Systems Integration in an Operational Environment

…or service *after* the sale.

Brief to INCOSE Region II

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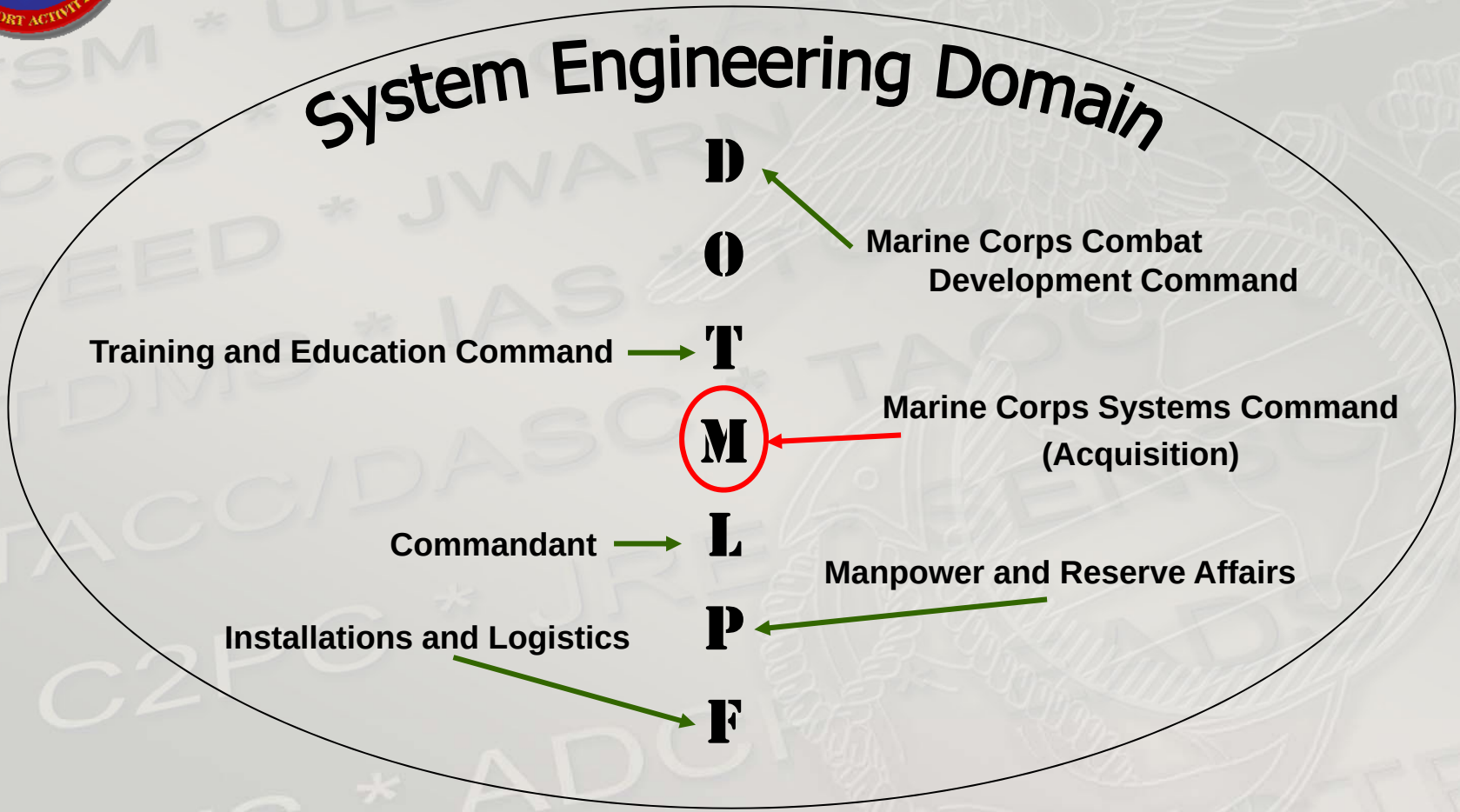
Overview

- **Intro**
- **Our Mission**
- **Systems Engineering in DoD**
- **The Challenges**
- **GSWAN – An Example**
- **Summary**

MCTSSA Mission

- **To provide technical support to the Commanding General, MARCORSYSCOM, and Program Managers to acquire and sustain C4ISR products for the Operating Forces.**
- **To provide technical support to the Deputy Commander for C4I Integration, MARCORSYSCOM, for C4ISR systems engineering and systems integration .**
- **To provide a Systems Integration Environment.**
- **To provide technical support to the Operating Forces for fielded tactical C4ISR systems.**

System Engineering in DoD



- DoD acquisition mandates use of systems engineering (DoD instructions 5000.1 and 5000.2), and systems engineering includes all of DOTMLPF…but systems engineers generally have limited trade space outside the “M”.

