

Interoperability & Airborne Operations

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Information

Air/Ground Interoperability

- Third dimension is essential to support Ground Operations
 - Close Air Support
 - ISR/ISTAR
- Air/Ground is almost always “Joint” and often “inter-allies”
 - Making interoperability complex at Operational level
- Network centric concepts of operation requires:
 - Interoperability of the networks
 - Dissemination of Intelligence, Surveillance and Target Acquisition
- Operations involving Air Strikes, Close Air Support are always of Strategic interest
 - Interoperability from Tactical to Operative to Strategic is necessary
- Tempo of operation is faster and faster
 - Short loop, from Intelligence collection to target acquisition and processing
 - Risks of fratricide and/or collateral damages are high



Integrating networks: a Roadmap

2013

2017

2020

2025

**Moving to Software
defined networks and
virtualize capabilities**

**Disruptive CONOPS
Integrate
Voice/Data/Video
Everything Over IP
Real Tactical Internet**

**Introduce SDR with
new open NB and
WB WF, MANET
Introduce some SOA
paradigms at tactical
level
Multi-Level Security**

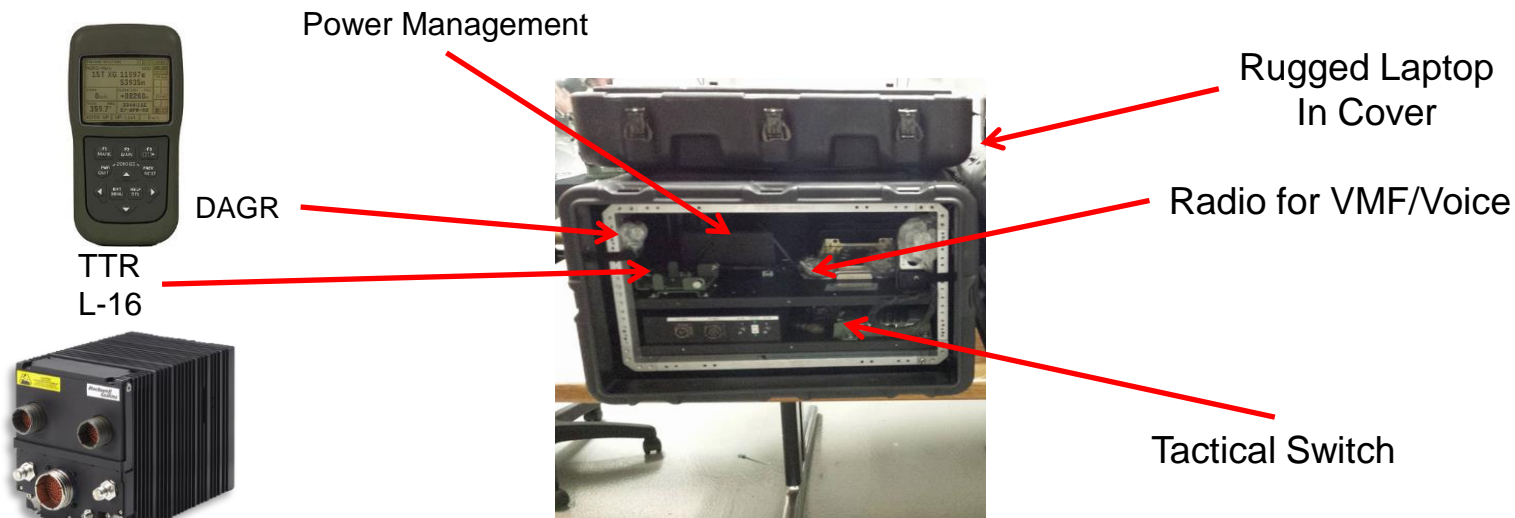
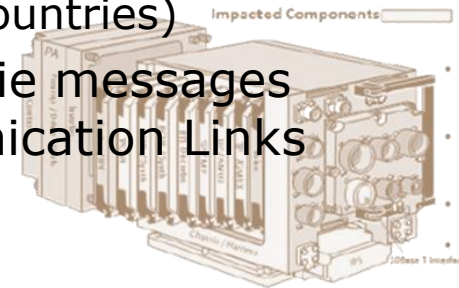
**Recombining Legacy
Filling Gaps**

**Objectives is to have one
integrated IP Network but it is a
Grail and intelligent gateways will
remain to create virtual networks
on top of physical networks**

Integrating Ground and Air networks

Connecting existing networks, legacy and gap fillers

- Link-16 has been the main Tactical Datalink since the 80's
 - Though old, it went through several general generations, now the Block Upgrade 2 and the MIDS-J
 - It has been adopted by NATO and other Nations (42 countries)
- VMF (Variable Message Format) to carry some J-series messages over CNR and other ground and air/ground communication Links
- Reach back with J-REAP over Satellite links



