

6-7 FEBRUARY 2018



# TACTICAL NETWORK INDUSTRY FORUM



# U.S. Army Cyber Center of Excellence and Fort Gordon



## ***BUILDING A WORLD CLASS CYBER WORKFORCE***

Mr. Paul Chernek, Deputy TCM  
TRADOC Capability Manager for Tactical Radios (TCM-TR)  
CFT Tactical Network Industry Forum  
(Air/Ground Integration Session)



# AGENDA



- **Cyber CoE – Discussion of problem we are trying to address**
- **AVN CoE – Discussion of how we communicate today & communications requirements in the future**
- **PEO AVN – Near term Aviation Integration Activities**



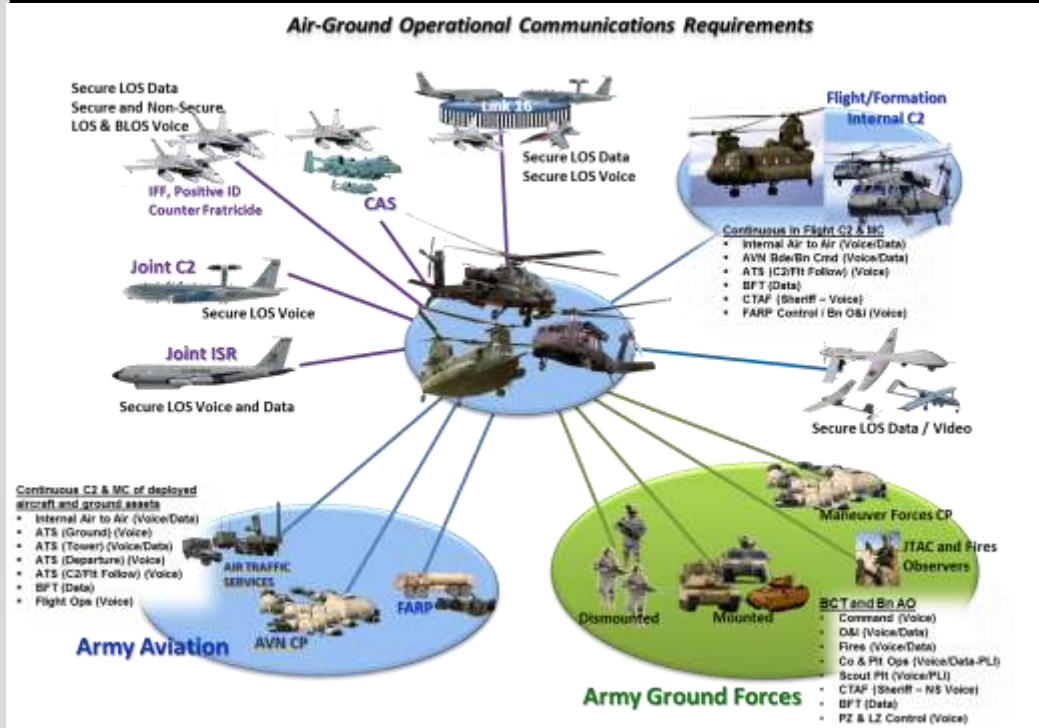
# Aviation Capability Gaps

## (What's the problem we are trying to address)



### Capability Gaps (Aviation CoE FY 2016 Capabilities Needs Assessment)

Control of Joint Effects	<p style="text-align: center;"><u>Mitigation/Capability</u></p> <p><b>Air-to-Ground and Air-to-Air networking</b></p> <p><b>Networked with mounted and dismounted leaders (Manpack / 2-Ch Leaders Radio/Nett Warrior) as well as all SINCGARS legacy radios</b></p> <p><b>Commanders and Aircrews share enhanced Situational Awareness &amp; Common Operational Picture</b></p> <p><b>Extends data networks and SINCGARS via Aerial Layer using Gray Eagle</b></p> <p><b>Meets needs for Combat Aviation Brigades (CAB), Theater Aviation Brigades (TAB), and Special Operations Aviation Regiment (SOAR)</b></p>
Operations in Highly Contested and Complex Airspace	
MEDEVAC Responsiveness	
Aircraft Platform Battle Management System	
Maintain CAB Equipment Readiness during High OPTEMPO Combat Operations	
Range Extension of Blue Force Communications	
Aircraft Network Setup and Initialization	
Airborne Mission Command on the Move	
Air Traffic Services and Airfield Management & Operations	





