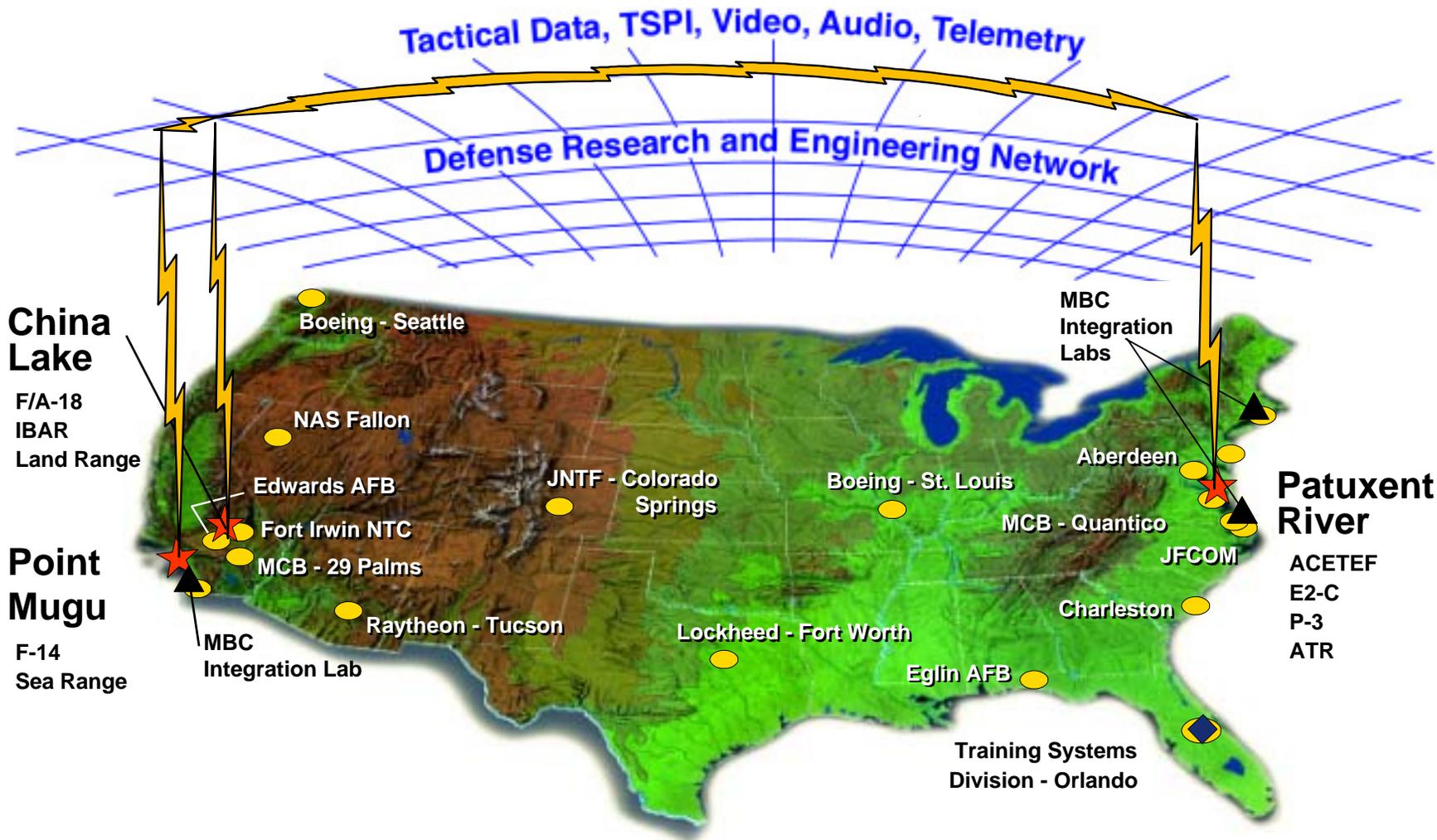




Eileen Shibley
Ray May
April 2004

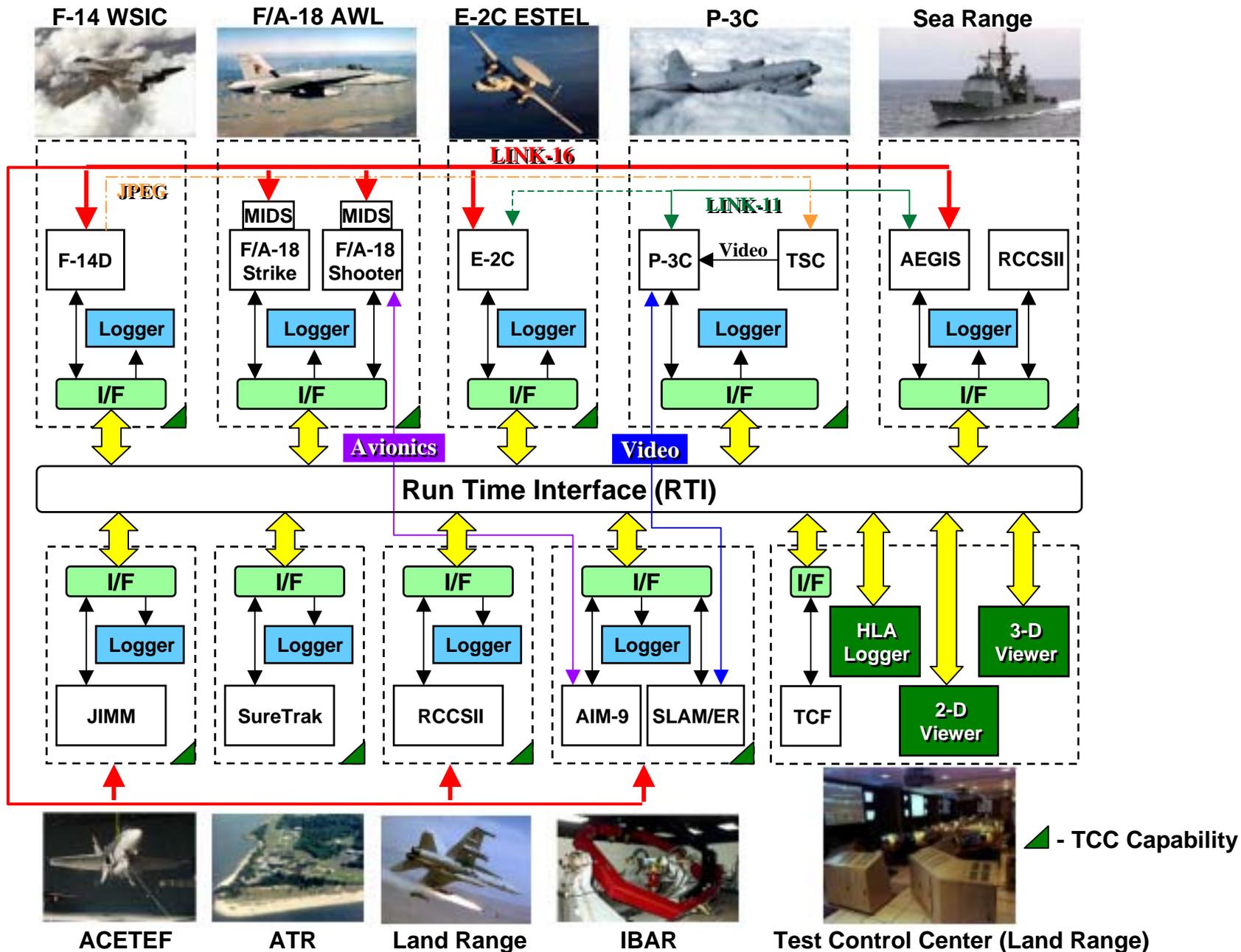
Full-Spectrum RDT&E

Coast-to-Coast Connectivity



- ★ Current DNet Nodes
- Potential DNet Nodes
- ▲ Maritime Battle Center
- ◆ Training Systems Integration Labs