C4I Integration Attributes

- "System" Complexity is increasing…period
  - Hardware, software
  - Process complexity
- Integration has become a continuous process
  - The tsunami of new systems fielded to warfighter forces integration.
  - Systems of systems, Federations of systems, Families of systems
- Nobody owns the whole "system"
  - System engineer of System A unaware of System B.
  - System Engineering compromises made up front
- Resources are always limited…perfect integration isn't possible
- Legacy systems and processes are a driver

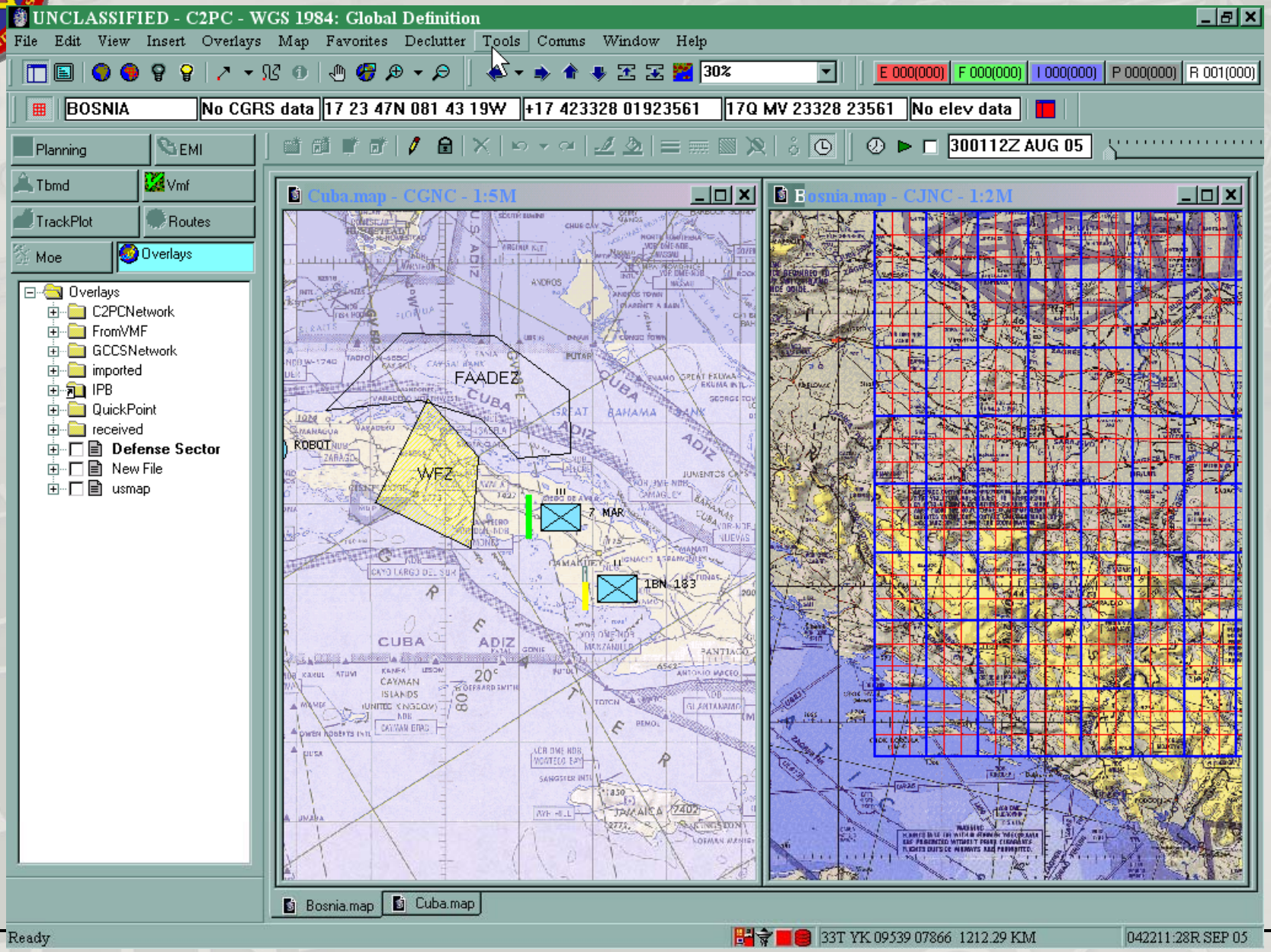
Hardware Complexity

Receiver - Transmitter, Radio
