# Composing Advanced C2 Networks Using the Tactical Component Network

**Topic #9**
**C2 Architectures and Technologies**

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# Advanced Sensor Network is Key Enabler

- **Emerging sources of tactical data and new operational paradigms demand C2 operational flexibility**

- **An advanced sensor network is a foundation of a net-enabled Joint operational architecture**

- **Extensibility, Flexibility, and Scalability are needed in network design to allow composable Joint architectures**

- **A flexible, robust and accessible common operating picture is the objective of advanced C2 network design**
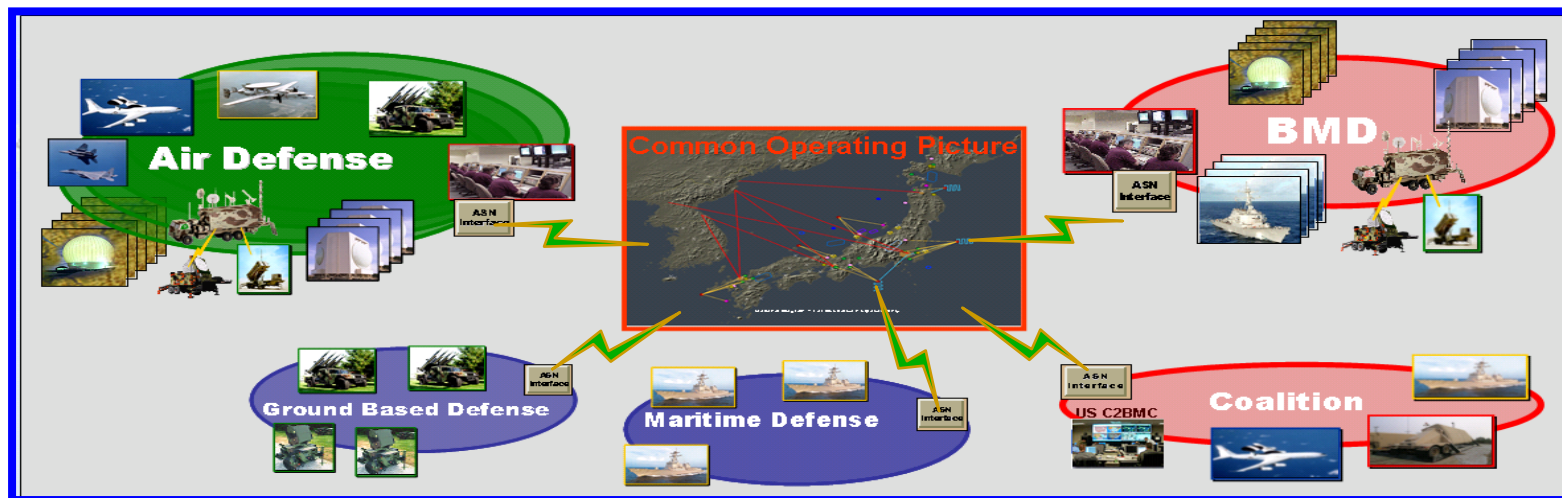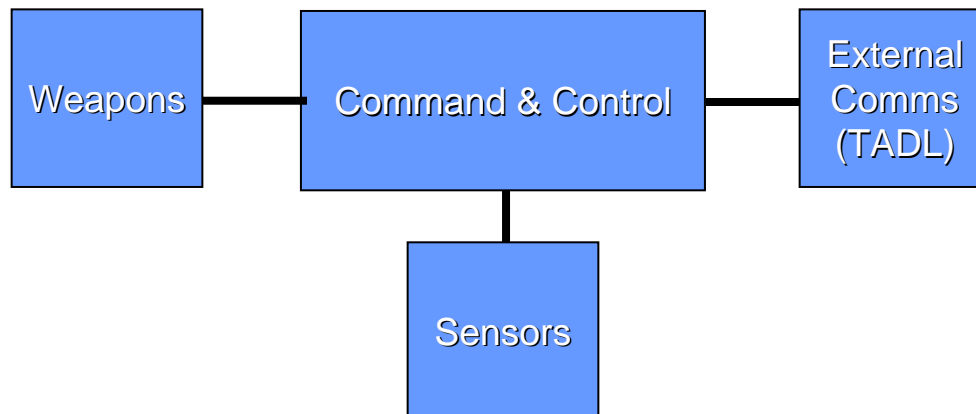
# Characteristics of an Ideal Sensor Network

