# RF Initiatives

## Electromagnetic Maneuver Warfare (EMW)

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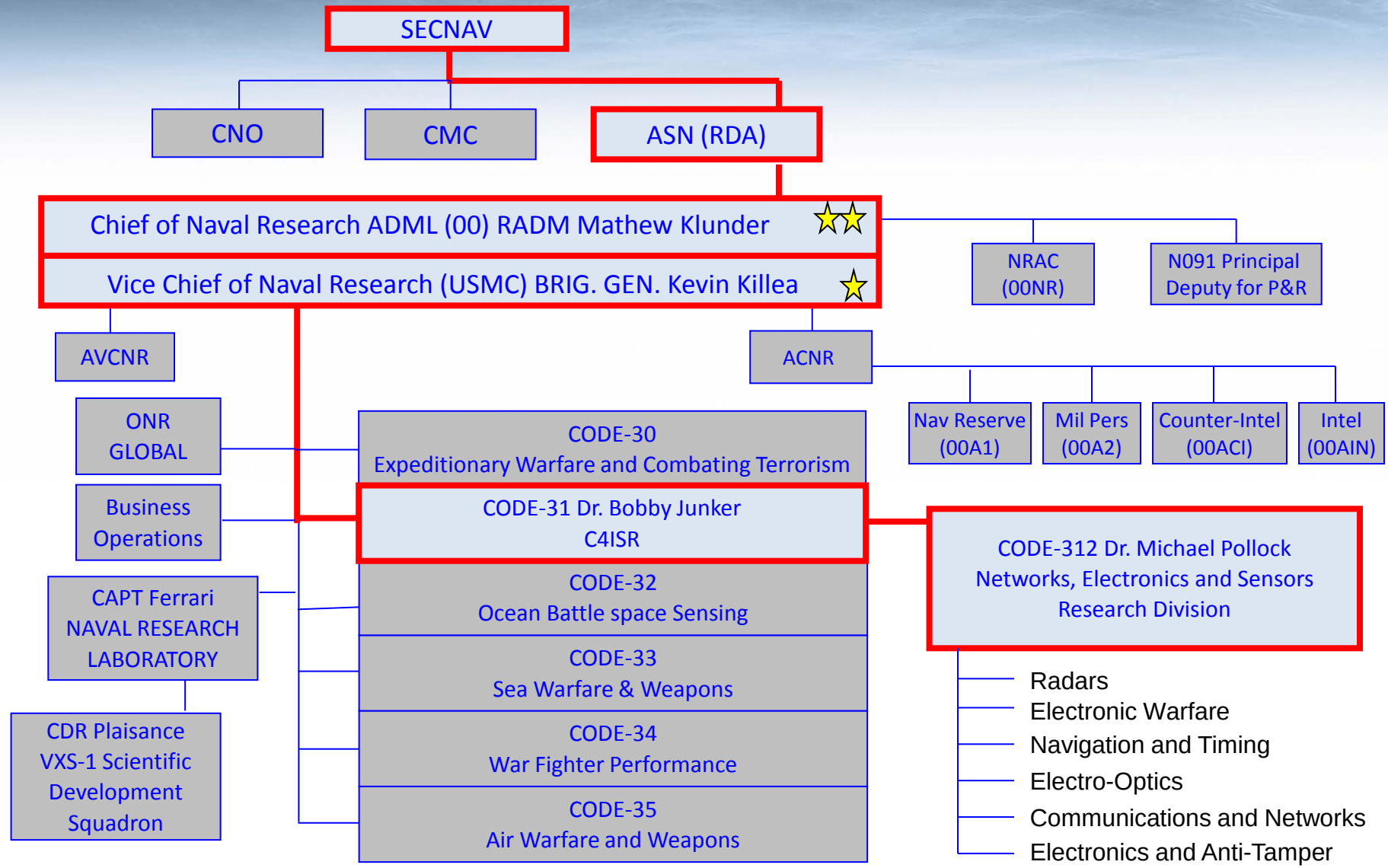
**10 April 2014**

