors
- System of Systems Manager
 - Key function that enables setup and teardown of Op Areas, Training networks, Hot-Backup
- Embedded Training and Simulator
 - Enables training in a realistic environment

What do we mean by an AWACS on the ground?

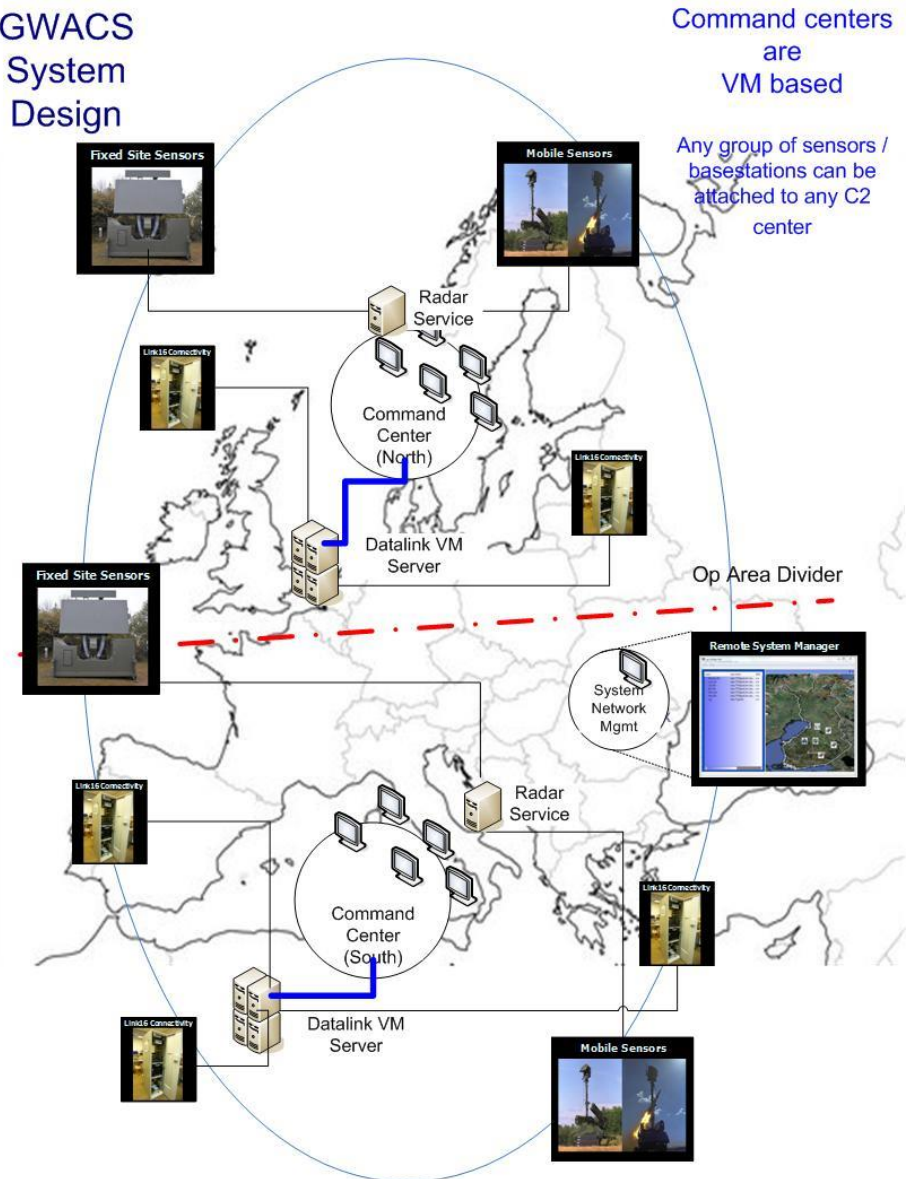
- Direct access to radar/sensor data
 - Provides a correlation engine to fuse Radar hits with Link-16 tracks
 - *Note that IFF Capability is integrated with the Radar and used to ID tracks on Link-16*
- Capability to assign missions to other C2 systems and/or aircraft
 - Mission management enables weapon coordination among C2 Commanders / Units
- Performs all C2 functions associated with Link-16, Close Air Support and Call for Fire
 - Air Intercept Control,
 - 9-Line processing,
 - Fires Control

Advantage of the virtual environment over an AWACS

- **GWACS capability**

- 99.999% operational availability with Hot-Back-up
- Remote management of all C2 Centers and Workstations
- Nation wide distribution
- Multiple base stations are selected by best connectivity and are hot swappable
- Correlation of Radar Picture with Link-16/VMF picture
- Mission assignments across TOC, JOC, AOC, and C2 Platforms
- Air Intercept Control
- Training networks can be stood up/down as needed.