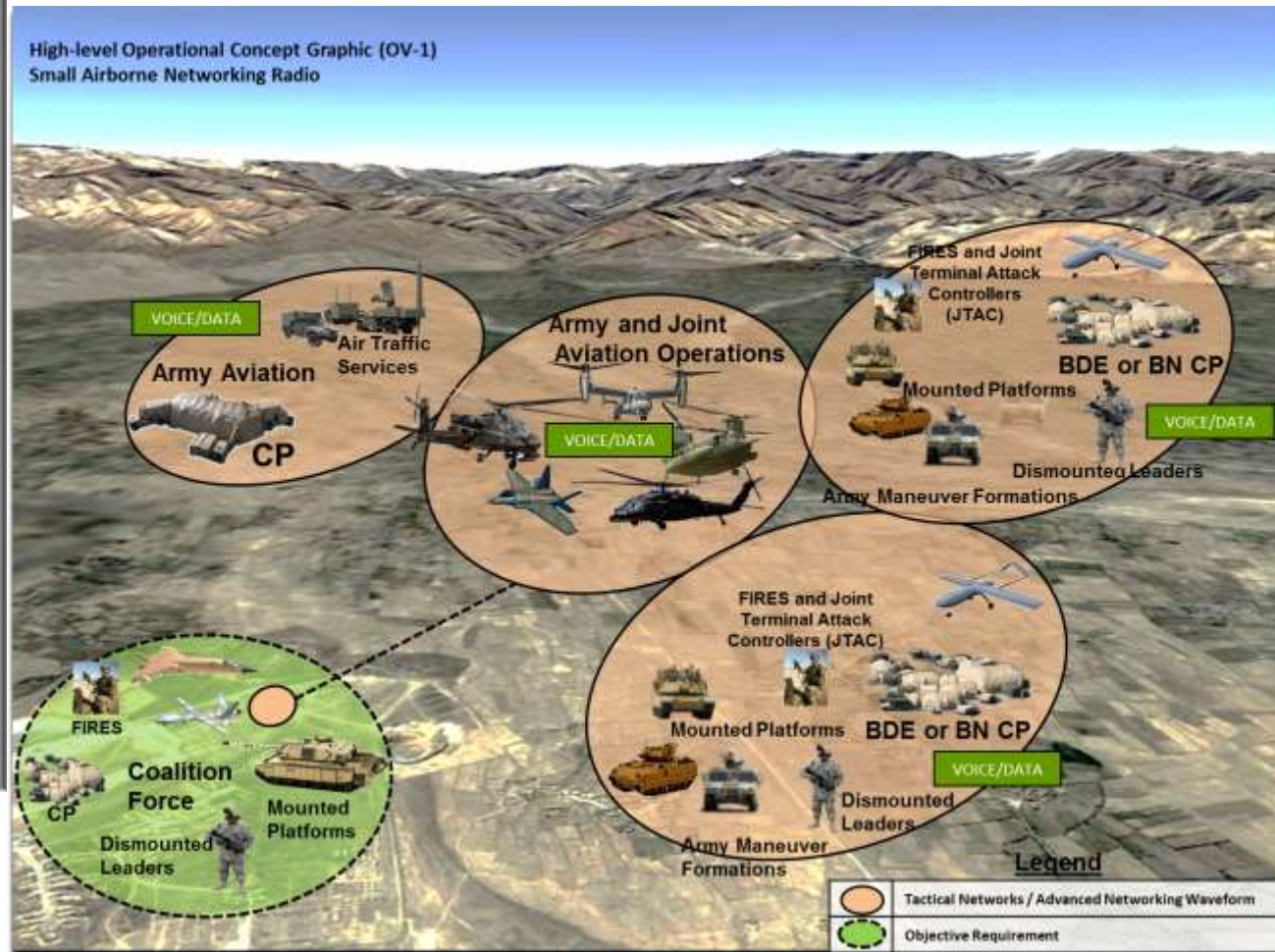


# Requirements Overview



## Provide Army Aviation Platforms

- Software Defined Radio multichannel, multimode supports legacy SINCGARS and a tactical networking capability for voice and data
- Connect with mounted and dismounted forces on the move (*Network-enabled Mission Command Initial Capabilities Document*)
- Robust self-healing and adaptable network transport capability



Operational View (OV-1)



U.S. ARMY



# Operational Communications Requirements





# Nw CFT Industry TEM

7 February 2018

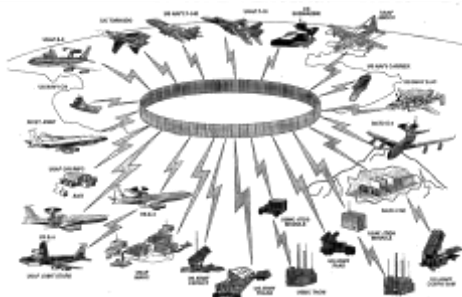
*Degraded Visual Environment (DVE)*



*Aircraft Survivability Equipment (ASE)*



*Network / Interoperability*



*Air Soldier Systems (Air SS)*

*Electronic Flight Bag (EFB)*



*Aviation Logistics*

*Air-Ground Operations*



*Air Traffic Services (ATS)*



*Maintaining Shared Understanding and Trust with Commanders and Soldiers on the Ground*

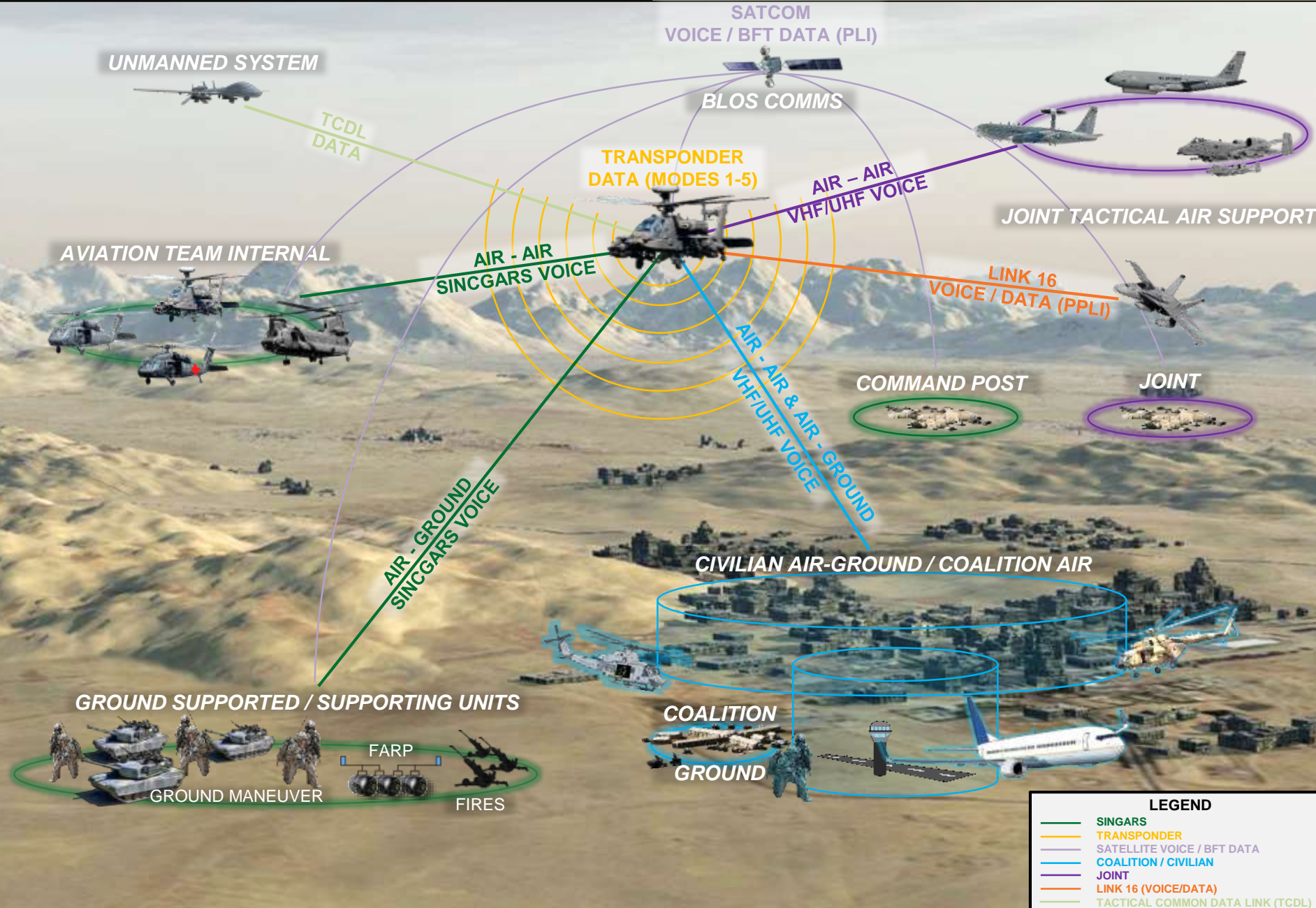




# ARMY AVIATION

## DECISIVE IN LAND WARFARE

# CURRENT AVIATION COMMUNICATIONS



LEGEND	
	SINGARS
	TRANSPONDER
	SATELLITE VOICE / BFT DATA
	COALITION / CIVILIAN
	LINK 16
	TACTICAL COMMON DATA LINK (TCDL)