RT-246/VRC

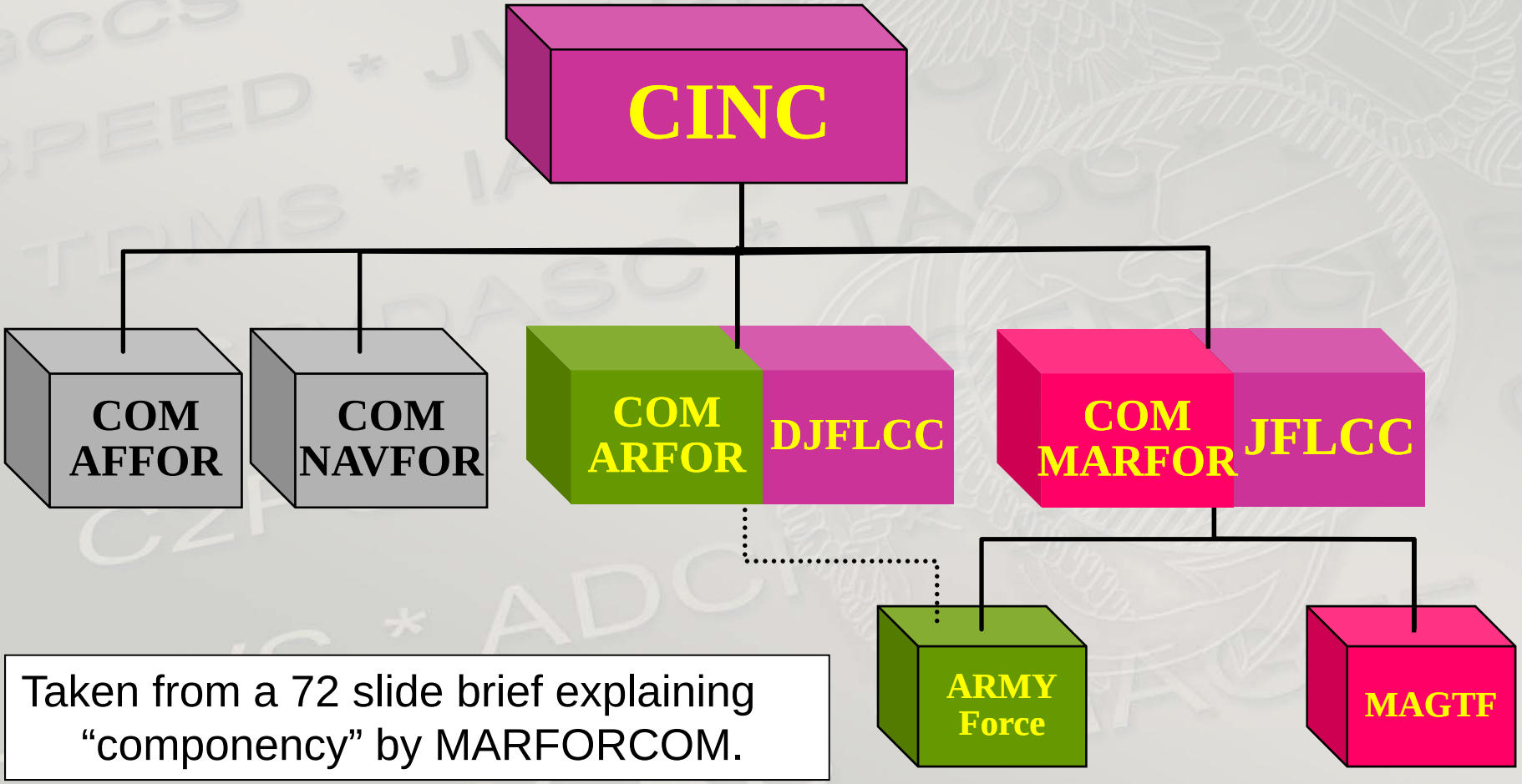
State of the art – Vietnam war

Typical Battalion comms - Iraq

Software Complexity

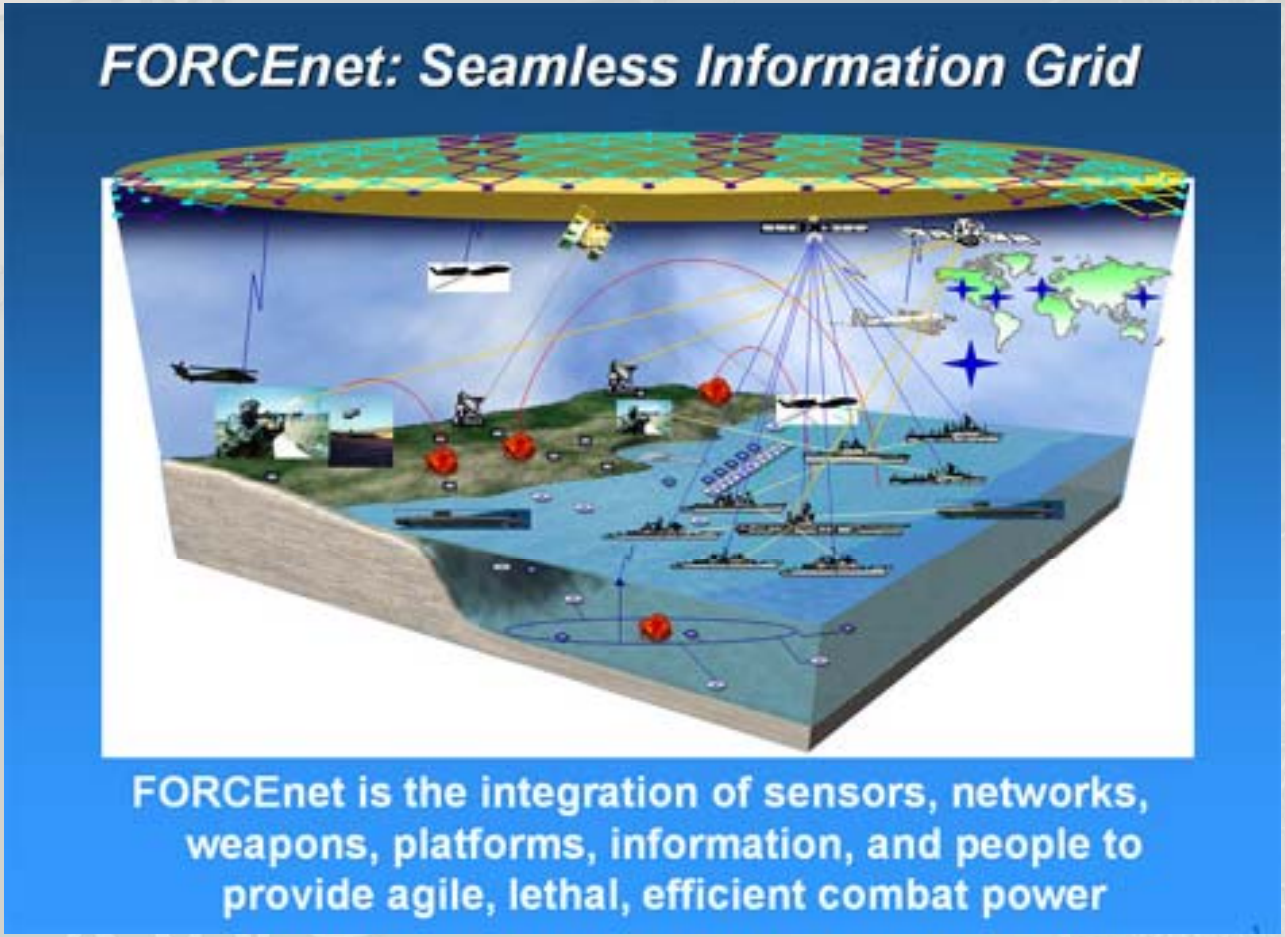


Joint Force Functional Commander



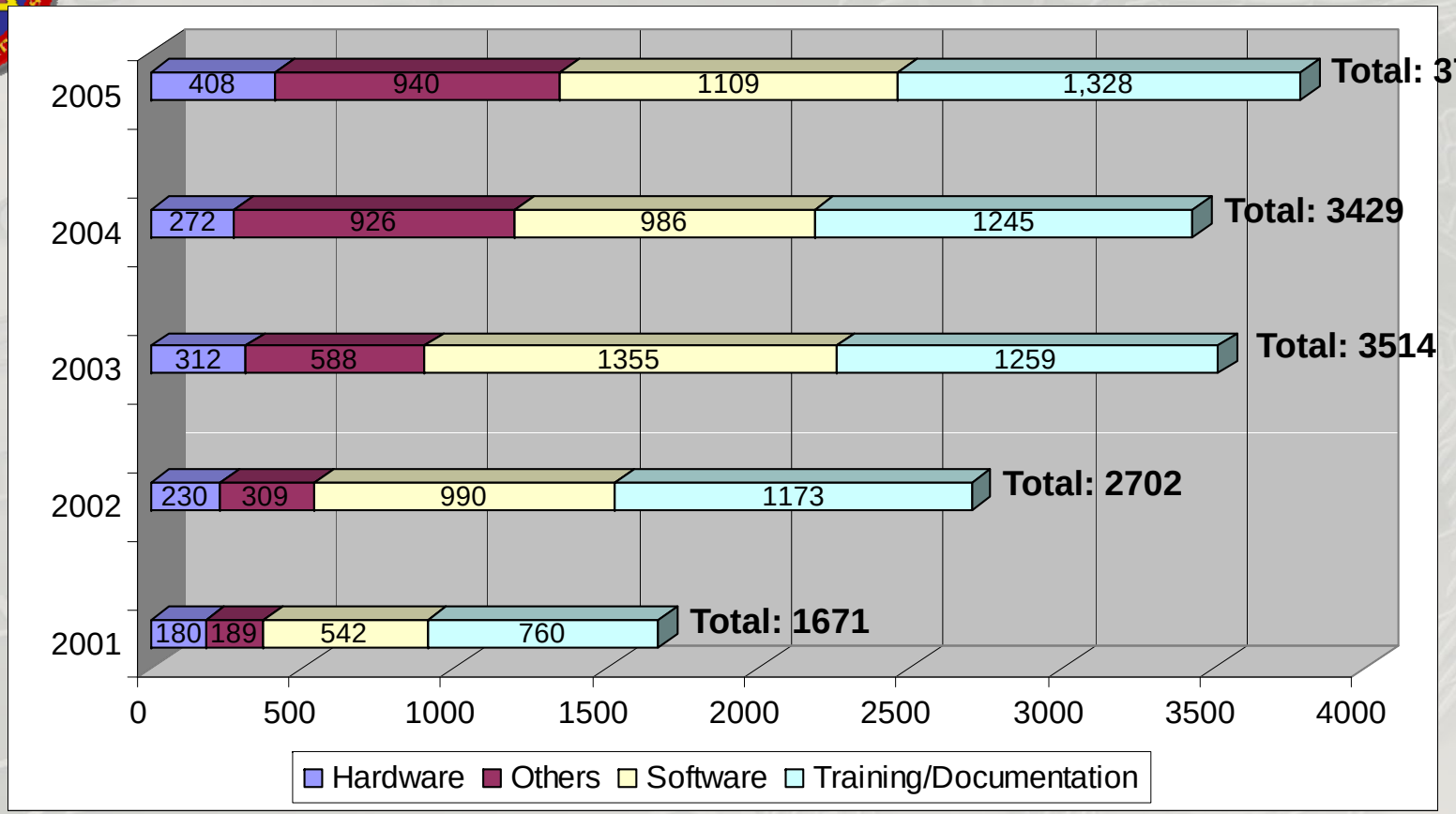
Taken from a 72 slide brief explaining "componency" by MARFORCOM.