GWACS System Design



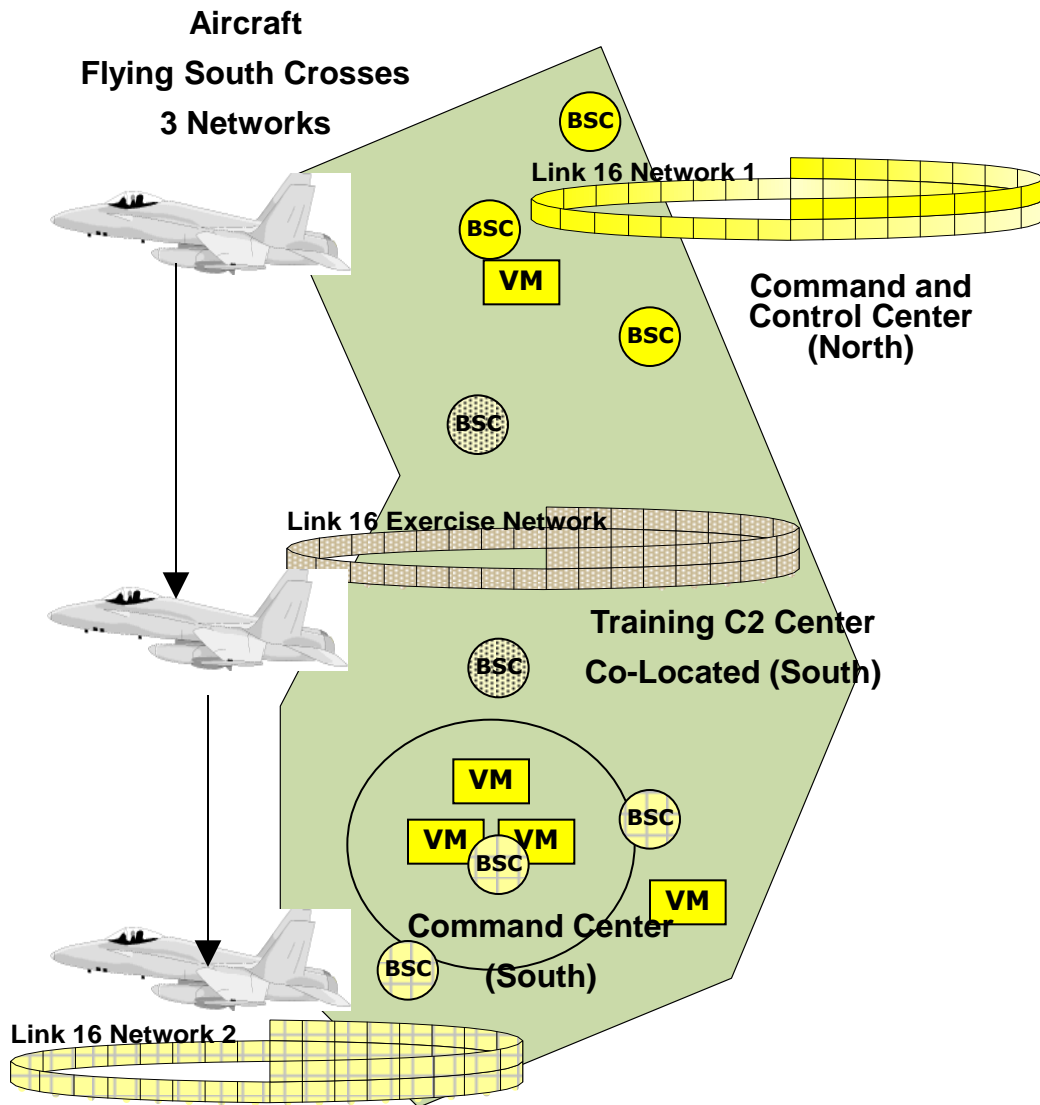
Virtual Machine Node Flexibility

- **C2 Centers can be created as needed**
 - TOC / ASOC C2 center can be created in virtual space
 - Operators could be “on the move” or in a temporary facility
- Role based login assigns operators to an Ops Center
 - Air Intercept control, Close Air Support, Fire Coordinator, etc.
- Operators do not have to be collocated
 - Air Intercept Controller in Sector A can take over for JTAC in Sector B