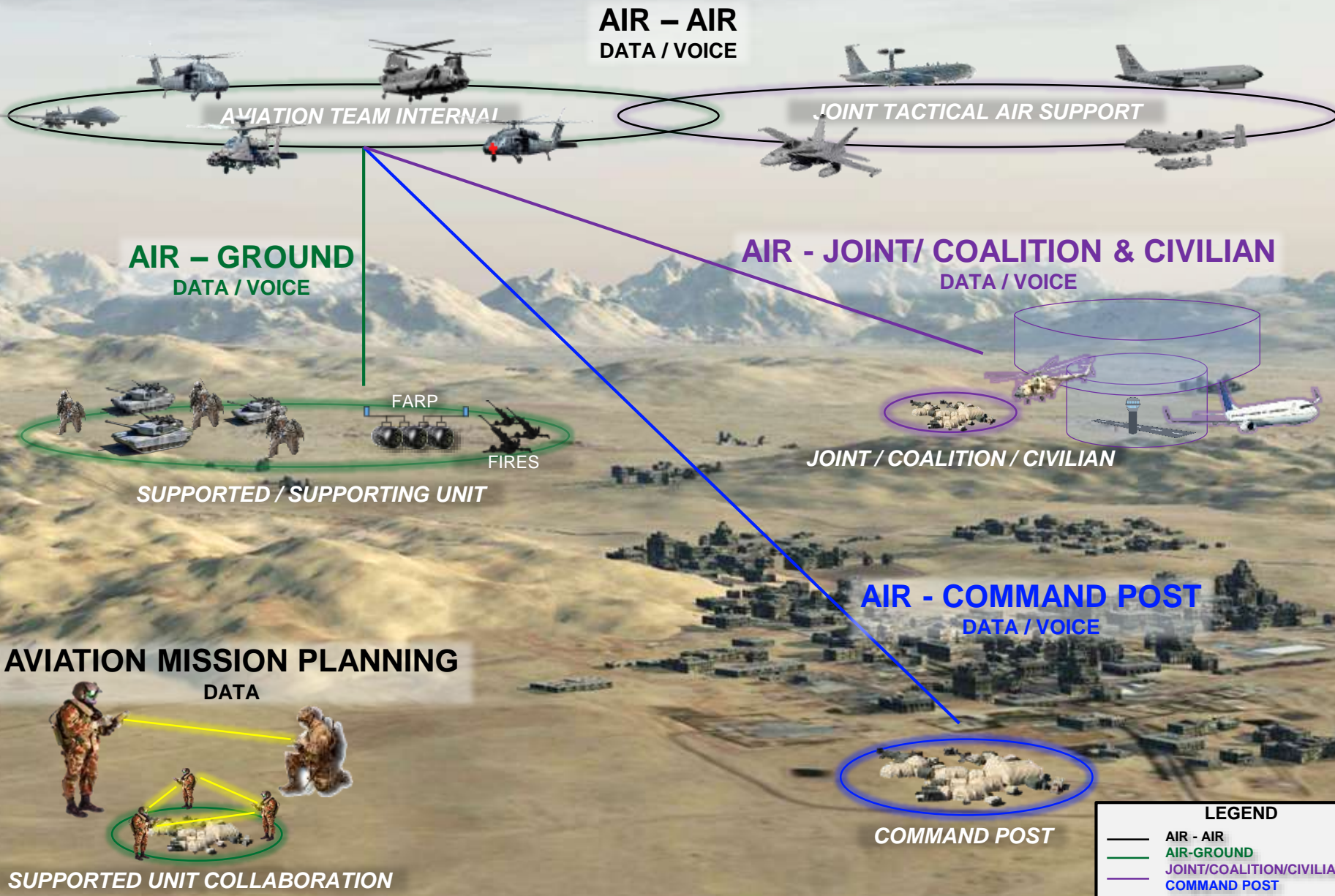




# ARMY AVIATION

## DECISIVE IN LAND WARFARE

# FUTURE AVIATION COMMUNICATIONS



**AIR - AIR**  
DATA / VOICE

AVIATION TEAM INTERNAL

JOINT TACTICAL AIR SUPPORT

**AIR - GROUND**  
DATA / VOICE

**AIR - JOINT/ COALITION & CIVILIAN**  
DATA / VOICE

FARP

FIRES

SUPPORTED / SUPPORTING UNIT

JOINT / COALITION / CIVILIAN

**AIR - COMMAND POST**  
DATA / VOICE

**AVIATION MISSION PLANNING**  
DATA

COMMAND POST

SUPPORTED UNIT COLLABORATION

### LEGEND

- AIR - AIR
- AIR-GROUND
- JOINT/COALITION/CIVILIAN
- COMMAND POST
- MISSION PLANNING



# Near Term Air-Ground Integration Activities

Network CFT Industry Day TEM

Al Abejon  
PM Aviation Systems / PEO Aviation  
Aviation Networks & Mission Command Integration Lead

7 February 2018

# Agenda



- **Air-Ground Integration Basis, Precepts & Considerations**
- **Previous Air-Ground Networks & Systems Integrations**
- **Planned Air-Ground Networks & Systems Integrations**
- **Airborne Multi-Network Prototyping Comms Lab**
- **Near-Term Timeline**





# Integrated Networks Operational Basis



- **SHOOT - MOVE - COMMUNICATE**
  - If you can't communicate, you don't know what to shoot (or not to shoot) or where to move (or where not to move)
- **SEE First, UNDERSTAND First, ADAPT First, ACT DECISIVELY First**
- **Effective Systems & Networks Integration must be:**
  - Mission Adaptable
  - Force Scalable
  - Joint Interoperable
  - Coalition Accessible



# Air-Ground Network Design Precepts



- Conduct **concurrent Design, Development, Interoperability, and Implementation** of air and ground networks
- **Design** for **three-dimensional implementation and employment**
- Enable **agile and adaptive exchange** of **critical information/data** throughout the **Spectrum of Mission Command – Full Combat, Peace & Stability, and Homeland Security**
- Support **Air-Ground Operations** in **Joint, Interagency, Intergovernmental, & Multi-national (JIIM)** environments
- Ensure **effectiveness** in a **satellite denied or degraded environment**
- Infuse **Cyber Security** as an **essential network component**