System of Systems Complexity



Models can be useful…but reality is a little more complex than shown here

Support Center Trouble Tickets



Training / Documentation Tickets Created by system (Top 5)

2001		2002		2003		2004		2005	
GCCS	167	GCCS	289	GCCS	338	GCCS	280	GCCS	294
IOS V2	97	C2PC	178	C2PC	221	C2PC	194	C2PC	184
C2PC	96	NETWORK	86	IOS V2	99	TDMS	123	IOS V2	120
NETWORK	58	IOS V2	85	JWARN	98	JWARN	87	NETWORK	103
JWARN	45	IOW	56	NETWORK	72	IOS V2	65	TDMS	95

Tactical C4I Integration Challenges

- **Systems integration in an Operational Environment is uniquely challenging**
- **Operational Environment in DoD = combat**
- **Enterprise scale systems (system of systems) located in remote locations**
  - **Dynamic environment**
  - **No single owner of the system-of-systems**
- **As much integration done prior to deployment as possible**
- **So…the new "system" was designed using systems engineering (DoD mandated)…but now it gets integrated in an Operational "system of systems". How does that work?**

An Operational Integration Example: GSWAN

General Storage Wide Area Network (GSWAN)

- I MEF UUNS ~ Oct 2004
  - Push UAV video around battlefield, assist with IED problem
- VSWAN – Video Storage Wide Area Network
- Rapid fielding – integrated under operational conditions.
- Highly successful – spawned other SWANs: Logistics, HOA, General, MEU.