Distributed Test Configuration



MIDS Program Office On Distributed Testing

- On two separate occasions, I witnessed and face-evaluated live Link-16 messages transmitted and received between the following hosts: E-2C Group II; F-14D; AEGIS Model 4; and F/A-18. The transmitted and received PPLI, SURV, F/F, and Air Control J messages were sighted and their contents broken out in real-time at the F/A-18 lab's GTE in response to specific test procedures steps.
- Specifically I believe
 - **Procedures are valid for MIDS/Link-16 testing**
 - **Data transfers were error-free**
 - **F/A-18 system under test responded correctly to received Link-16 J-messages**
 - **Link-16 messages are valid and representative of actual lab and flight test data**

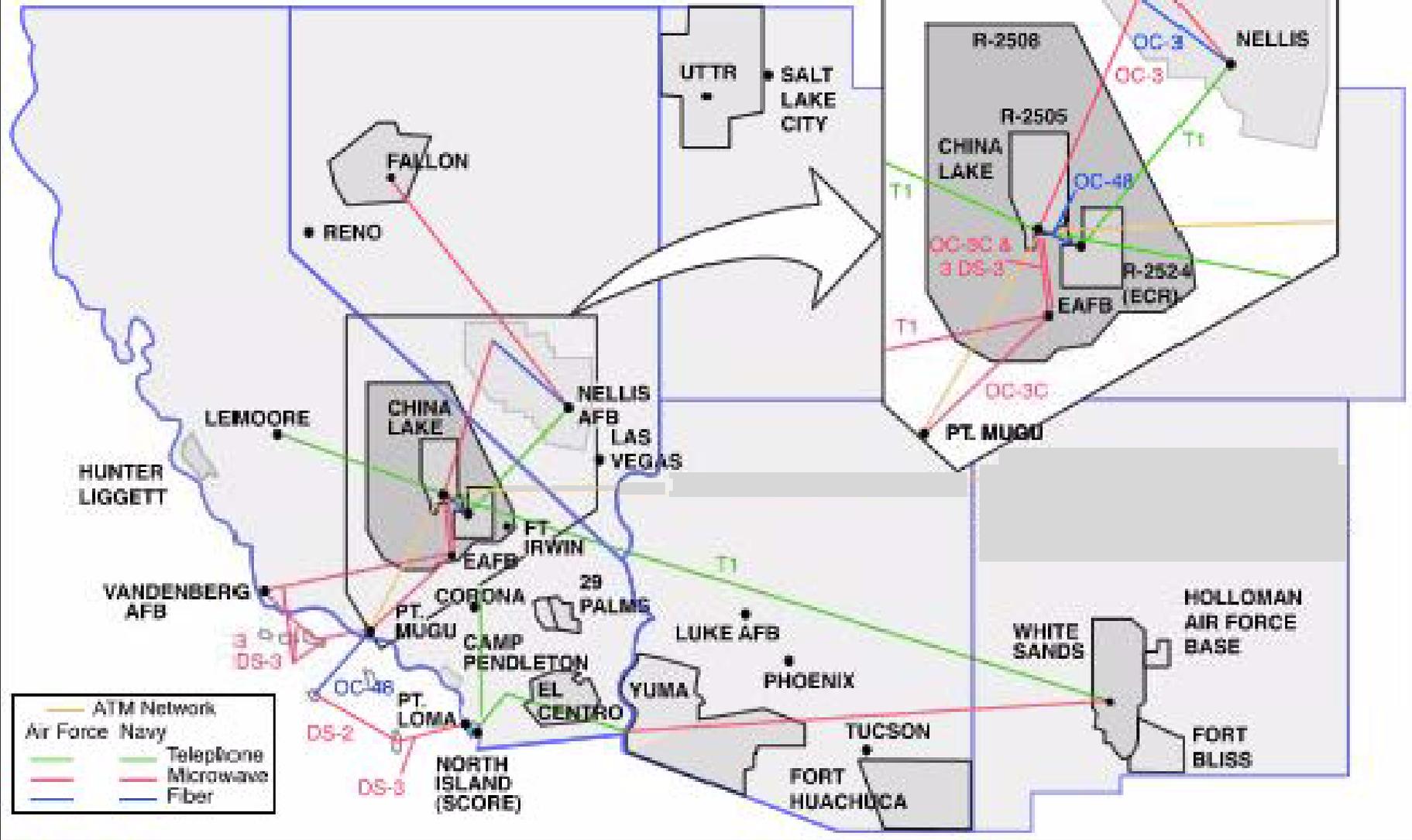
- *I wish this capability had existed three years ago.*
- *It would have taken me three years and a battle group to accomplish what I accomplished during two hours of DNet test time*