# Air-Ground Integration Considerations



- **Holistic vs. Isolated View – “Support Air-Ground Operations”**
- **Networks & Systems as Complementary not “Stovepiped Entities”**
- **Rapid Pace of Technology Changes and Airworthiness**
- **Systems Development & Programmatic Synchronization**
- **Adaptation to Dynamic Symmetrical / Asymmetrical Threats**
- **Exploring “Art of the Possible” with Users as opportunities occur**
- **Acceptable Interim Capabilities / Enable earlier Air-Ground Parity**
- **Evolve Network Strategies and Solution Sets for relevance and adaptability to Future Aircraft capabilities**

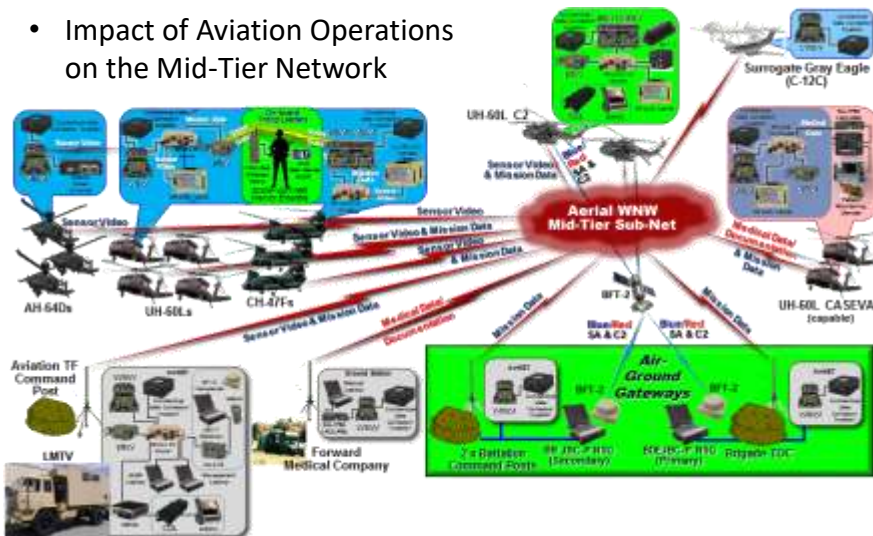


# Previous Air-Ground Networks and Systems Integrations

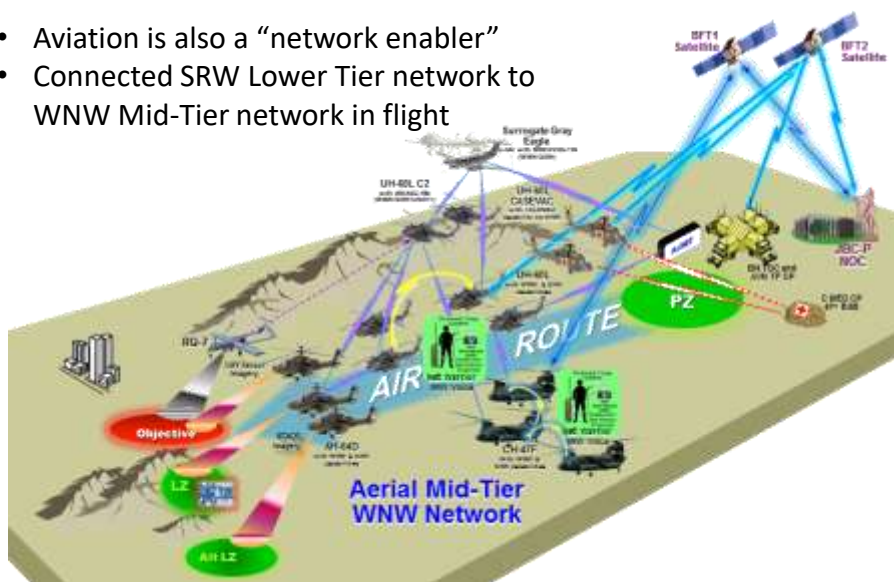


## eMAGINET AWA 17.1 (Oct 16)

- Impact of Aviation Operations on the Mid-Tier Network

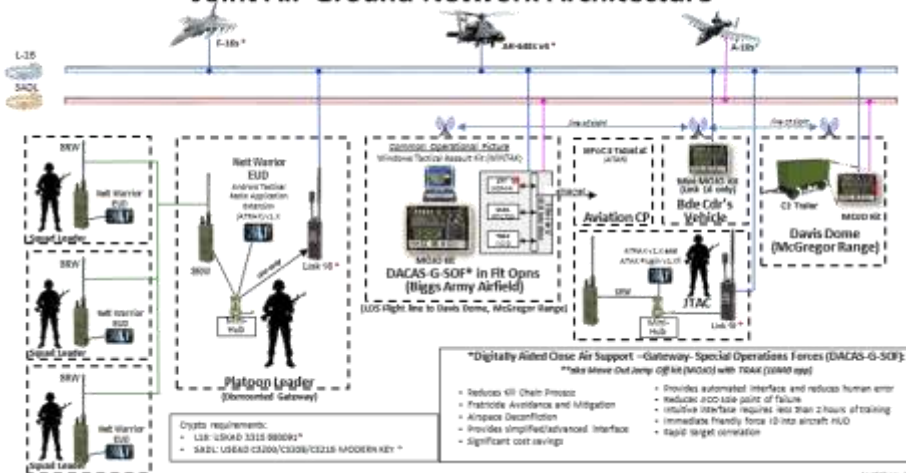


- Aviation is also a "network enabler"
- Connected SRW Lower Tier network to WNW Mid-Tier network in flight



## AGILENET NIE 17.2 (Jul 17)

### Joint Air-Ground Network Architecture



- Ground SRW tactical network joined to air Link 16 and SADL tactical networks to share SA