Network Tactical gateway, integrating Tactical DL and ground networks

Extending the Battlefield

Rosetta connects Airborne and Ground Networks

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

Link-16 RF to VMF over RF Data Forwarding

Link-16 Ground Systems (JREAP-C) with VMF Networks

Link-16 RF to Link-16 JREAP-C

Connects JTAC/FAC/FO with Link-16 participants



C2 Coordination (i.e. CAOC)

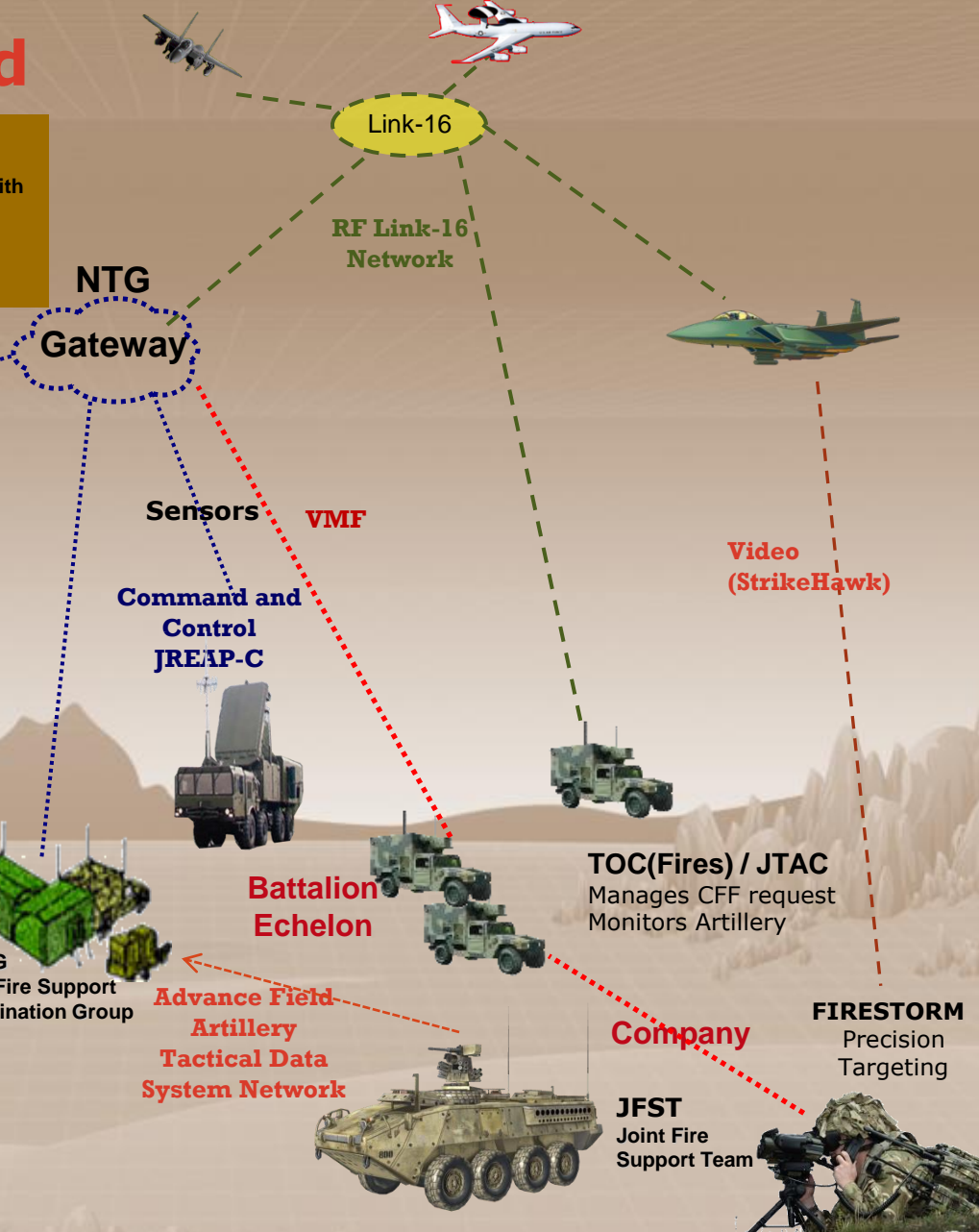
Fire Direction Center
Control Artillery



Key:

Fires Network

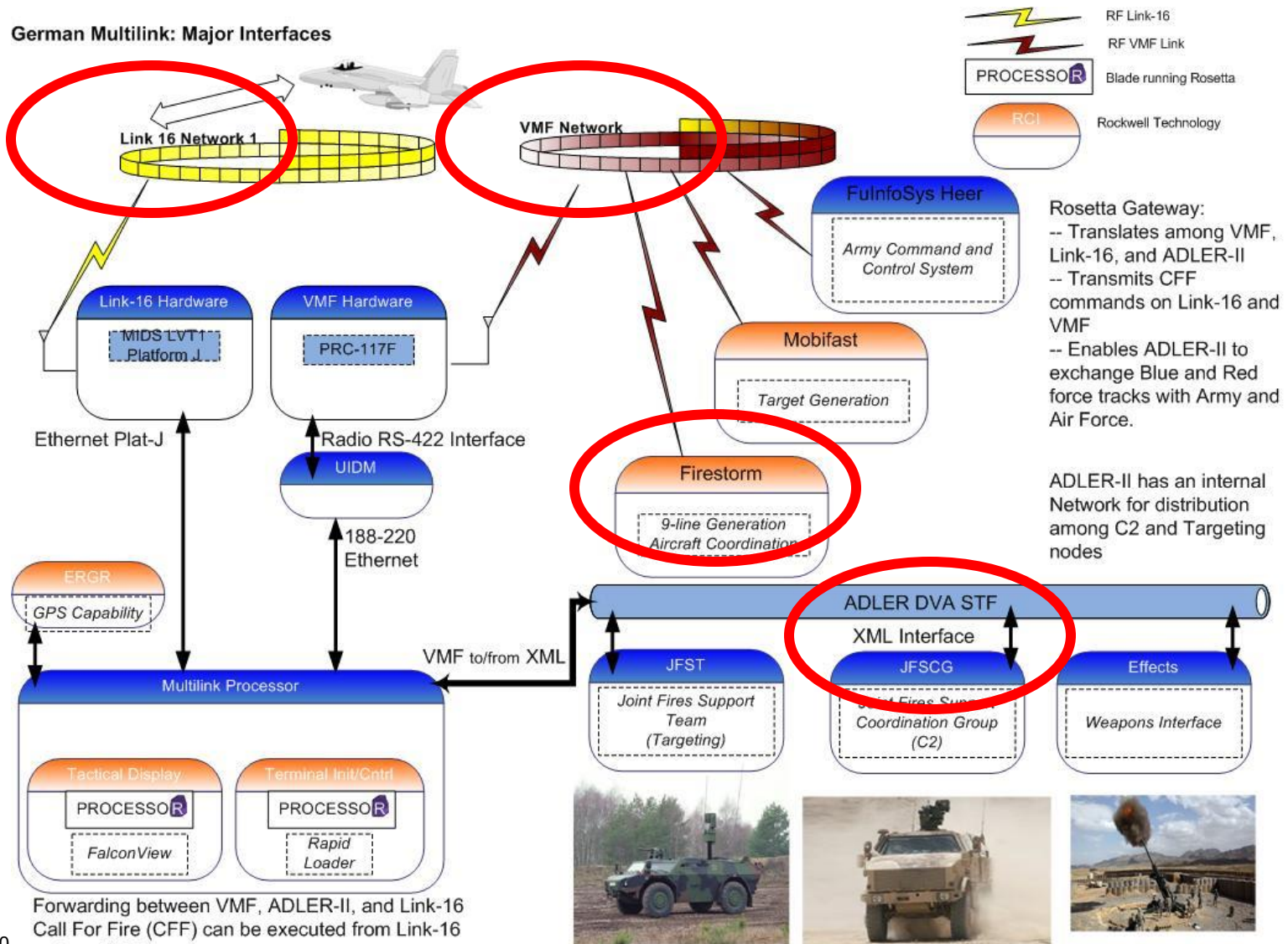
Link-16 Network



Call For Fire can be exchanged to/from Link-16 and Fire control Systems on VMF

Example: Implementing Command and Control in Germany

- NTG/Rosetta supports Link-16, CAS, and CFF



Virtual Machine C2 Server

Virtual Machine System Supports:

- All Dual Workstation functions
- Training
- Link-16 network management
 - Hot Back-Up with 24/7/365 Operational Capability
 - Remote Control and Crypto loading of basestations
 - On-the-fly configuration of AOC & Mobile TOCs