Frank Achille
F/A-18 MIDS expert

Full Spectrum RDT&E

- **Network Centric RDT&E environment that provides scientists, engineers, analysts, and participating warfighters distributed yet fully integrated access to ranges, labs, and test assets:**
 - Joint, Joint, Joint - develop, test, train the way we fight
 - System-of-Systems perspective - designed from the outset
 - Interoperability requirements – intra-Service and Joint
 - Deliver quality products faster to the Warfighter
 - Reduce time to process and analyze test data
 - Eliminate stove pipe networked solutions: cost-share the WAN
 - 24/7 access to test data on an as needed basis: use a network-based secure data warehouse
 - Provide access to “what’s needed” “when it’s needed” not all data the just once
 - Reduce travel associated with conducting tests

RDT&E Connectivity



RDT&E Community Requirements

■ Provide Engineers, Analysts, and other Scientists access to:

- Real Time and non-Real Test Data
- Real Time Telemetry
- Real Time and non-Real Time Video
- Real Time and non-Real Time Audio

■ Return On Investment:

- Deliver quality products faster to the Warfighter
- Reduce time to process and analyze test data
- Eliminate stove pipe networked solutions: cost-share the WAN
- 24/7 access to test data on an as needed basis: use a network-based secure data warehouse
- Provide access to “what’s needed” “when it’s needed” not all data the just once
- Reduce travel associated with conducting test

Solution

- Single Integrated WAN utilizing Type 1 Multi-point Encryptors:
 - Migrate away from stove pipe solutions that use point-to-point links
 - Service aggregation
 - ATM-based: KG-75A
 - IP-based: KG-175
 - Cost reduction and savings
- Cryptographically isolated channels using:
 - Pre-Placed Key (PPK) Material
 - Permanent Virtual Circuits (PVC)
- Multi-Level System for Authentication, Access, and Auditing (AAA):
 - Trusted Solaris and/or Trusted Irix
 - Discretionary Access Control (DAC) rules via strong username and password authentication
 - Mandatory Access Control (MAC) rules via label encodings database based on Classification and Compartment
 - Log all transactions: role-based rather than user-based system

Leveraging Investments

■Architecture:

■Eliminate point-to-point links by utilizing meshed WAN cloud:

■China Lake, CA:	OC-12c (ATM & IP)
■Pt. Mugu, CA:	OC-3c (ATM & IP)
■NSWC Crane, IN:	DS-3 (ATM)
■El Segundo, CA (Raytheon):	OC-3c (ATM)
■Hazelwood, MO (Boeing) :	OC-3c (ATM)
■Bethpage, NY (Northrop Grumman):	DS-3 (ATM)

■ATM call-based solution

■Capacity and bandwidth sharing

■KG-75A Encryptors

■Mult-level security PVCs associated with unique closed segment PPKs allows single encryptor to support multiple communities of interest