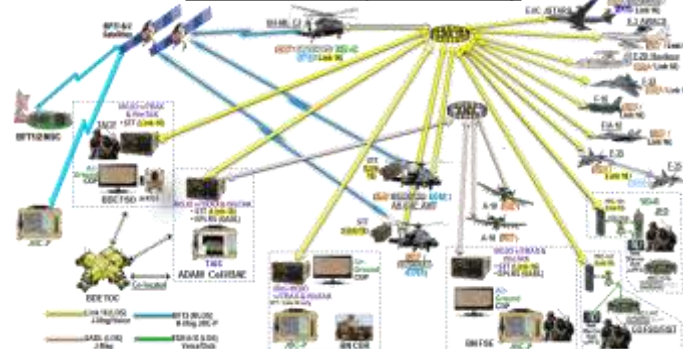
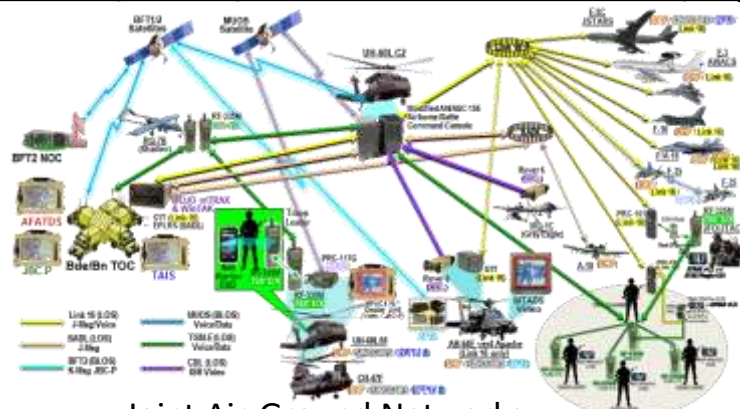


# Planned Air-Ground Networks and Systems Integrations



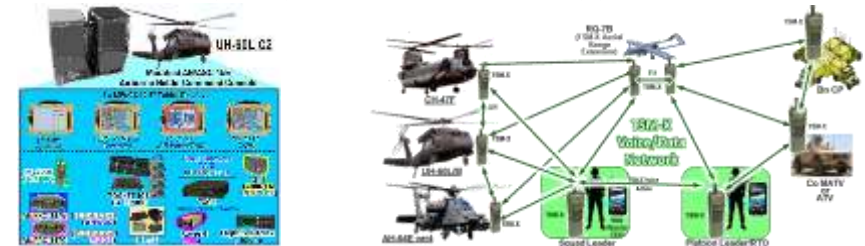
RIMPAC 18 (Jul 18) / Island Marauder 18 (Sep 18)

NIE 18.2 (Nov 18)



Joint Air-Ground Networks

Digitally Aided Close Air Support

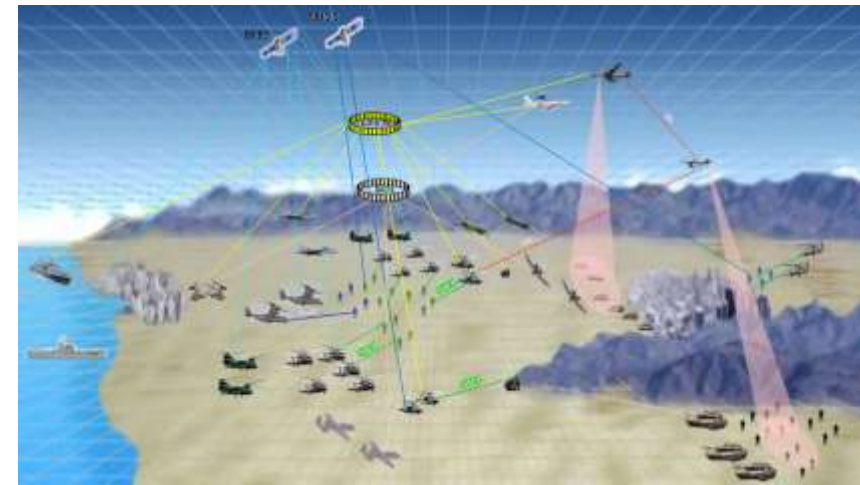


C2 Mobility & Agility

Extended Medical Network

C2 Mobility & Agility

Air-Ground TSM Interoperability



Expeditionary Force / Multi-Domain Operations

Joint Multi-Network Operations

# Airborne Multi-Network Comms Prototyping Lab



MULTIPLE FEDERATED RADIOS HOSTING:		
Waveform	LOS/BLOS	Voice/Data
SINGARS (w/CM)	LOS	Voice
ANW2C	LOS	Voice/Data
TSM-X	LOS	Voice/Data
MUOS	BLOS	Voice/Data
HQI/II (SATURN)	LOS	Voice
LINK 16	LOS	Data
BFT2	BLOS	Data
P25	LOS	Data

<p><b>MULTIPLE SURROGATE RADIOS (POR / NDI / COTS)</b></p>	<p>AVIATION MISSION COMMS COLLABORATION TOOL (CONFIGURATION/SERVER ROUTER/CONTROLLER)</p>
<p><b>AIRCRAFT TYPE SPECIFIC PALLET</b></p>	

- USER INTERFACE DEVICE (Tablet)
- RADIO SELECTOR
- WAVEFORM SELECTOR
- CHANNEL SELECTOR
- DATA INPUT

(IN COCKPIT)



CH-47F

UH/HH-60L/M/V

AH-64D/E v3/4/6





# Near-Term Air-Ground Integration Timeline



FY18								FY19													
2Q		3Q			4Q			1Q			2Q			3Q			4Q				
FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP		
SYSTEMS DESIGN, BUILD, TEST, AWR & SAFETY CERT DOCUMENTATION		RIM PAC 18 (PREP)			RIM PAC 18	ISLAND MRADR 18 (PREP)	ISLND MRDR 18	NIE 18.2 (PREP)	NIE 18.2	SYSTEMS DESIGN, BUILD, TEST, AWR & SAFETY CERT DOCUMENTATION			JWA 19.1 (PREP)	JWA 19.1							
																					Fort A.P.HILL Ex with 1-508/82nd
														SYSTEMS DESIGN, BUILD, TEST, AWR & SAFETY CERT DOCUMENTATION			NIE 19.2 (PREP)	NIE 19.2			