# Who Are We



# An Uncertain Future

## Advancing Threats







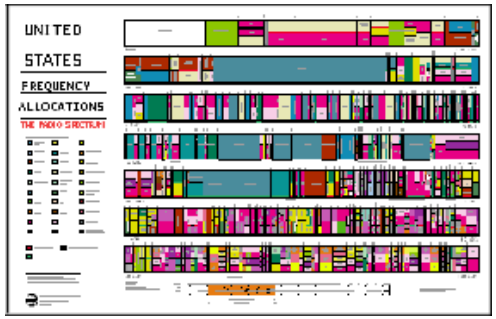

## Challenging Resources




**Smartly leverage RF resources to achieve the advantage**

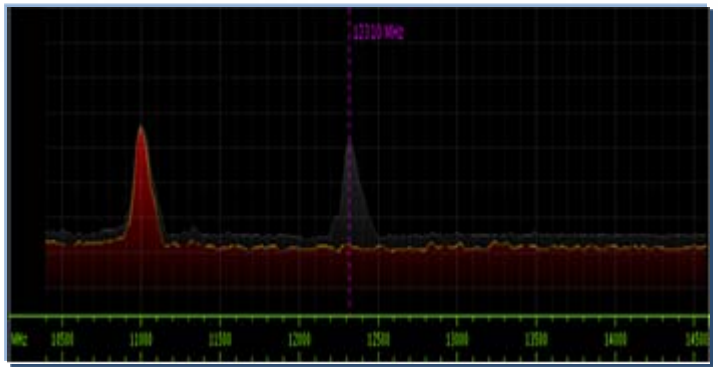
## More Demanding Environments



# Electromagnetic Maneuver Warfare

- Fundamental warfighting domain
- Enable rapid, agile and synergistic electromagnetic exploitation
- Increase affordable non kinetic options
- Exploit the EM-cyber environment
- Collective effects are more effective than individual RF actions



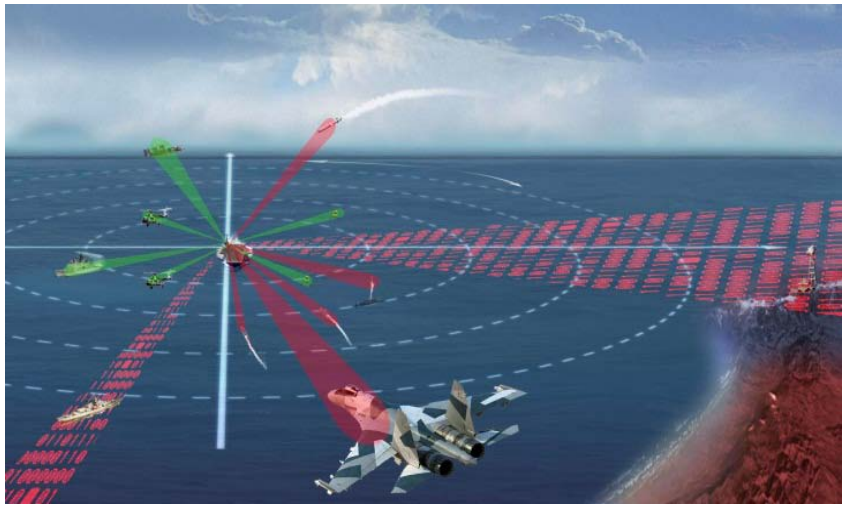
**"Enhances our ability to maneuver freely in the electromagnetic spectrum, while denying adversaries' ability to do the same. "**

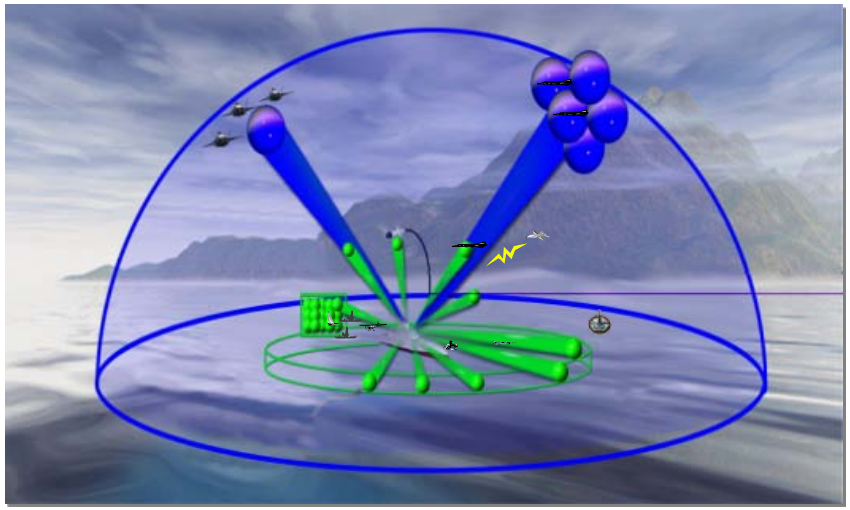
ADMIRAL JONATHAN GREENERT, U.S. NAVY, CHIEF OF NAVAL OPERATIONS, BEFORE THE HOUSE ARMED SERVICES COMMITTEE