- **Functional and physical independence, allowing continuous improvement without impact to fielded systems**
- **Information exchanged supports and is responsive to the needs of the network users**
- **Network extensibility must be minimally impacted by the number of network participants**
- **Comms neutral - uses multiple communications paths and existing communications devices where applicable**
- **Support multiple levels of echange security while maintaining the needed currency**
  - **Support Joint and coalition operations**
  - **Maintain abiltiy to contribute to the network without revealing elemental information**

*Provide seamless, automatic distribution of required data between Joint forces to effectively synchronize operations*

# Tactical Data Links

- **Basic Enabler in developing a Common Operating Picture**
  - **Extends sensor capability by integrating with digital communications capability**
  - **"Best Source" selection method for data distribution (R2 = Reporting Responsibility)**
  - **Limited ability to combine data from multiple sources to improve continuity**
  - **Fixed transmission and update schedule for information exchange**
  - **"Near Real Time" exchange provides limited responsiveness to dynamic target behavior**
  - **Limited by Communications Bandwidth, Integration Approach**

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  ┌──────────┐     ┌──────────────────┐     ┌──────────┐
  │ Weapons  │─────│ Command & Control │─────│ External │
  │          │     │                  │     │  Comms   │
  └──────────┘     └────────┬─────────┘     │ (TADL)   │
                            │                └──────────┘
                      ┌─────┴────┐
                      │ Sensors  │
                      └──────────┘
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# Common Operational Picture
# TADL Operational View



Naval CoIN

Air CoIN

Ground CoIN
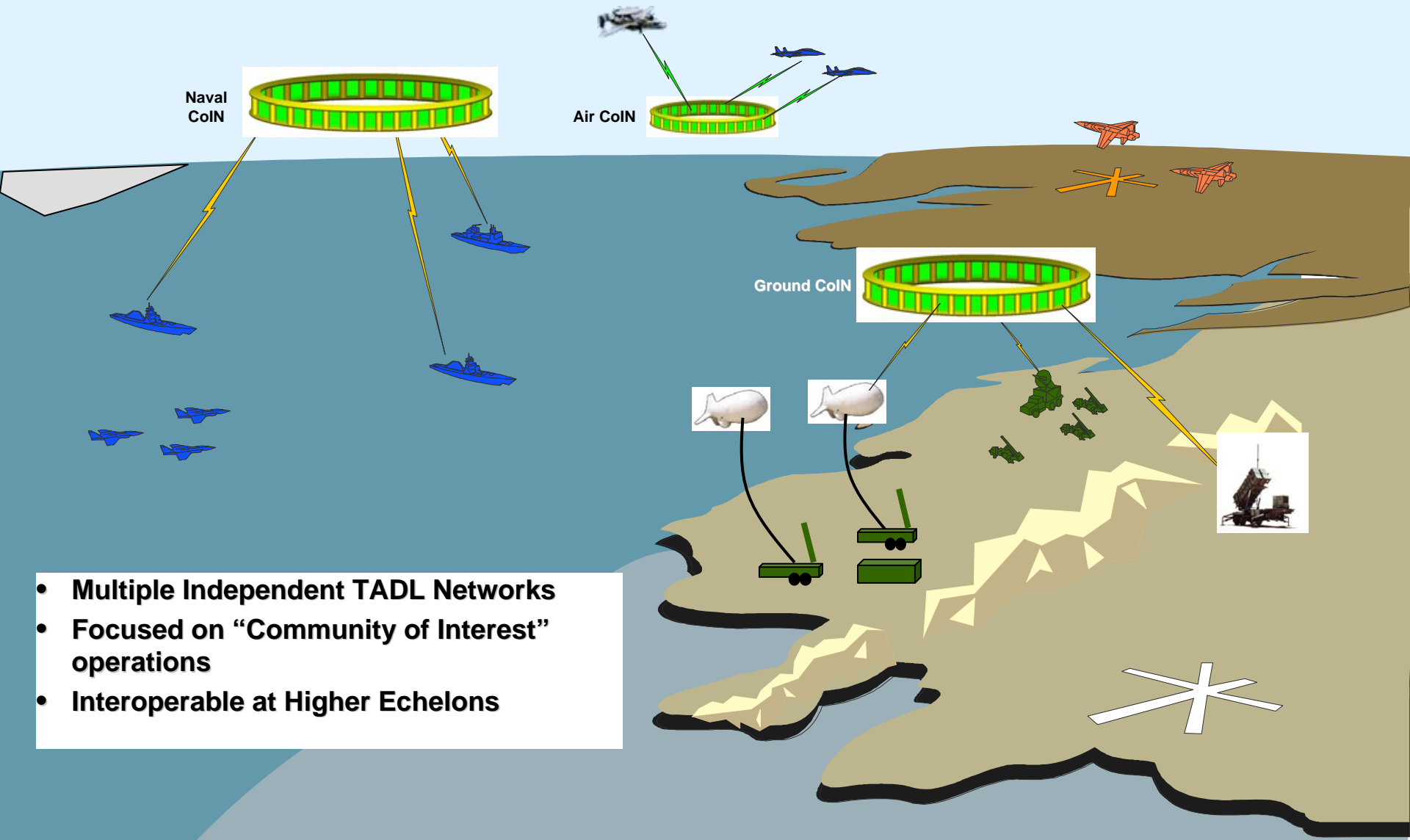
- **Multiple Independent TADL Networks**
- **Focused on "Community of Interest" operations**
- **Interoperable at Higher Echelons**