Sensors



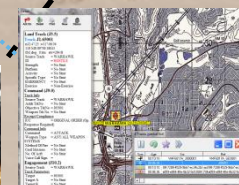
Ground Based Air Defense



Radar Base station



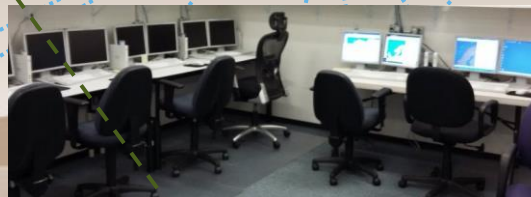
FIRESTORM Precision Targeting DaCAS



ASOC Stand Alone NTG Mobile Site

GWACS Virtual C2 Server

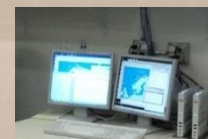
IP WAN



Dual Workstation NTG Radar Site 3



Dual Workstation NTG Radar Site 2



Dual Workstation NTG Radar Site 1

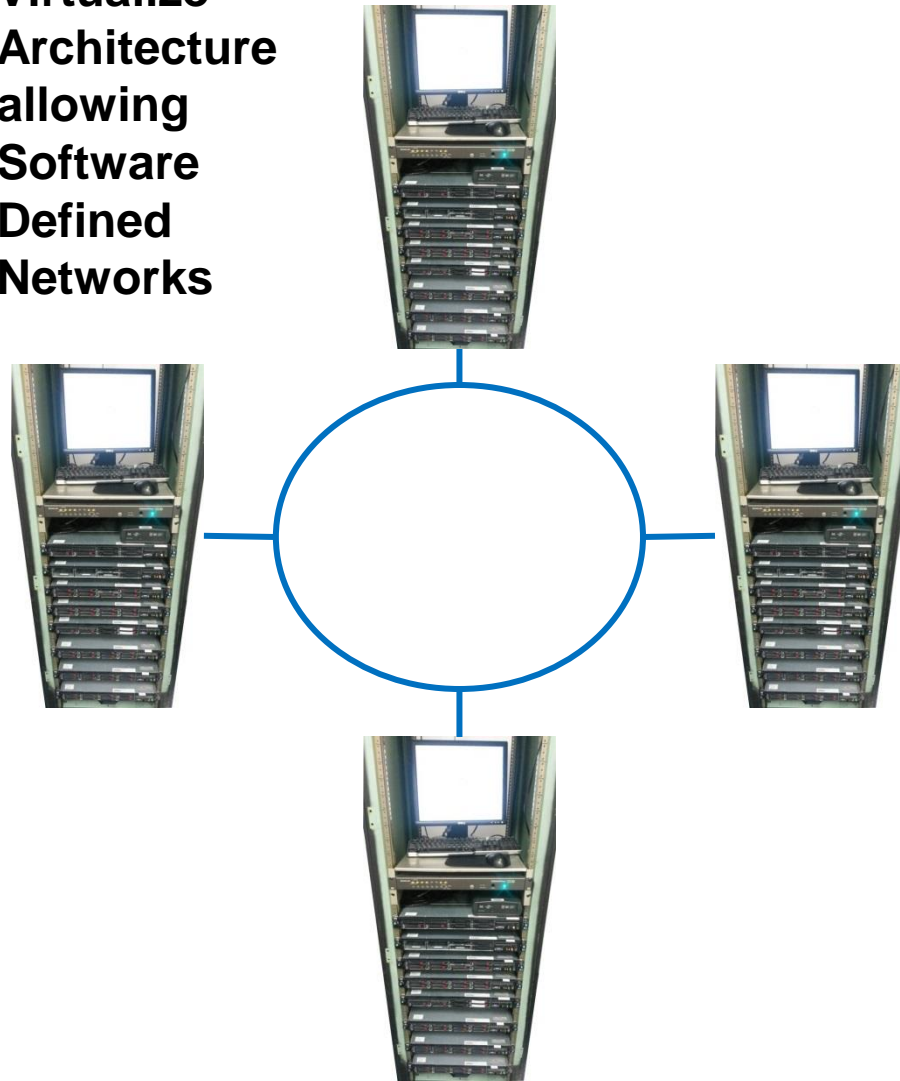


Link-16

RF Link-16 Network

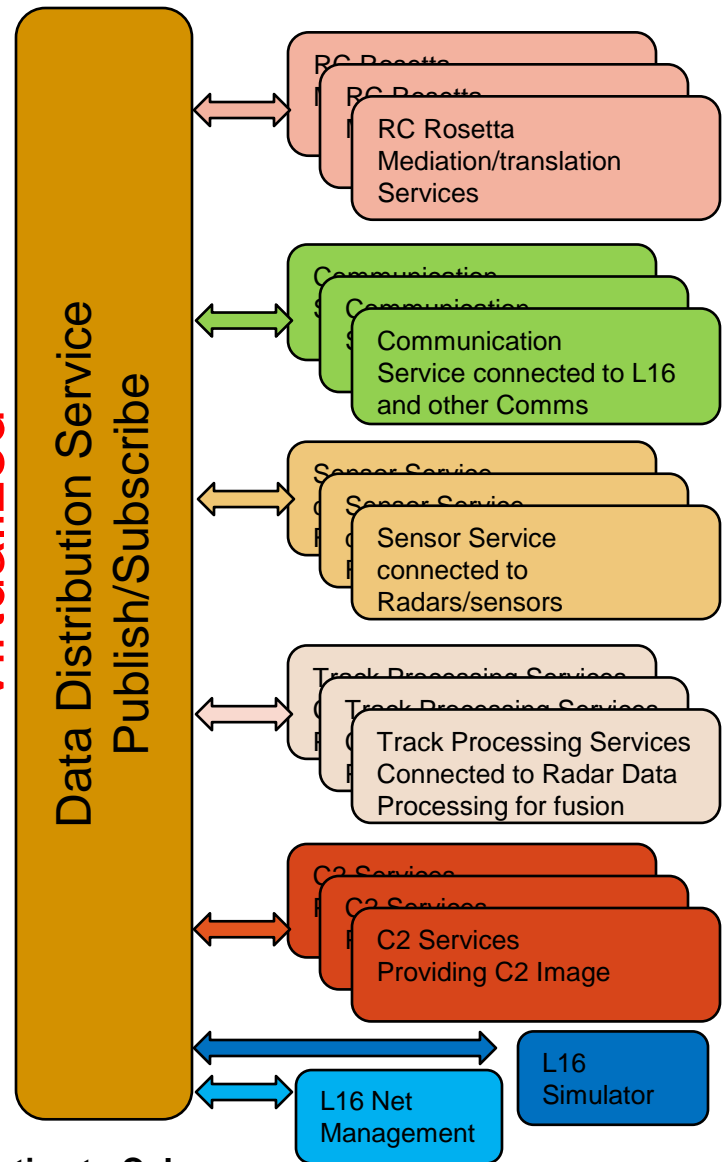
Key:
IP Backbone
Link-16 Network

**Virtualize
Architecture
allowing
Software
Defined
Networks**