# EMW Tenets

Know, shape, and exploit the electromagnetic environment for military advantage:

- Demand modular, **open** and scalable systems
- Enable algorithm and technique re-use across systems
- Provide agile and flexible RF access
- Achieve real time electromagnetic battle management





# EMW Toolbox

- **Design and build affordable distributed RF systems that can:**
  - coordinate and deliver specific spatial-spectral-temporal RF effects on demand
  - support arbitrary time shared and concurrent functions
  - perform beyond narrowly focused functions
  - deliver open and accessible spatial, spectral, and temporal deconfliction, scheduling, execution, reception, processing, exchange, and fusion
  - Incrementally insert, reuse, and improve capabilities

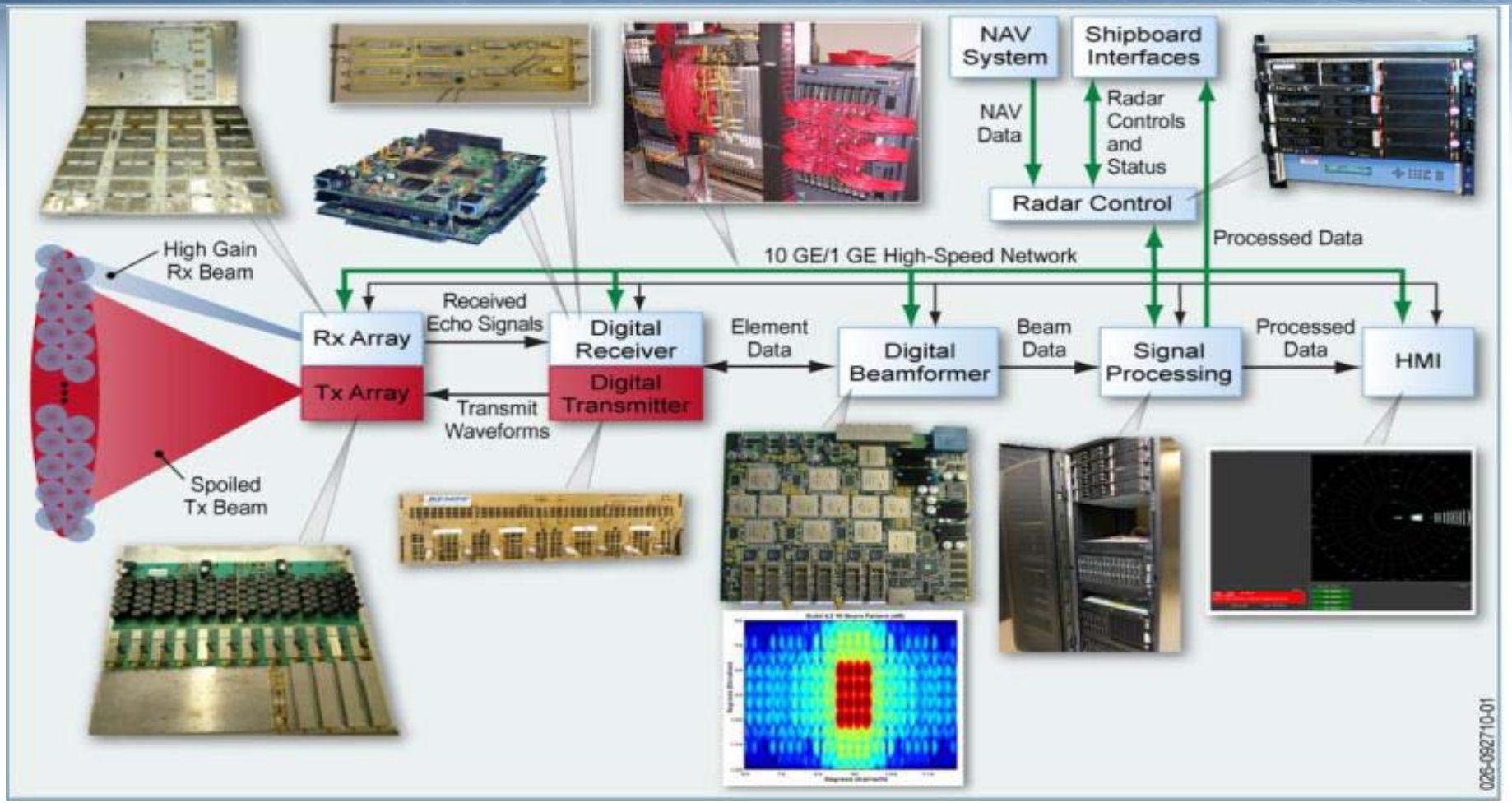
**Agile Flexible Reconfigurable Hardware and Software to Win the Electromagnetic War**