- Training environments can be created as needed
 - C2 Center, Link-16 network, Strategy simulators can be integrated as needed
 - Training resources can be re-assigned to operational networks
- Hot-Back-Up can be managed from any admin node in the network
 - Systems can be hot swapped to resolve maintenance issues
 - Status of all nodes available to operators as needed



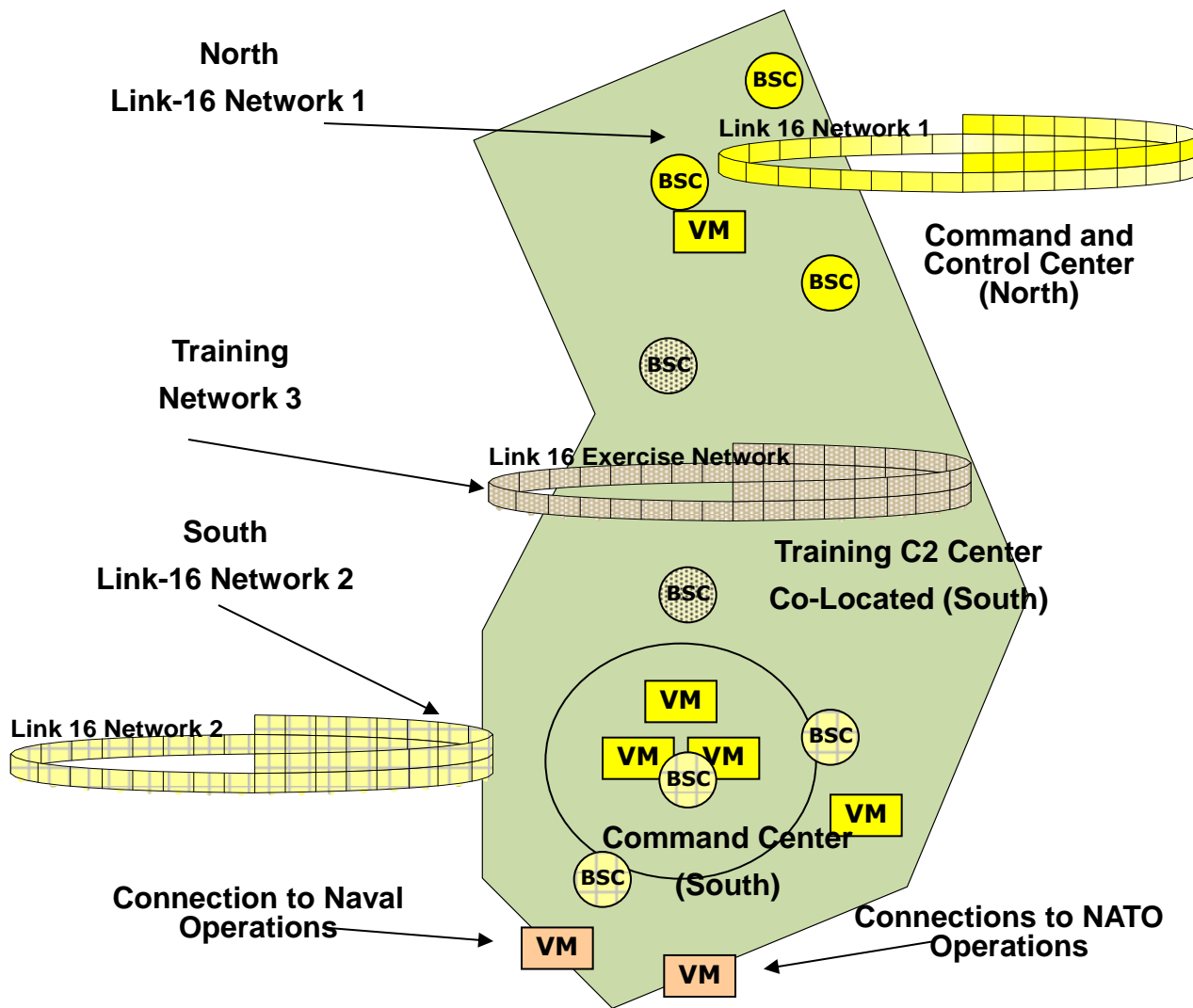
SoS Manager Monitors and Controls the virtual nodes