GSWAN System Description

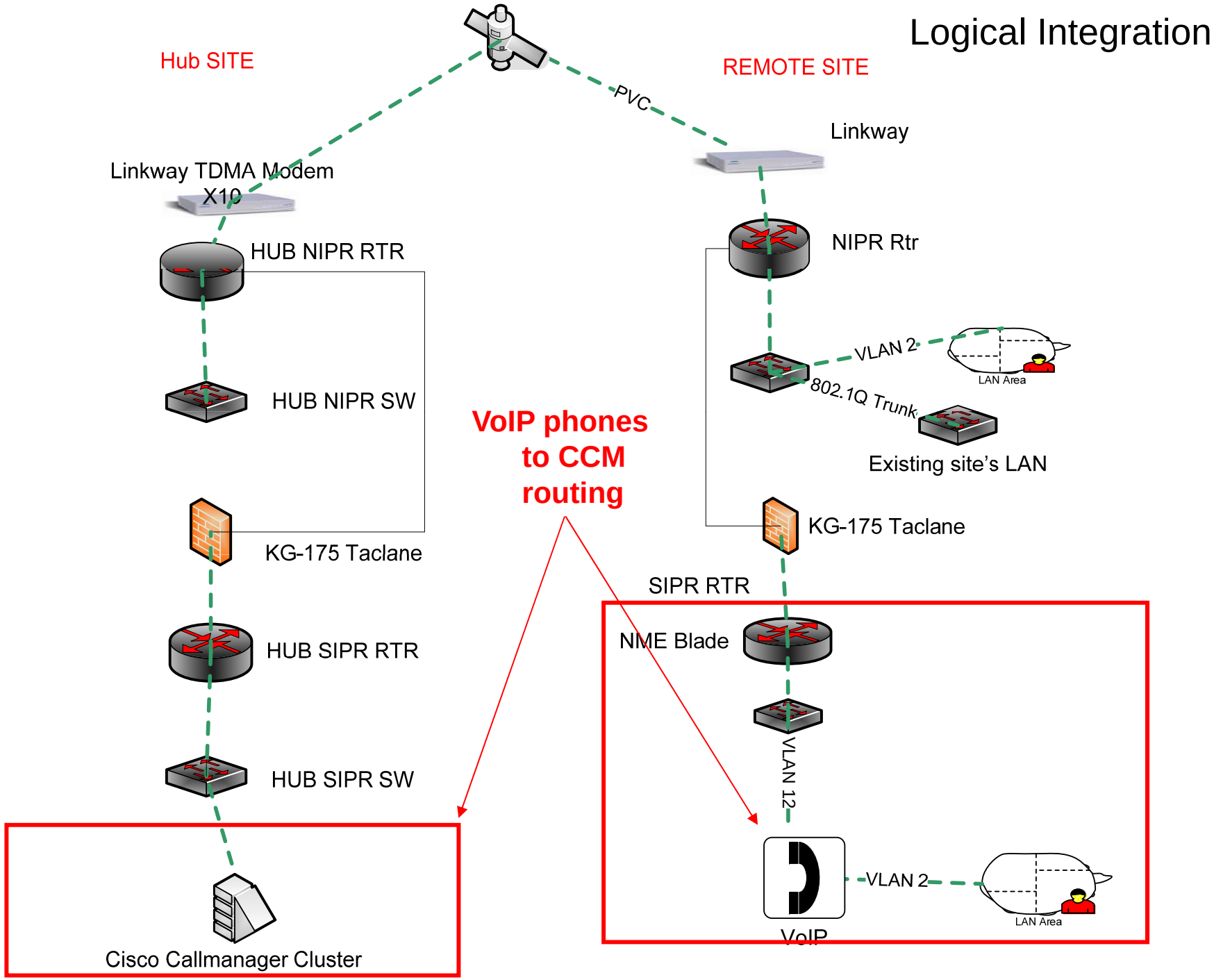
- The major functional groups:
  - Ku-Band Very Small Aperture Terminal (VSAT) auto-acquiring antenna,
  - ViaSat Linkway IP modem, routers, accelerators, KG-175/TACLANE, and Cisco Call Manager for SIPRNET Voice over Internet Protocol (Secure VoIP). NIPRNET VoIP ready.
- All equipment is packaged in transit cases which are all HMMWV transportable.
- GSWAN remotes hub back to the DKET LT at Al Asad.

An Operational Integration Example: SWAN

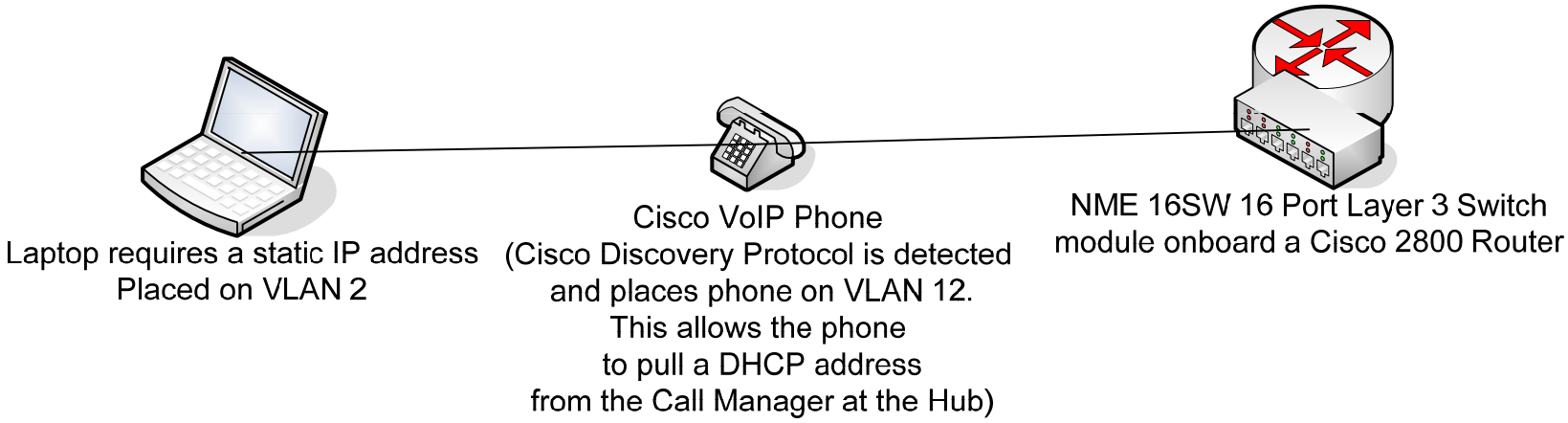
- Integration Challenges
  - Physical
    - Placement / Ownership
    - Form factor
  - Process
    - TTPs changed
    - Training
  - Logical (configuration)
  - Proprietary issues
    - CDP
  - Organizational challenges