■Resources

■Labs

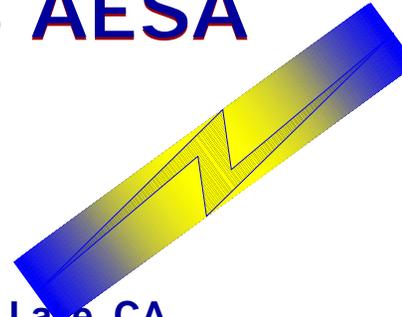
■Ranges

■People: Scientists, Engineers, Analysts

Full Spectrum RDT&E Success Stories

- F/A-18 APG-79: Active Electronically Scanned Array (AESA)
- SLAM-ER
- E/A-18G
- A/V-8B
- F-15
- NGA

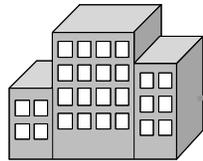
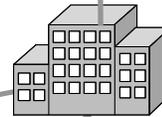
F/A-18 AESA



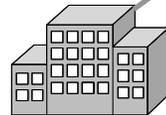
RCC – China Lake, CA



**Advanced Weapons Lab –
China Lake, CA**



Boeing - St. Louis, MO



Raytheon - El Segundo, CA

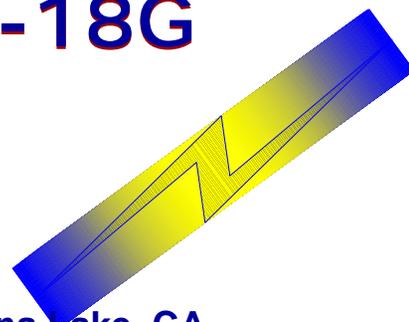
- **FY03-FY06 600+ Flights**
- **Successful Initial Test Flight on 7/30/03**
- **Fully Operational**

- Next Generation Radar for F/A-18 Super Hornet
- Real time telemetry, audio, and video feeds
- ATM Network
- Classified communications architecture
- Connectivity to multiple facilities including Air Force and Contractor
- Post-test access into Data Warehouse @AWL

E/A-18G



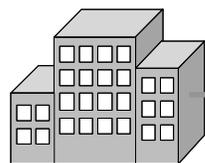
- E2 Capability for F/A-18 Super Hornet
- Real time telemetry, audio, and video feeds
- ATM Network
- Classified communications architecture
- Connectivity to multiple facilities including Contractor
- Post-test access into Data Warehouse @AWL



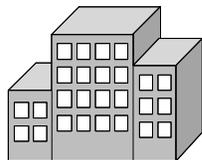
RCC – China Lake, CA



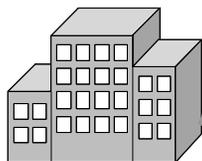
Advanced Weapons Lab –
China Lake, CA



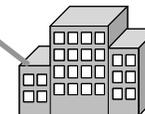
Pax River, MD



Boeing - St. Louis, MO



NSWC Crane, IN



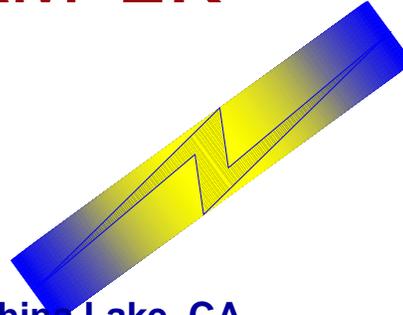
Northrop Grumman – Bethpage, NY



Pt. Mugu, CA

● Distributed Test Team IOC:
01JULY04

SLAM-ER

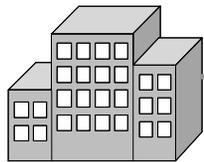
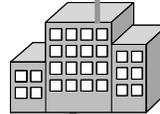


- AGM-84K Standoff Land Attack Missile – Expanded Response (SLAM-ER)
- Full PCM bit stream sent to St. Charles, MO
- RangeView data streamed to St. Charles, MO
- Live and Captive Test support
- Post-test Data Warehouse Access