# Industry Opportunities

- Electronics
  - Wideband, high power, linear RF components
  - Opto-electronics for interconnects
- Apertures
  - Efficient, wideband, affordable and manufacturable
- Tools
  - Logic and software portability
  - Spatial and spectral visualization and awareness
- Open Architectures
  - Modular and reusable hardware and software across systems and vendors
  - True interchangeability across common COTS interfaces – eg Ethernet
  - Government-Owned Standards

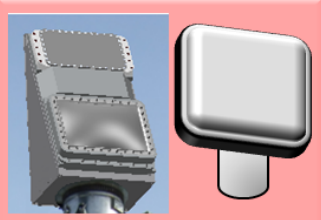
**Achieve game-changing cost per channel, from RF to Ethernet**

# Open Architecture RF




**Government Ownership of Open Architectures, Systems Specifications and Interfaces.**

# INtegrated TOPside (INTOP)

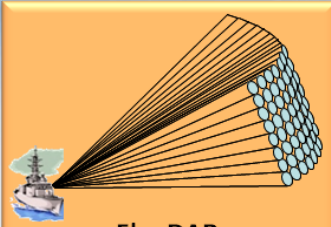


Consolidated SatCom for Submarines and Ships

Primary Functions:
- C thru Q Band SatCom
- 4 to 8+ Simul. Links

Secondary Functions:
- IO / EW Support
- LOS Comm Augment

**Sub SatCom – TO 0002**
**TRL-6 goal FY-13**
**Transition to AdvHDR/ for all Submarines**

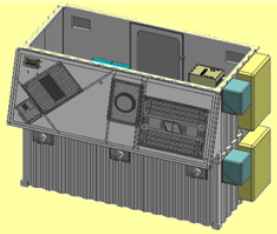


FlexDAR
Multi-Static Flexible Distributed Array Radar

Primary Functions:
- S Band Radar
- Volume Search
- Precision Track
- Missile Data Link
- Air Traffic Control
- In-Band ES/EA/EP

Secondary Functions:
- Weather Surveillance
- Navigation
- IO/EW Support

**FlexDAR – TO 000X**
**TRL-6 goal FY-15/16**



Multibeam
EW/IO/Comm

Primary Functions:
- C thru Ka Band EA
- EA Support (Rx)
- Hawklink, CDL-S
- Network Links (HNW)
- SEI/ES Support
- IO Support

Secondary Functions:
- SatCom Augment

**EW/IO/Comms – TO 0003**
**TRL-6 goal FY-12**
**Transition to SEWIP Block 3**

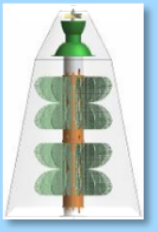
MFEW ADM
(complete)

Primary Functions:
- HPOI Acq/PDF ESM
- ASMD
- Sit. Awareness
- SEI Support

Secondary Functions:
- EA Support
- IO Support

MFEW FNC
TRL-6 FY-09
Transitioned to SEWIP Block 2

**Transitioned to SEWIP Block 2**



Consolidated Low Band
IO/Comm/EW

Primary Functions:
- VHF thru C Band Comm
- IO / SSEE Support
- EW Support

Secondary Functions:
- AIS
- JTIDS
- Other Omni Comm

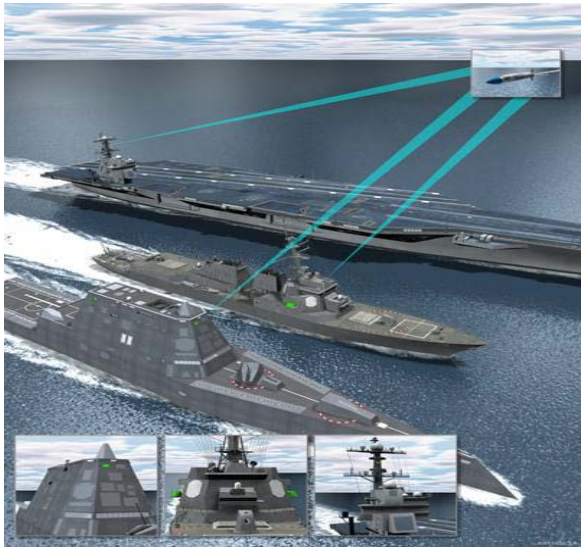
**LB IO/Comms – TO 000X**
**TRL-6 goal FY-14/16**

**Open, Re-usable, Arbitrary RF Capabilities... Multi-function.**

# Electronic Warfare

Control the Electro-Magnetic Spectrum by exploiting, deceiving, or denying the enemy use of spectrum while ensuring its use by friendly forces.
Technologies include:

- High Band Electronic Sensing Technologies and High Power Amplifiers
- High Band EW Subsystem Demonstrators
- Low-Band Compact Efficient Antennas
- Effective and Responsive Automation
- See ONR BAA 14-006

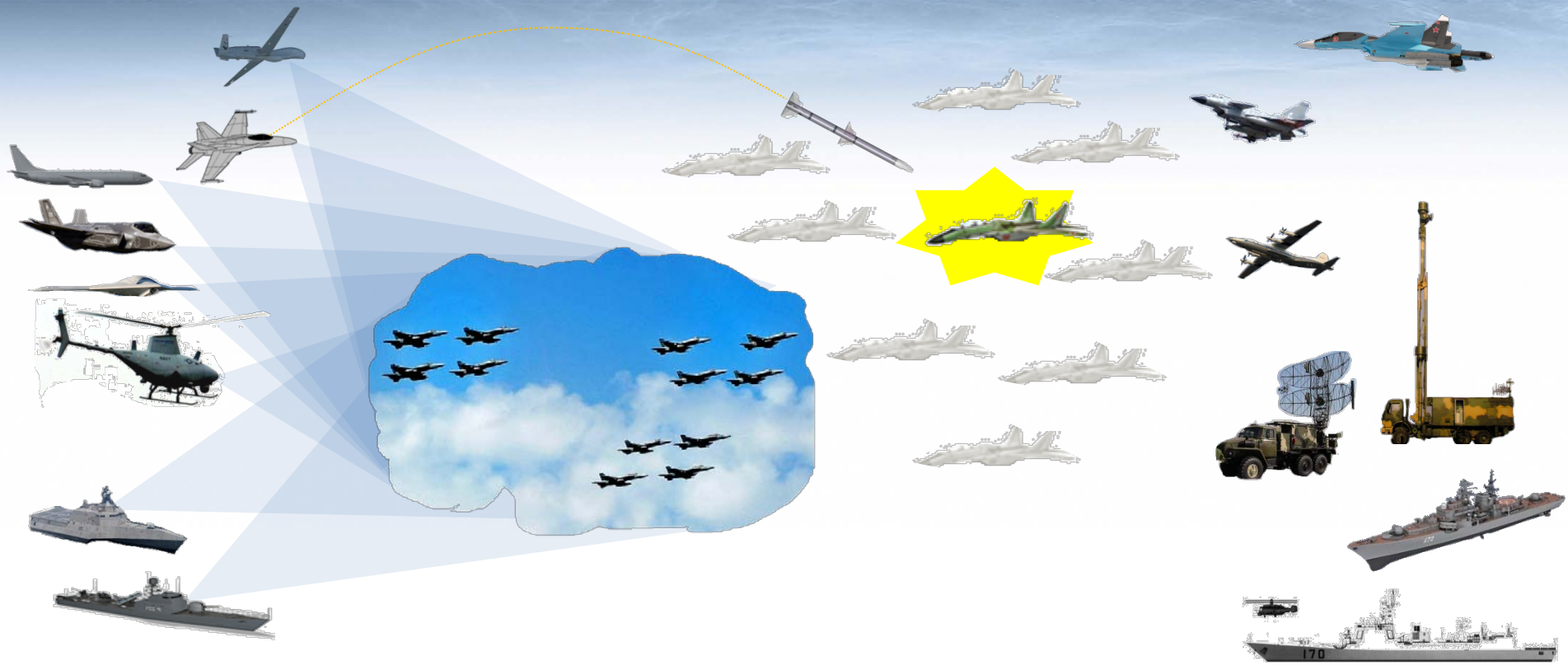


# EWM-Cyber Operations

As part of Electro-Magnetic Maneuver Warfare Information research in the Cyber domain advances the science of security to ensure safe and secure operations.

- Secure software for network-enabled devices
- Securing the host and network architectures
- Automated threat mitigation, graceful degradation, remediation
- Moving target defenses
- Automated information countermeasure
- Metrics for information assurance
- Quantum computing and communication for security

# RF Sensing and Deception



**Sense wide area distributed picture**

**Discern and defeat point and distributed deception**

**Project consistent coherent scene**

**Preserve military effort, options, and resources**

# Summary

- Science & Technology to enable Cyber and EMW
- Demonstrate collective effects to impact affordability
- Require flexible, agile, open, reusable RF systems
- Develop RF command and control to achieve any desired effect
- Exploit what we have, add what we need

**Agility and Flexibility is Essential to Win the Electromagnetic War**