**Opportunities for Network Integration Exploration**



# QUESTIONS



# ST&TCO

RDECOM | CERDEC

Space and Terrestrial  
Communications Directorate



## Automated PACE



**Scott Newman**

Chief, Integrated Capabilities Office





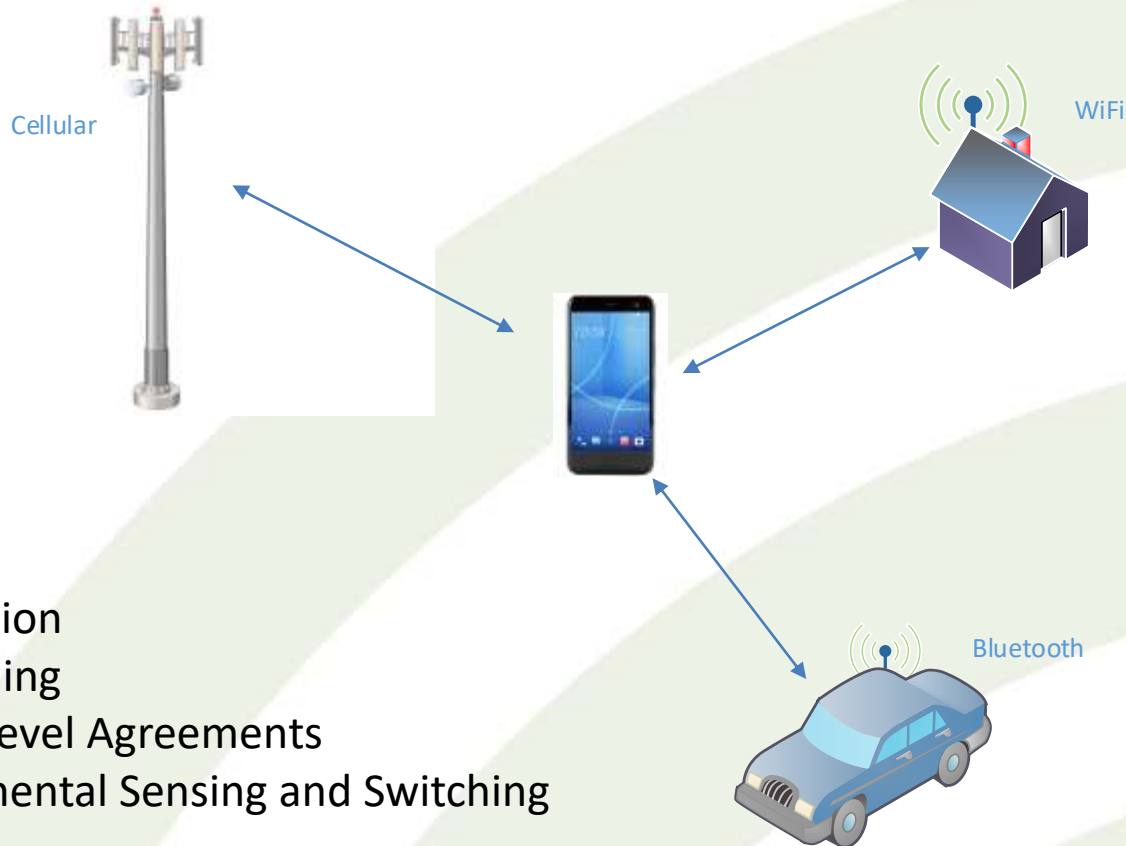


# What is PACE?



- PACE (Primary Alternate Contingency Emergency)
  - A plan that designates the order in which an element will move through available communications systems until contact can be established with the desired distant element
  - It is the S6's responsibility to develop a communications plan to support the Warfighting Function's (WFF) requirement to maintain communications
- Developing a PACE Plan is labor intensive, and time consuming
  - Each WFF evaluates its communication requirements with subordinate echelons and works with the S6 to develop an effective plan
  - The S6 must develop a PACE plan for each phase of an operation to insure that each WFF can maintain its required communications
- The PACE plan must be included in the Operations Order (OPORD) or Fragmentary Order (FRAGO) when published
  - It is the subordinate unit's responsibility to implement the PACE Plan IAW the orders
- PACE designates the order in which communications paths will be utilized
  - Ideally each method will be completely separate and independent of the other communications systems

# Commercial Example



## Primary Implementation Challenges

### • Network Segmentation

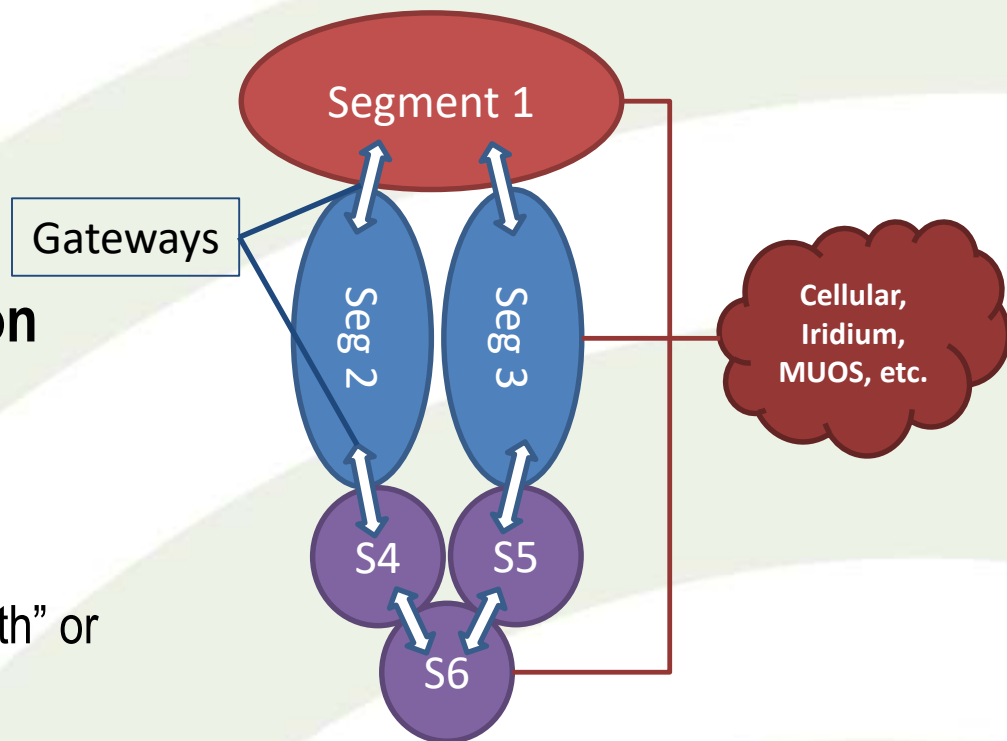
- Subnet
- Radio Frequency (RF)
- Routing Protocol