**Computing resources distributed across
the network running VMWare**

Virtualized



**Data Dissemination to Col
With various QoS**

**Variety of Services
virtualized somewhere with
dynamic configuration**

Finland LGS: A Ground Based Early Warning & Control system

Operational Capability

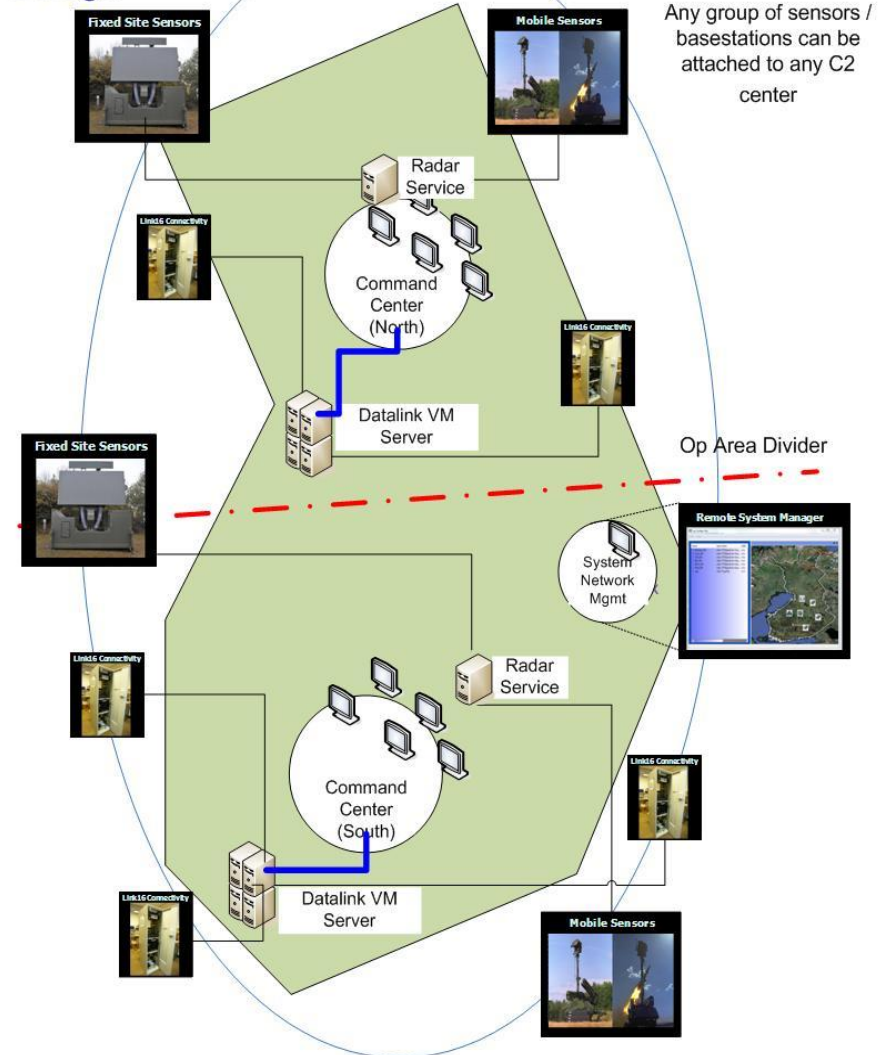
- All functions of an AWACS to include Link-16 Command and Control of Assets (L-16 Aircraft, GBAD, etc.)
- Integration of country wide Radar/IFF system into single integrated air picture
- Nation wide distribution of fused Link-16/Radar/IFF picture
- Target and Mission assignments across TOC, JOC, AOC, and C2 Platforms