Complexity of the Multi Terminal Environment



- Should the Aircraft Switch Networks?
 - How Many L16 loads can it carry?
- How Do you pick an appropriate Base Station?
 - Regional?
 - Best Connectivity?
- How do you limit pulses
 - Best “n” number of terminals
- How do you setup/breakdown training networks?
 - Common control of all resources is required at some Ops Center
- Correlation Interface to the Radar
- How do the base stations get initialized?
 - Do you need multiple networks in each base station?

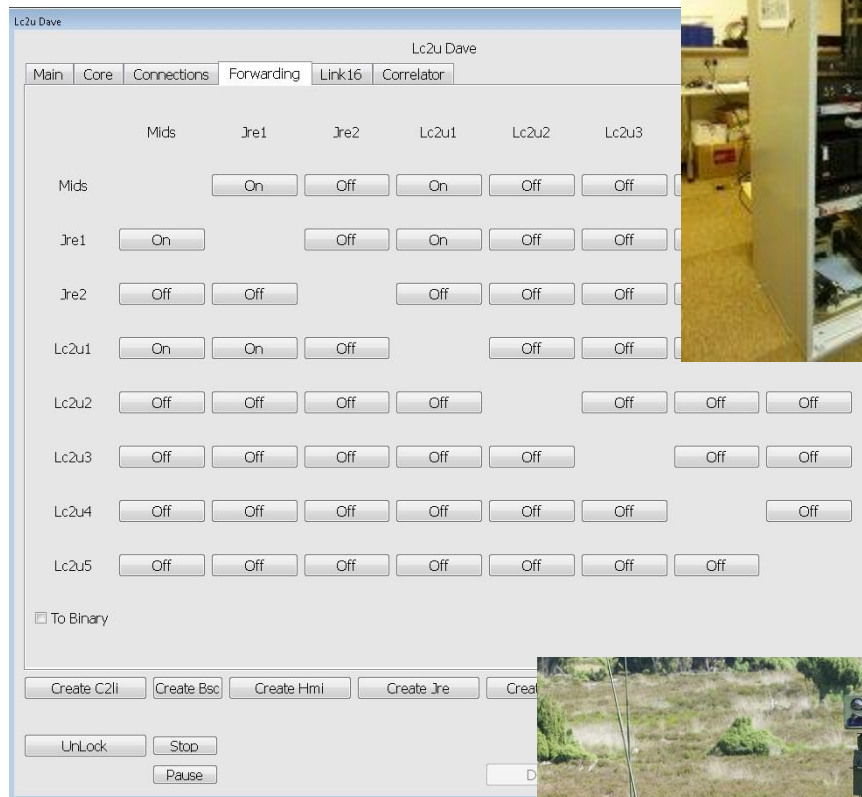
GWACS Support for Training



- Training Center can be stood up and taken down as needed
- Rosetta instances run on every node and are synchronized country-wide
- Training assets can be reallocated to operational networks
- Training C2 Center can be managed by any existing C2 center
- Connections are controlled by System Manager

Communications Architecture

- Remote base stations are used to connect WAN to datalinks
- Total Remote control and Monitoring of all buffers
- Rosetta integrates and forwards data in realtime to support information management



Leveraging Rosetta for Command and Control

- Rosetta provides Link-16, VMF, AFATDS, ADLER-II, and all tactical data processing
- JMMTIDS performs the tactical display function and morphs to support a variety C2 roles
 - User Logins change the GUI for each operator
- Information management is key to successful SoS integration
 - Data is distributed on a series of VLANs run across the backbone
 - VLANs can be encrypted to segregate the networks
 - Rosetta data forwarding manages the exchange of information

Extending the Battlefield

Rosetta connects Airborne and Ground Networks

- Workstations can access any network
- VPNs used to separate traffic



C2 Coordination (i.e. CAOC)