### • Gateway Placement & Selection Mechanisms

### • Lack of Route Symmetry

### • Choice between:

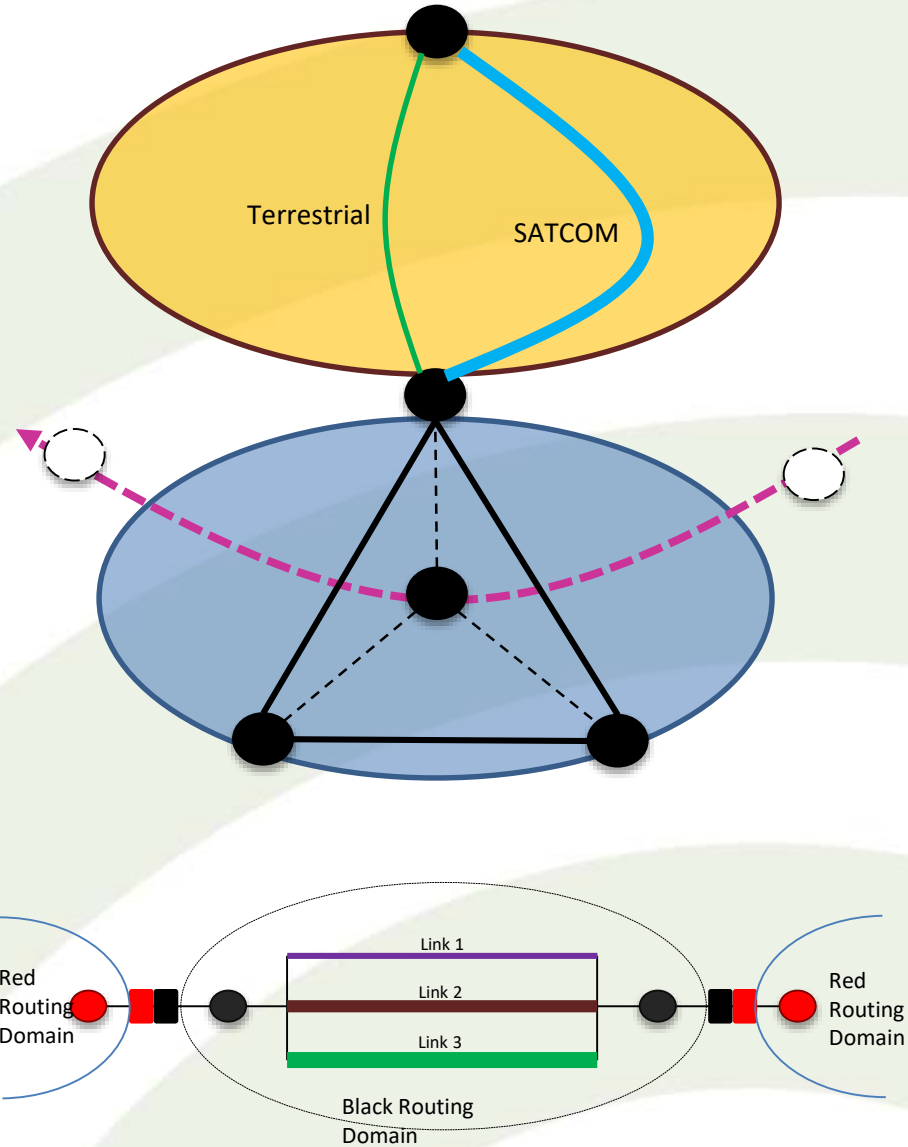
- Mechanism to choose a “best path” or
- Send traffic over multiple paths simultaneously and de-duplicate



To what extent do we invest in “healing” everything vs. accepting some level of network isolation in certain conditions (e.g., map & compass with local CNR voice)?

# Automated PACE: Routing Challenges

- Route flapping with mobile nodes
  - Not all nodes are equal; based on echelon or users
  - Some neighbors are preferred; traveling nodes affecting preferred neighbors is not preferred
  - Traveling nodes healing network is still a desired capability
- Traffic balancing across links with different characteristics
  - Satellite vs. terrestrial
  - Application-aware load balancing
- Non-common black cores restricts complete routing knowledge
- Lack of Red/Black route knowledge restricts routing optimization





# The Future Network



## Technology Components

- 1** Autonomous and Intelligence
- 2** Resiliency
- 3** Situational Understanding

## Network

- A** Automated and Intelligence Network
- B** Anti-Jam Voice
- C** Anti-Jam Data
- D** Autonomous Platform Comms
- E** Spectrum Situational Awareness
- F** High Bandwidth Commercial
- G** Spectrum Decoys
- H** Diversity and Situational Awareness