System Capability

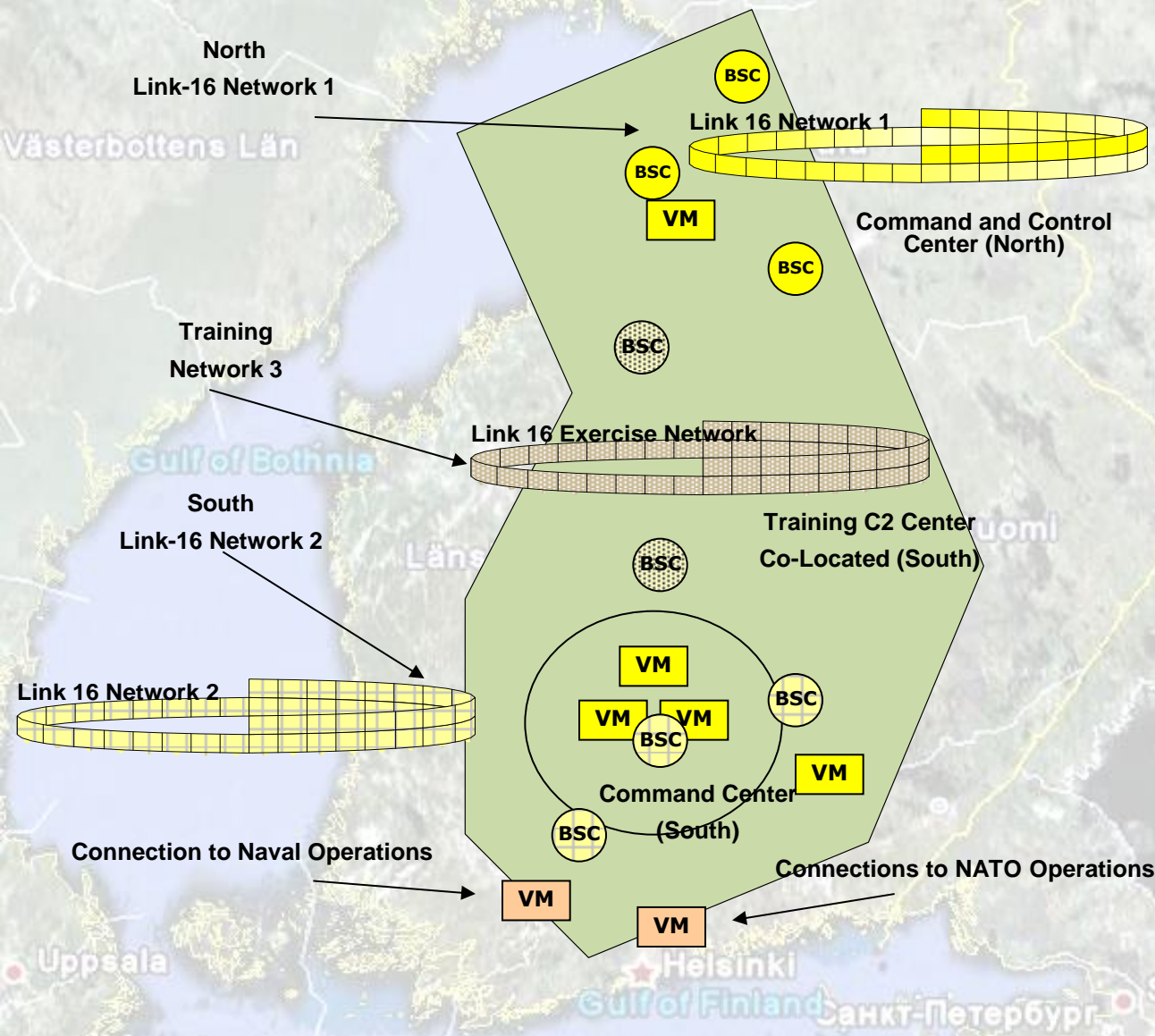
- Base Stations and Radars distributed around the country and integrated by VM based Rosetta C2 Server
- System Administrator can create AOCs, TOCs, and Remote C2 centers "on-the-fly"
- All nodes are virtual machine based any radar / Base Station can be assigned to any AOC, TOC, etc.
- Training networks can be stood up/down as needed.