Fire Direction Center
Control Artillery



Key:
Fires Network
Link-16 Network

Rosetta Gateway

Link-16

RF Link-16 Network

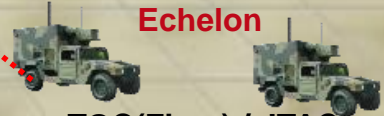
Sensors



Command and Control
JREAP-C

VMF

Battalion Echelon



TOC(Fires) / JTAC
Manages CFF request
Monitors Artillery

JFSCG
Joint Fire Support
Coordination Group

Fires Network
VMF

AFATDS Network

Company



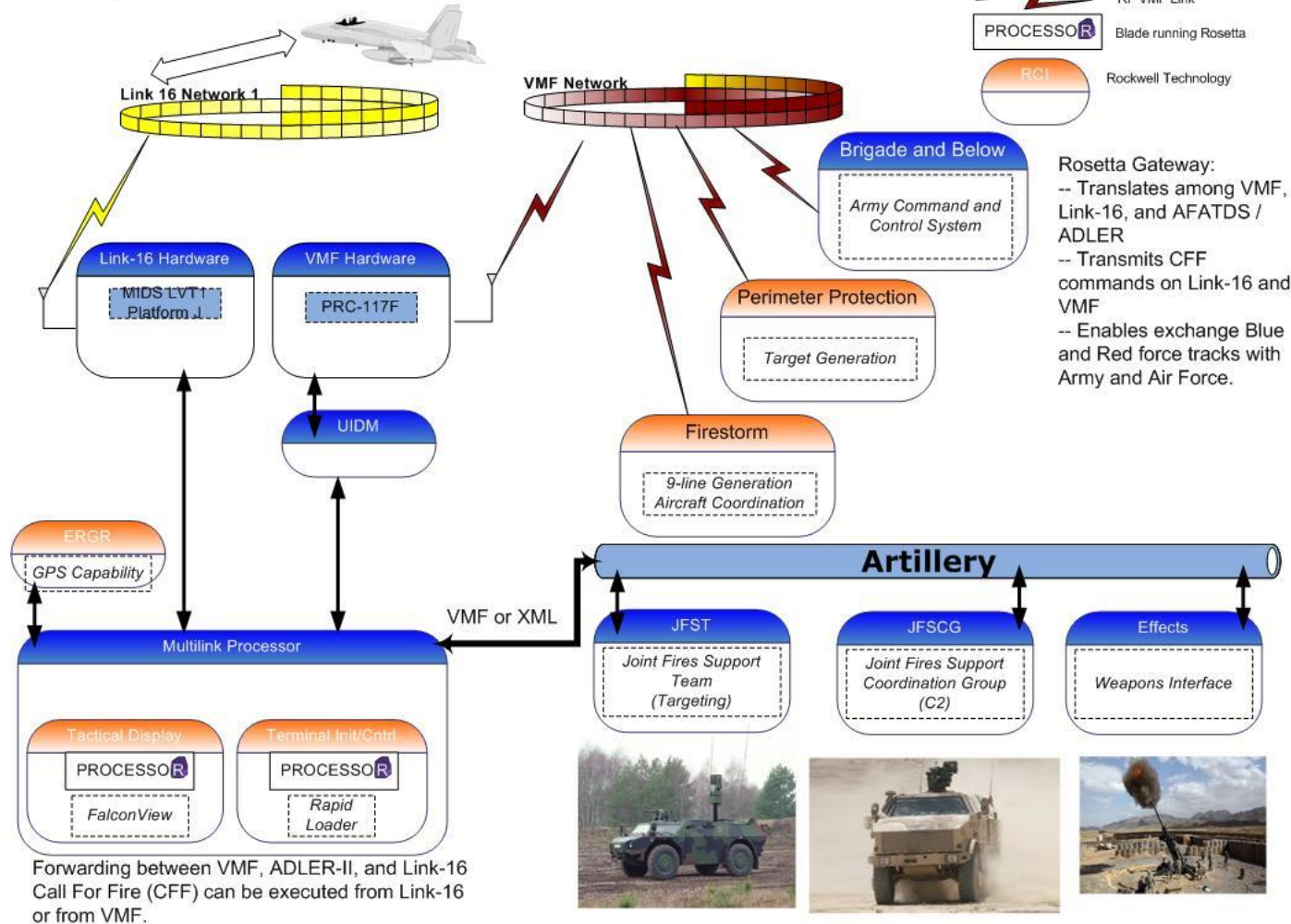
FIRESTORM
Precision Targeting



JFST
Joint Fire Support Team

Implementing Command and Control across networks

GWACS Major System Interfaces



Integrating Call for Fire across networks

- **The Multilink Gateway is the first system to perform CFF on Link-16**
- **Link-16 Command and Control messages create a Call for Fire on the Artillery system**
 - The exchange includes converting a series of messages
 - Commands
 - Engagement Status
 - Track Management
 - Free Text