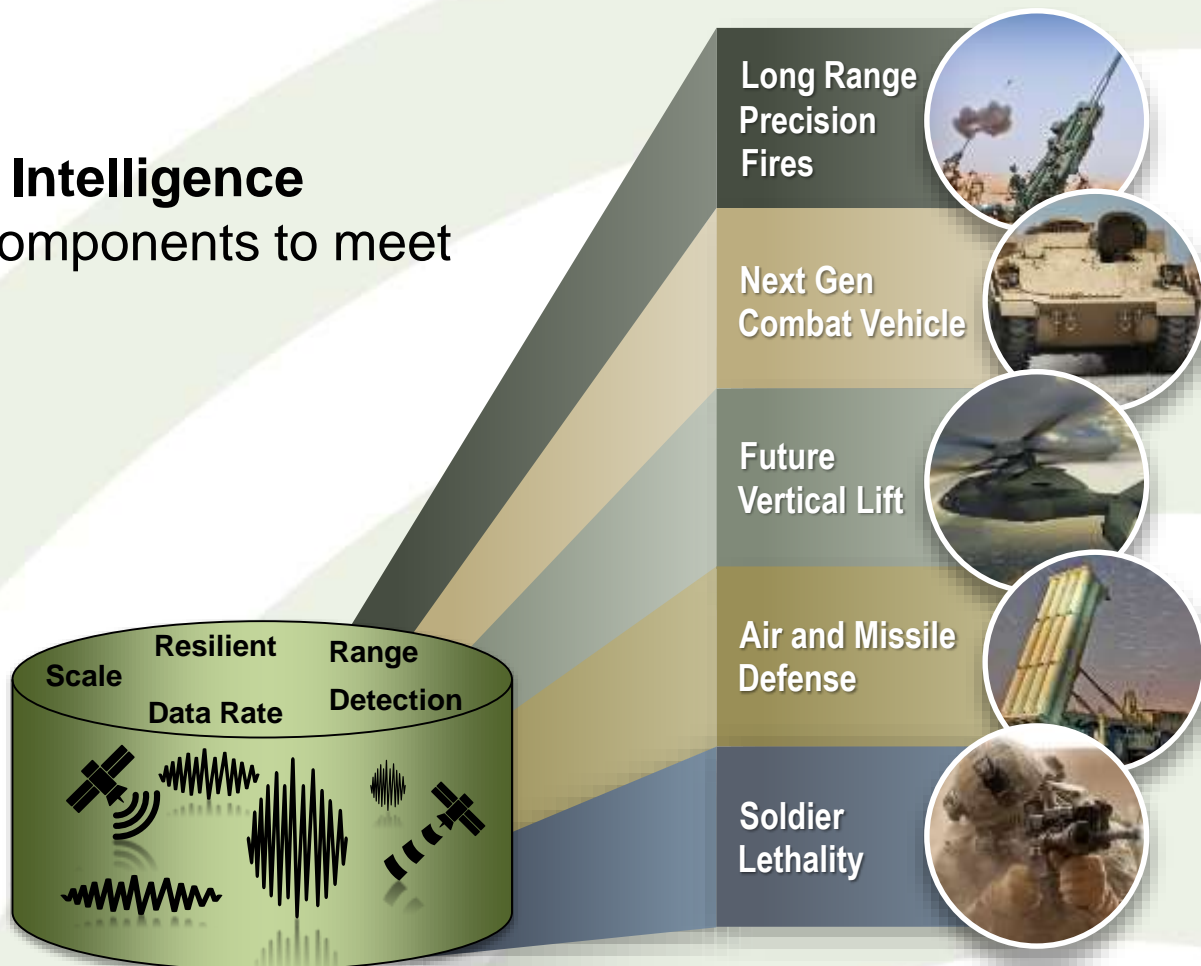
### Big 6 Priorities

- Long Range Precision Fires
- Next Gen Combat Vehicles
- Future Vertical Lift
- Air & Missile Defense
- Network/C3I
- Solider Lethality

## One Network

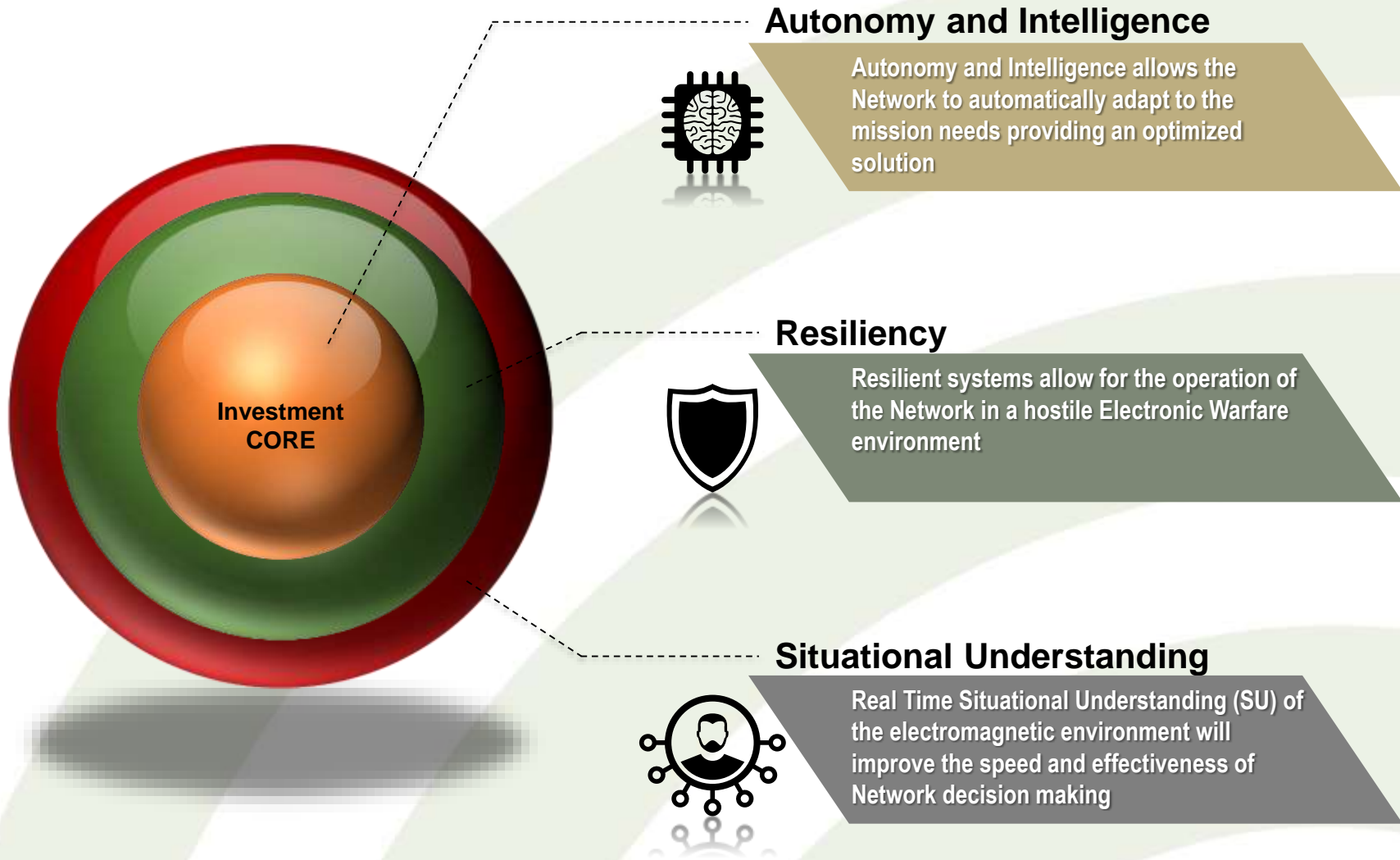
With **Automation and Intelligence** selecting the optimal components to meet the mission needs

## Army Priorities



“Tool Box” of waveforms





- New S&T effort starting in FY19
- Focuses on the following:
  - Automated Initialization
  - Decision Engine
  - Standard/Data Model for Collection
- Looking at C5 Consortium OTA as possible vehicle





# NetModX Overview

- **S&TCD is planning a field based experiment in July 2018 at Fort Dix / CGA.**
- **Purpose:** To experiment with state of the art COTS / GOTS network technologies at various maturity levels in a operationally relevant scenario / environment. New S&T programs are starting and focused on future network technologies and capabilities within the Six Modernization Priorities. Utilizing experimentation, data collection, and analysis to assist in identifying and prioritizing technology gaps. The theme of this event will be network technologies enabling **Soldier Lethality**.
- **Context:** NetModX FY18 event primary objective is to demonstrate a resilient and reliable communications capability operating in a contested electromagnetic environment at the dismounted tactical edge. To do this, both lab based and field based risk reduction activities focused on collecting and analyzing experimental data are critical to the success of our Network Modernization S&T programs.
- **Outcomes:**
  - Spectrum and Network Performance data
  - Future Network ConOps Exploration
  - Develop Metrics for operating in contested environment