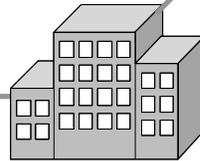
RCC – China Lake, CA



**Advanced Weapons Lab –
China Lake, CA**



Boeing St. Charles, MO

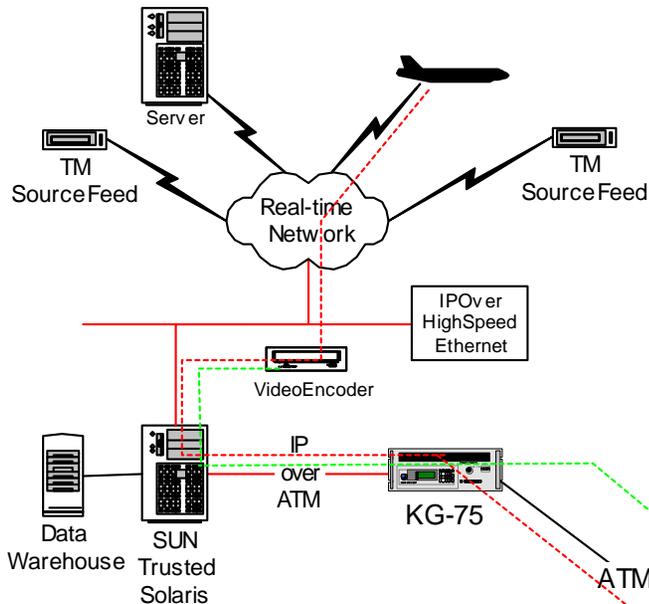


Boeing St. Louis, MO

- **IOC: 15OCT03**
- **Currently Fully Operational**

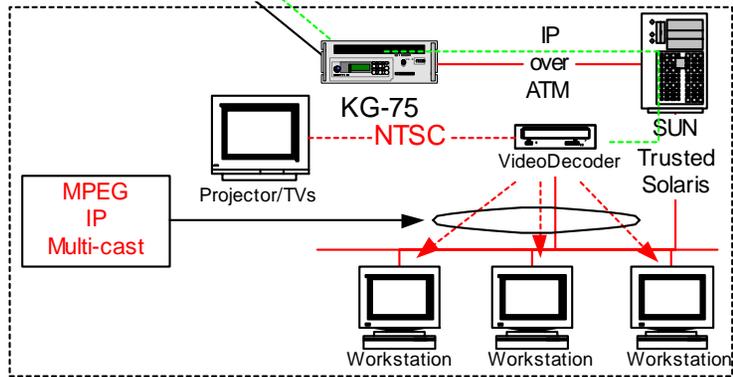
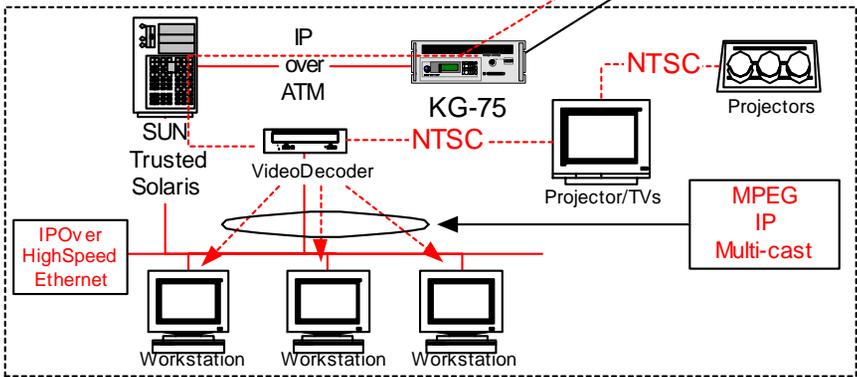
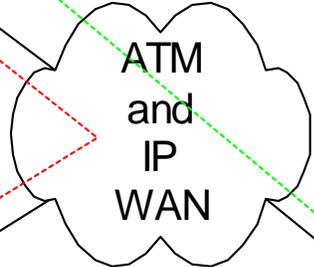
F/A-18 APG-79: Active Electronically Scanned Array (AESA)