GSWAN fielding team – Iraq

Logical Integration



Proprietary Considerations

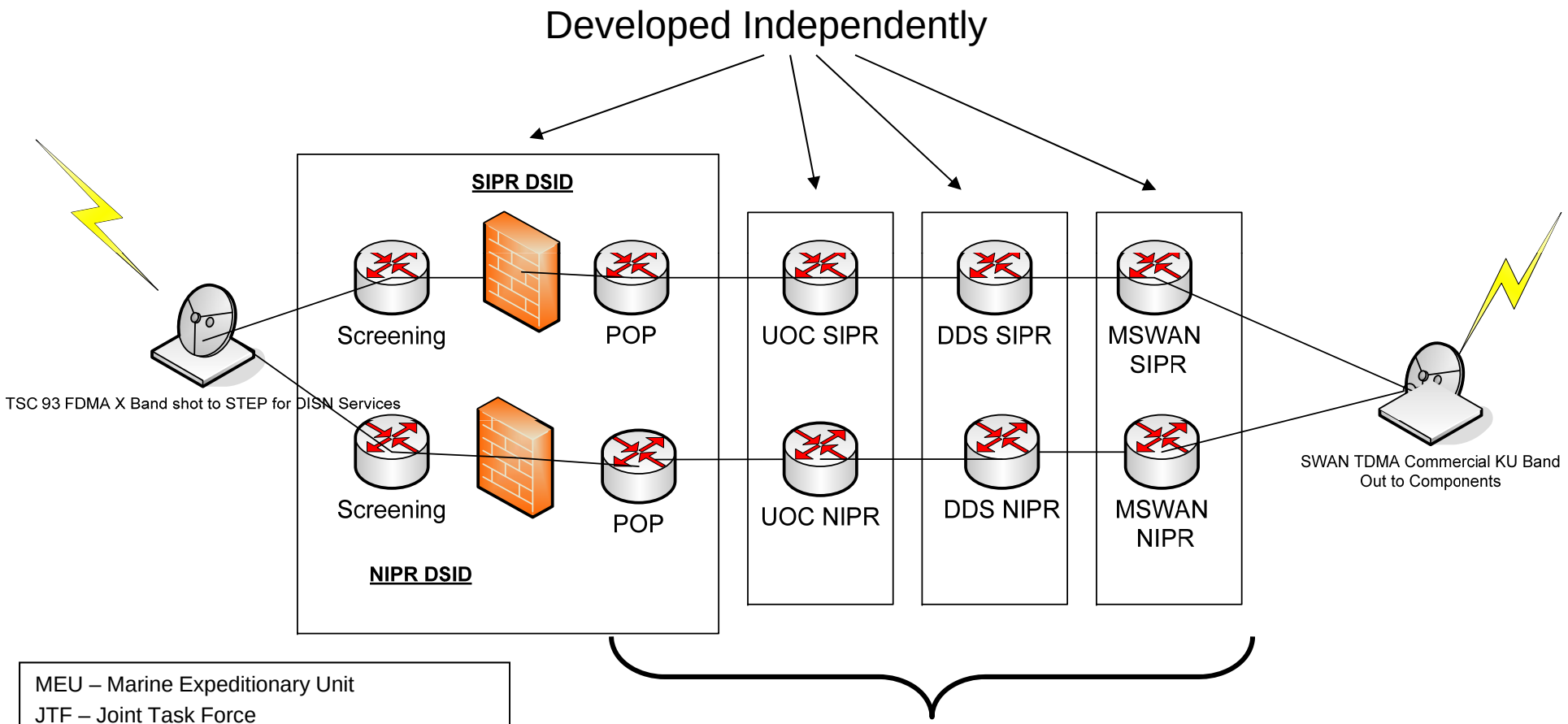


Benefit: This solution allows 2 devices on single physical port (2 VLANs). Mixing of DHCP and static IP.

Consideration: No mixing of non-Cisco IP phones.