All nodes run in Hot Back-Up mode

GWACS System Design



Finland LGS Support for Training Networks



- **Training Center can be stood up and taken down as needed**
- **Training assets can be reallocated to operational networks**
- **Training C2 Center can be managed by any existing C2 center**
- **Rosetta instances run on every node and synchronize the training assets**
- **Radar / Datalink connections are controlled by LGS System Manager on-the-fly**

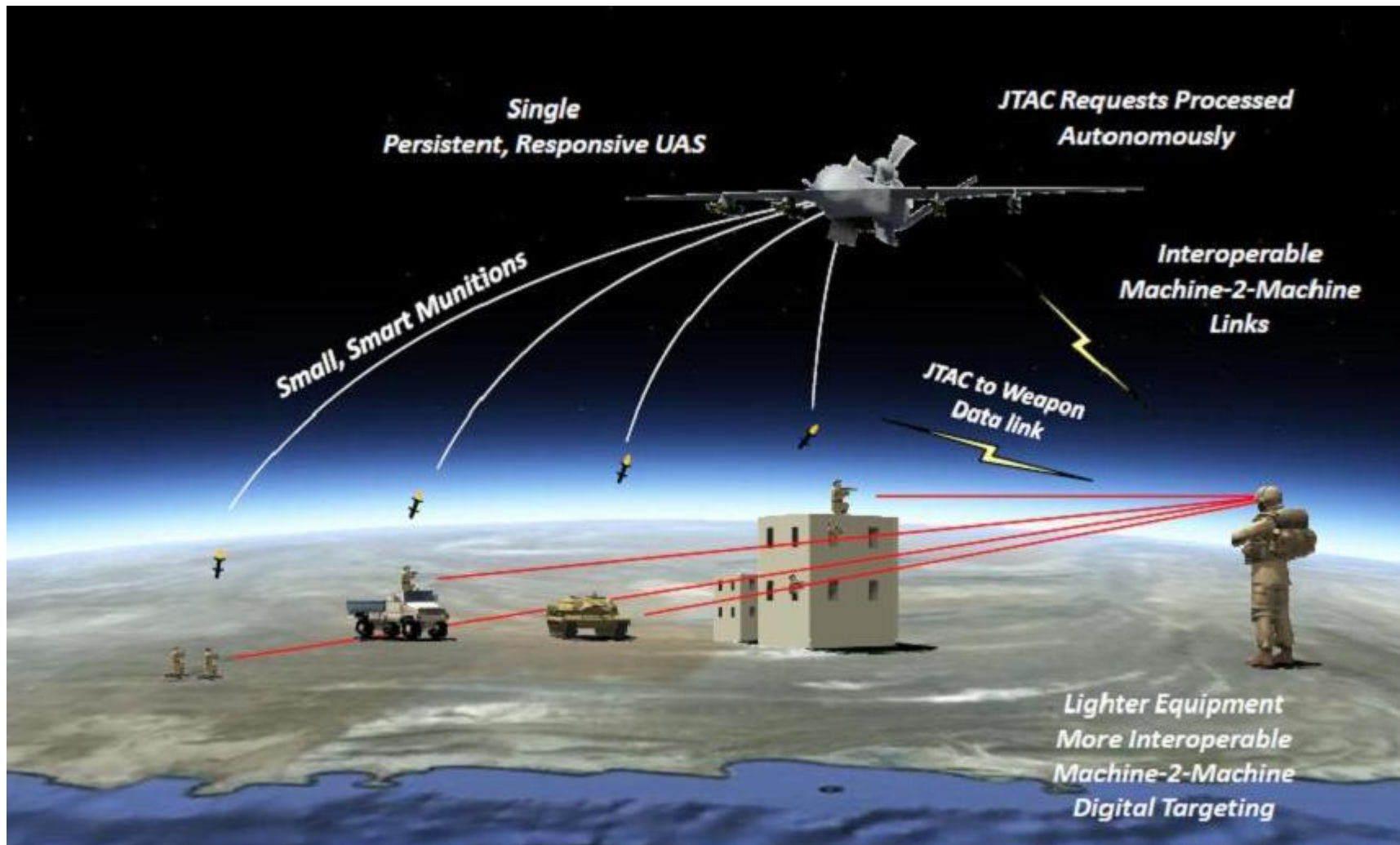
Moving toward Disruptive Conops: Persistent CAS

When implementing new network technologies, it has to fulfill high level requirements:

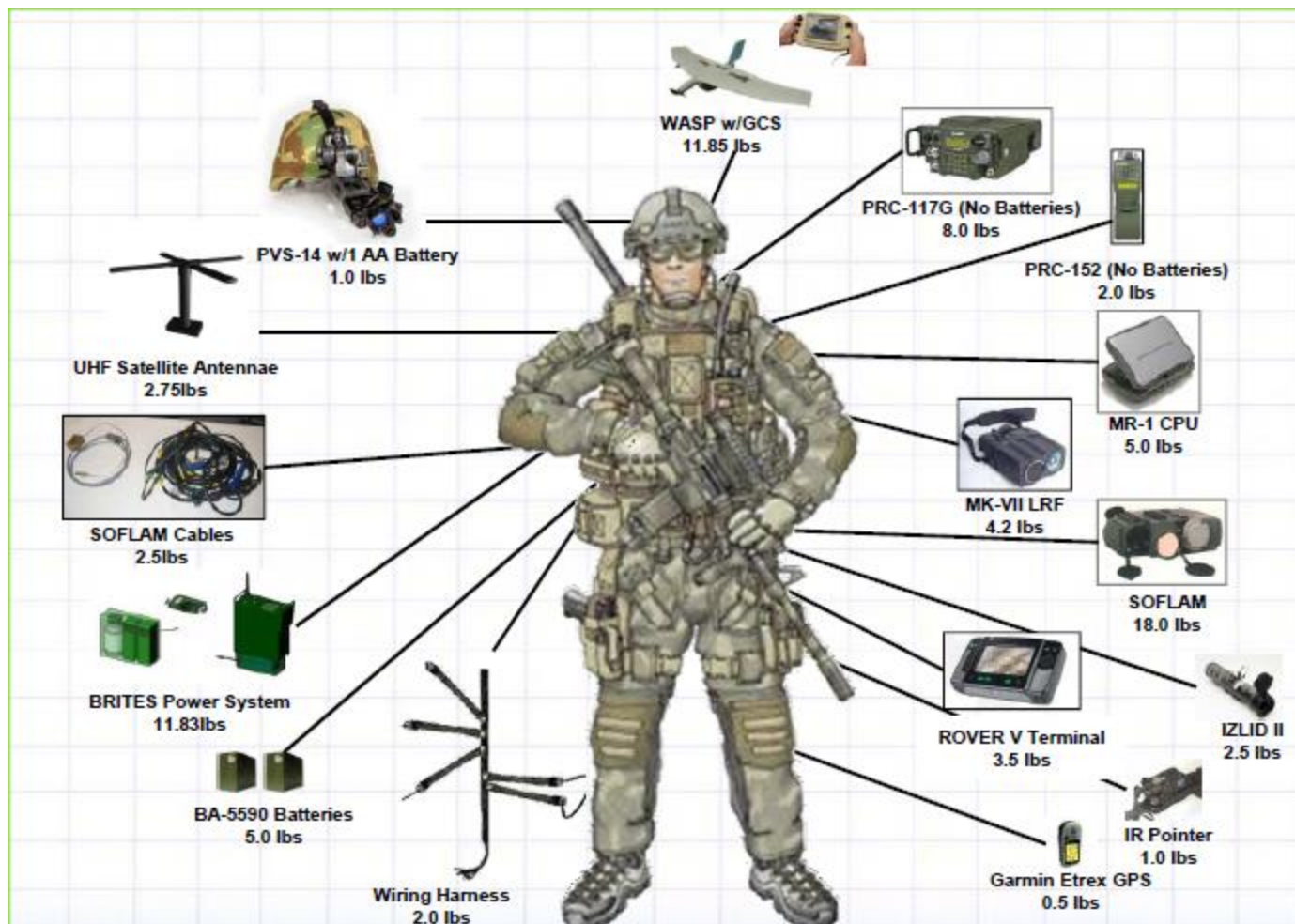
- Reducing the time from calling in a strike to the weapon hitting the target by a factor of 10, from up to 60 minutes down to just 6 minutes
- Direct coordination of airstrikes by a ground agent from manned or unmanned air vehicles
- Reducing risk of collateral damages
- Improved speed and survivability of ground forces engaged with enemy forces
- Use of smaller, more precise munitions against smaller and moving targets in degraded visual environments
- Graceful degradation of services—if one piece of the system fails, warfighters would still retain CAS capability
- Lighter equipment (particularly radios) for JTAC



Persistent Close-Air Support (PCAS)



JTAC Current Equipment





Integrated Laser Rangefinder

- Multispectral vision
- Laser range finding, target designation
- Visual/IR spectrums



Wearable tactical display screen

- Rugged
- Day/Night capable
- User friendly



Radio

- Lightweight small
- High bandwidth
- Backward compatible
- Communication between JTAC, platform, GCS



Single Power Supply

- Renewable
- High capacity
- Lightweight



Conclusion

- Building networks on top of existing physical capabilities
 - Recombining Legacy, some capabilities are here for a long time
- Introducing new technologies to fill gaps
 - To bring Interoperability, Flexibility, Scalability
 - Spiral development, a pragmatic approach
- Consider the high level operational requirements when building new equipment, new waveforms ...
 - CONOPS to be disruptive not necessarily technology

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