- Successfully created AESA Distributed Test Team:
 - Government and Industry Triad conducting research, development, integration, and deployment of next-generation F/A-18 Radar
 - Sponsored and established DREN nodes at Boeing in St. Louis, MO and Raytheon in El Segundo, CA
 - Created classified real-time test network between China Lake's Land Range, Pt. Mugu's Sea Range, Boeing, and Raytheon
 - Provide end-to-end real-time video, audio and RangeView TM feeds to Boeing and Raytheon during flight test operations
 - Provide high-speed classified access for Boeing and Raytheon to post-test data on a multi-level security warehouse utilizing Trusted Solaris
 - Provide classified video and audio conferencing capability
 - Achieved full security accreditation at all sites

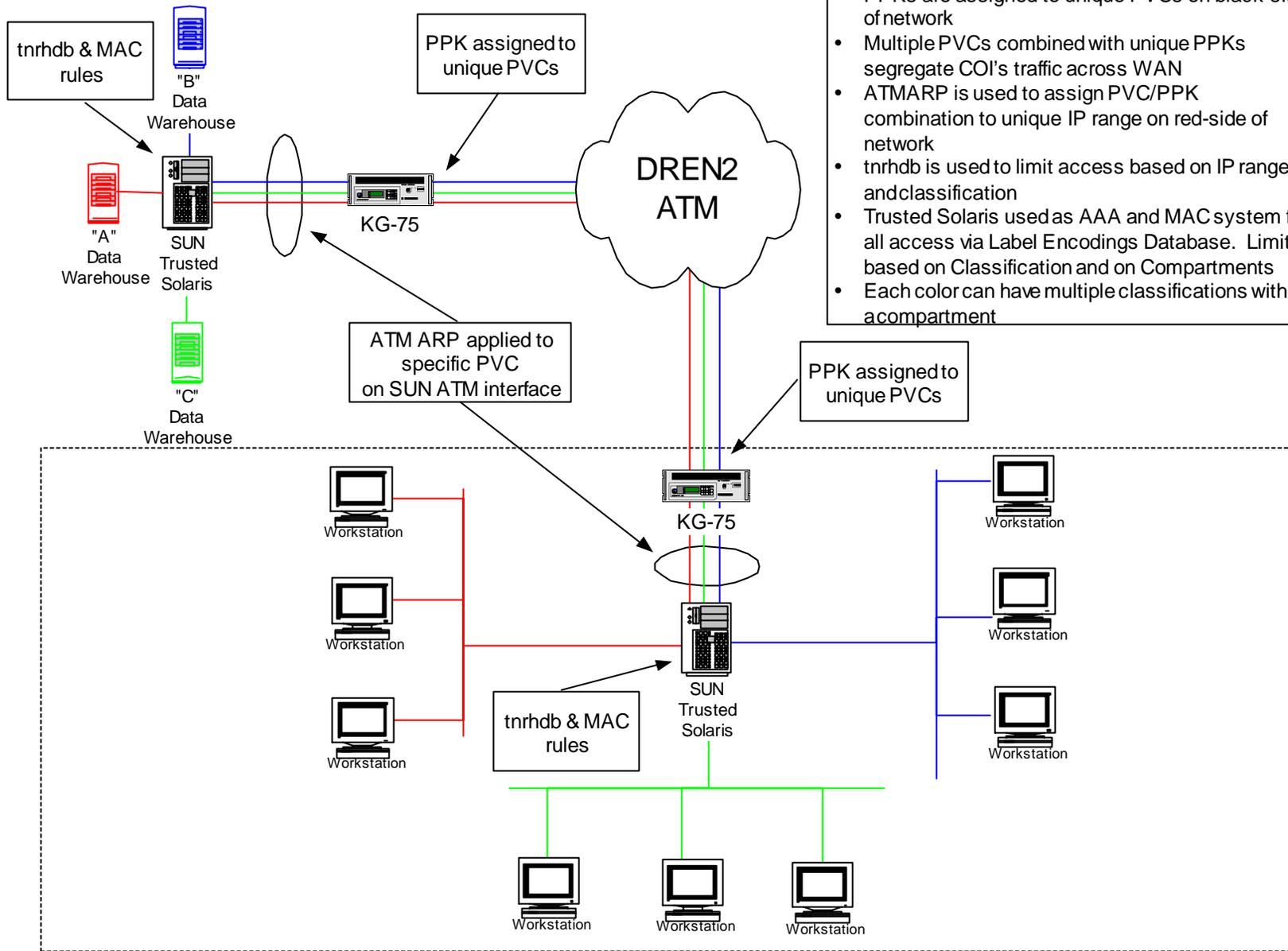


- Video/Audio Encoder sends MPEG stream to remote sites
- Remote sites' Video/Audio Decoder outputs feed to NTSC devices and IP multicasts over LAN
- Remote sites' Video/Audio Decoder IP multicasts MPEG stream over LAN enabling multiple local PC's to receive streaming video and audio
- Multiple PVCs combined with unique PPKs segregate COI's traffic across WAN
- ATMARP is used to assign PVC/PPK combination to unique IP range
- tnrhdb
- Trusted Solaris used as AAA and MAC system for all Real-time and non Real-time data access via Label Encodings DB

F/A-18 AESA



- PPKs are assigned to unique PVCs on black-side of network
- Multiple PVCs combined with unique PPKs segregate COI's traffic across WAN