CFF exchange with Link-16 is a breakthrough technology



Rosetta Support for Call For Fire Missions

- **Call for Fire support**
 - Adjust Fire Mission
 - Fire For Effect Mission
 - Excalibur Mission
 - Immediate Suppression Mission
 - Immediate Smoke/Quick Smoke
 - Continuous Illumination Mission
 - On Call Mission
 - Mark Mission (Not supported by all systems)
 - Destruction Mission

Rosetta Network Tactical Gateway Capability

- Link-16 RF to VMF over RF Data Forwarding
 - Connects airborne networks to ground based network
 - Connects JTAC/FAC/FO with Link-16 participants
- Link-16 Ground Systems (JREAP-C) with VMF Networks
 - JREAP-C used to forward VMF ground pictures to upper echelons
- Link-16 RF to Link-16 JREAP-C
 - Commonly used to distribute Blue Force Tracking and SA picture among echelons
 - Secure TOC to ASOC communications
- SADL can be forwarded to/from VMF and Link-16
 - Supports legacy aircraft with SADL.

NTG integrates Airborne networks with Ground networks

Issues with Integrating the Networks

- Link-16 was not designed to manage Call For Fire
 - Difficult to support more than the most basic CFF missions
 - Link-16 Networks are not deigned for CFF
- VMF does not support advanced track management
 - ID Conflict Reports, Data Update Request, Correlation messages are not supported
- ADLER / AFATDS
 - Vast capability is hard to translate into Link-16 and VMF
- Mapping Track Numbers across the networks
 - Common scheme for exchanging tracks numbers is required.

DaFS standards are under development and will have to consider Link-16

Impact of large scale Integration of Land and Air Platforms

- Support for Troops in Contact
 - Interface to dismounted soldiers via tactical Gateway
 - DaCAS VMF to/from Link-16 procedures used ensure NATO and Allied interoperability
- ASOC operators have ID data from local sensors and datalinks
- Mobile Radars are supported with no change in architecture
 - Mobile radars can be assigned to any Link-16 network
- Integration of Ground Based Air Defense radars with long range sensor
 - JREAP-C connection to GBAD systems used to complete sensor coverage
 - Tightly control of overlapping air-space with filters
- Integrating Edge Users
 - Enables dismount soldiers to be “seen” by the fighters
 - Dismount soldiers can control UAVs and/or Strike aircraft
 - Selective Situational Awareness (5 mile radius) sent to dismounts

Joint Operations Center

Developing the JOC will require integrating all networks

- CFF networks
- CAS Networks
- Video Networks

Higher Echelon



C2 Coordination (i.e. CAOC)

Rosetta Gateway

Link-16

RF Link-16 Network

Command and Control JREAP-C

VMF

Company

FIRESTORM Precision Targeting

JFSCG Joint Fire Support Coordination Group

ADLER Network XML

TOC(Fires) / JTAC
Manages CFF request
Monitors Artillery

ADLER Network
Fires Network

JFST
Joint Fire Support Team

Sensors



Fire Direction Center
Manages CFF request
Monitors Artillery



JOC:
Fires Nomination Sys:
- Path to CAS and to ADLER

Summary

- GWACS is an extremely effective AWACS like capability on the ground.
 - Operators can be located anywhere on the WAN and perform coordinated complex missions (AIC, CAS, CFF, etc).
 - The entire C2 system has been virtualized enabling role based login.
- Rosetta technology enables filtering and routing data to/from the appropriate base stations, sensor, and effectors
 - Rosetta enables hot back-up of any C2 Center and/or C2 workstation
- A significant advantage of a GWACS is the ability to create and break down networks as required by the Ops Tempo.
 - This includes setting up training networks as needed
- GWACS is the first system to support Call for fire from a Link-16 C2 Platform
- The system enables engagement of targets on Close Air Support and Fires networks