Physical Integration Challenge

11th MEU JTF Enabler



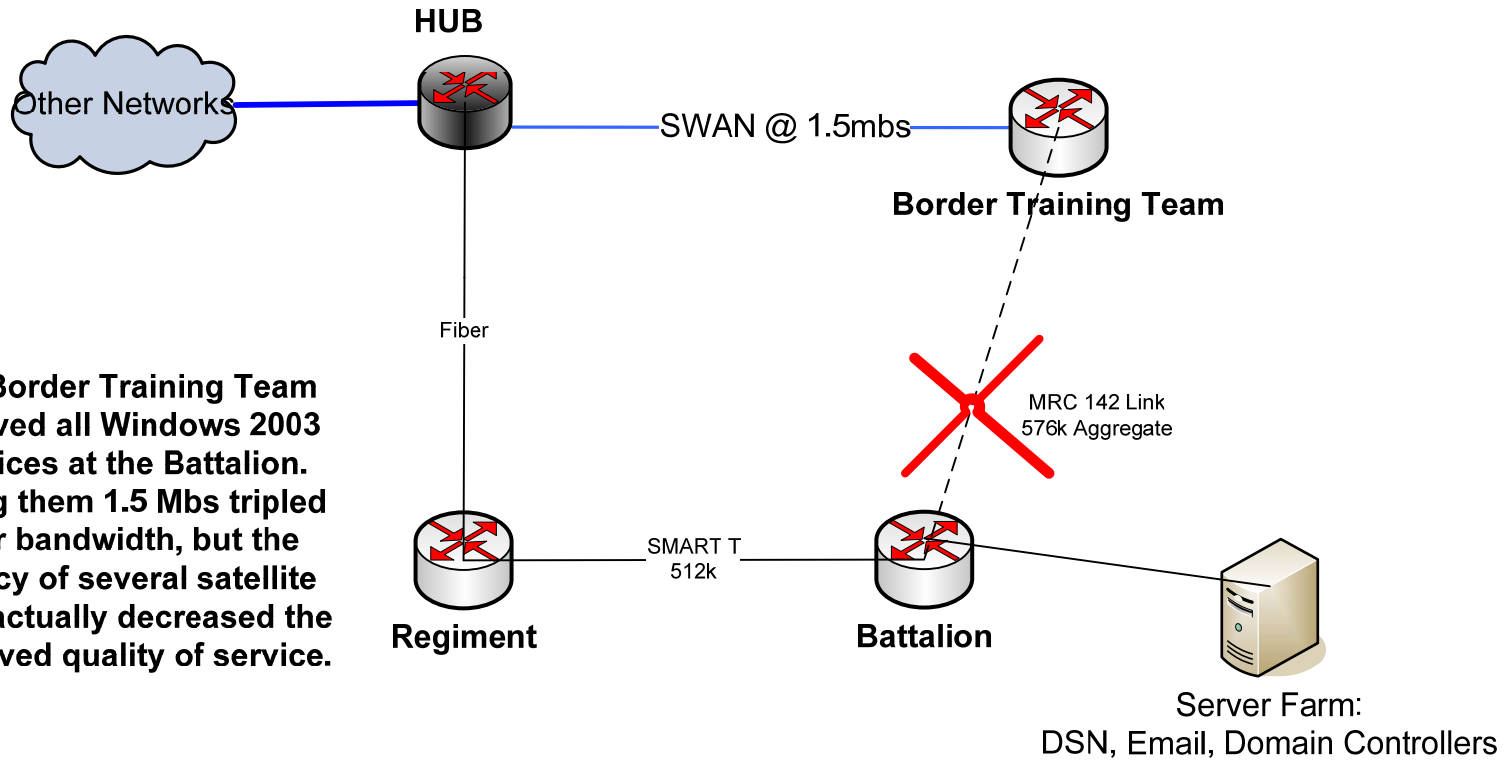
MEU – Marine Expeditionary Unit
JTF – Joint Task Force
DSID – Deployed Security Interdiction Device
UOC – Unit Operations Center
DDS – Data Distribution System
MSWAN – MEU Storage Wide Area Network
TPFDD – Time Phased Force Deployment Data

Eight routers!

Each “system” also has servers

TPFDD Hasn’t changed for MEU Comms – footprint is bigger

Integration is mission effective…but not perfect



The Border Training Team resolved all Windows 2003 Services at the Battalion. Giving them 1.5 Mbs tripled their bandwidth, but the latency of several satellite hops actually decreased the perceived quality of service.

Final Thoughts

- **Perfect integration is not the goal…mission effectiveness is.**
- **Human systems integration is critical (effectiveness depends on people's capabilities, training, currency, proficiency, etc)**
- **Integration is facilitated by open architecture (OA), non-proprietary solutions, adaptability (think - internet protocols), simplicity (Occam's razor)**
- **"System of systems" integration…still requires systems engineering discipline**
- **There's always factors not considered**
- **Systems Engineers are the "first line of defense" in solving system of systems integration problems in the operational environment**

QUESTIONS ?

Backup Slides

Wireless Point-to-Point Link (WPPL)

- Orthogonal Frequency Division Multiplexing Waveform (form of 802.16 – WiMax)
- AN-50e system operates in the license-exempt 5.8 GHz band or 5.4 GHz band.
- Delivers rates up to 48 Mbps depending on distance and terrain.
- The essence of OFDM is that it breaks up the transmitted signal into many smaller signals.
- OFDM can communicate over hills, around buildings, and through trees for a non line-of-sight capability.
  - NIPRNET and SIPRNET
  - 4 Voice calls (support POTS, STU/STE, and VoIP phones)
  - 1x1 foot and 2x2 foot antennas
  - 10 foot masts