- ATMARP is used to assign PVC/PPK combination to unique IP range on red-side of network
- tnrhdb is used to limit access based on IP range and classification
- Trusted Solaris used as AAA and MAC system for all access via Label Encodings Database. Limits based on Classification and on Compartments
- Each color can have multiple classifications within a compartment



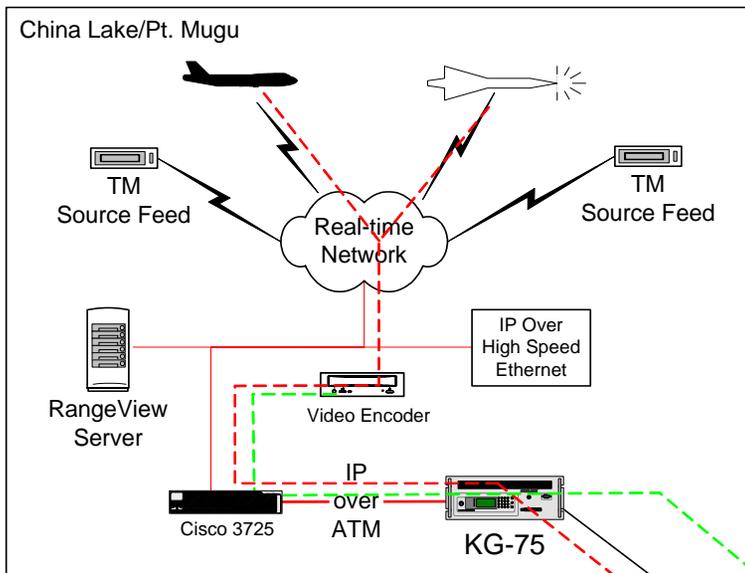
Summary

- Requirements based RDT&E and Training
- Maximize RDT&E community resources by cost sharing WAN links
- Future Challenge – “right” mix of M&S and Test or Training assets
- Reduce Test Development Cycle to help deliver quality products faster to the Warfighter
- Network-based architectures versus platform-based
- Leverage Investments

Battlespace Environment



***The ability to combine live, virtual, and constructive
in a Common Battlespace Environment***



- Video/Audio Encoder sends MPEG stream to remote sites
- Remote sites' Video/Audio Decoder outputs feed to NTSC devices and IP multicasts over LAN
- Remote sites' Video/Audio Decoder IP multicasts MPEG stream over LAN enabling multiple local PC's to receive streaming video and audio
- Multiple PVCs combined with unique PPKs segregate COI's traffic across WAN
- ATMARP is used to assign PVC/PPK combination to unique IP range
- RangeView Server @ CL/PM collects & process R/T TM
- R/T TM is sent to remote site's RV Server and displayed simultaneously with video

SLAM-ER