# Sensor Netting

- **The first enabler of a more robust Common Operating Picture (COP)**
  - **Leverages existing assets to the maximum of their self-defensive potential**
    - **Integrates senor data directly into the network vs. through the C2 system**
    - **More capable communications (real-time) enables improved performance against maneuvering/advanced threats**
  - **Flexible architecture that supports future growth**
  - **Improves Multiple Mission Integration**
- **Enables individual self defense assets to be integrated as a team. "The sum of the whole is greater than the sum of the parts" : '2+2=5')**
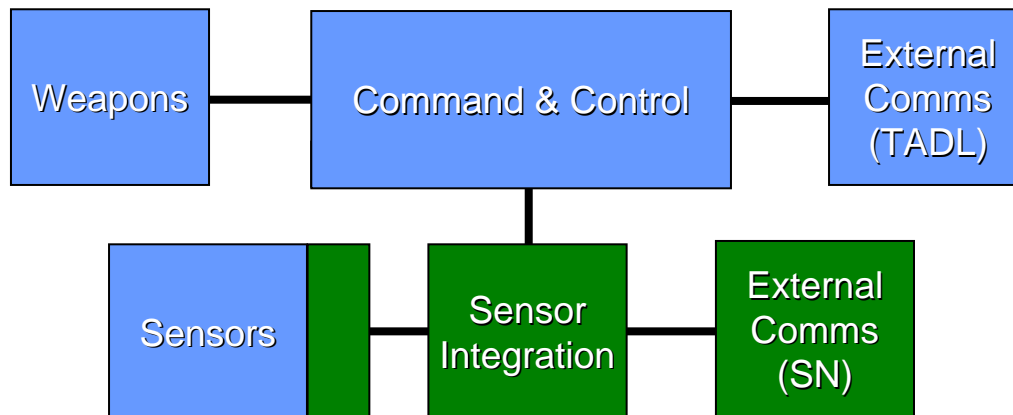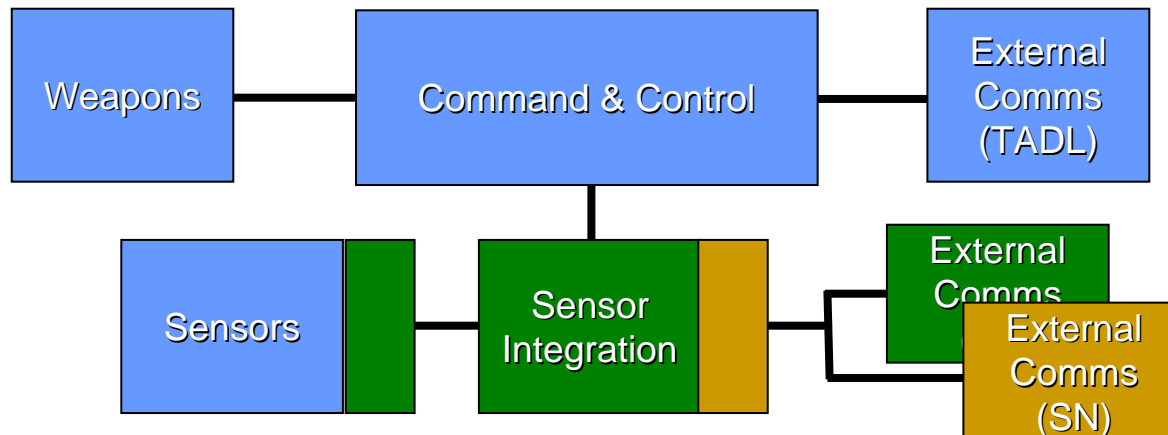
# Common Tactical Picture
# Sensor Net Operational View



**Naval CoIN**

**Air CoIN**

**Ground CoIN**
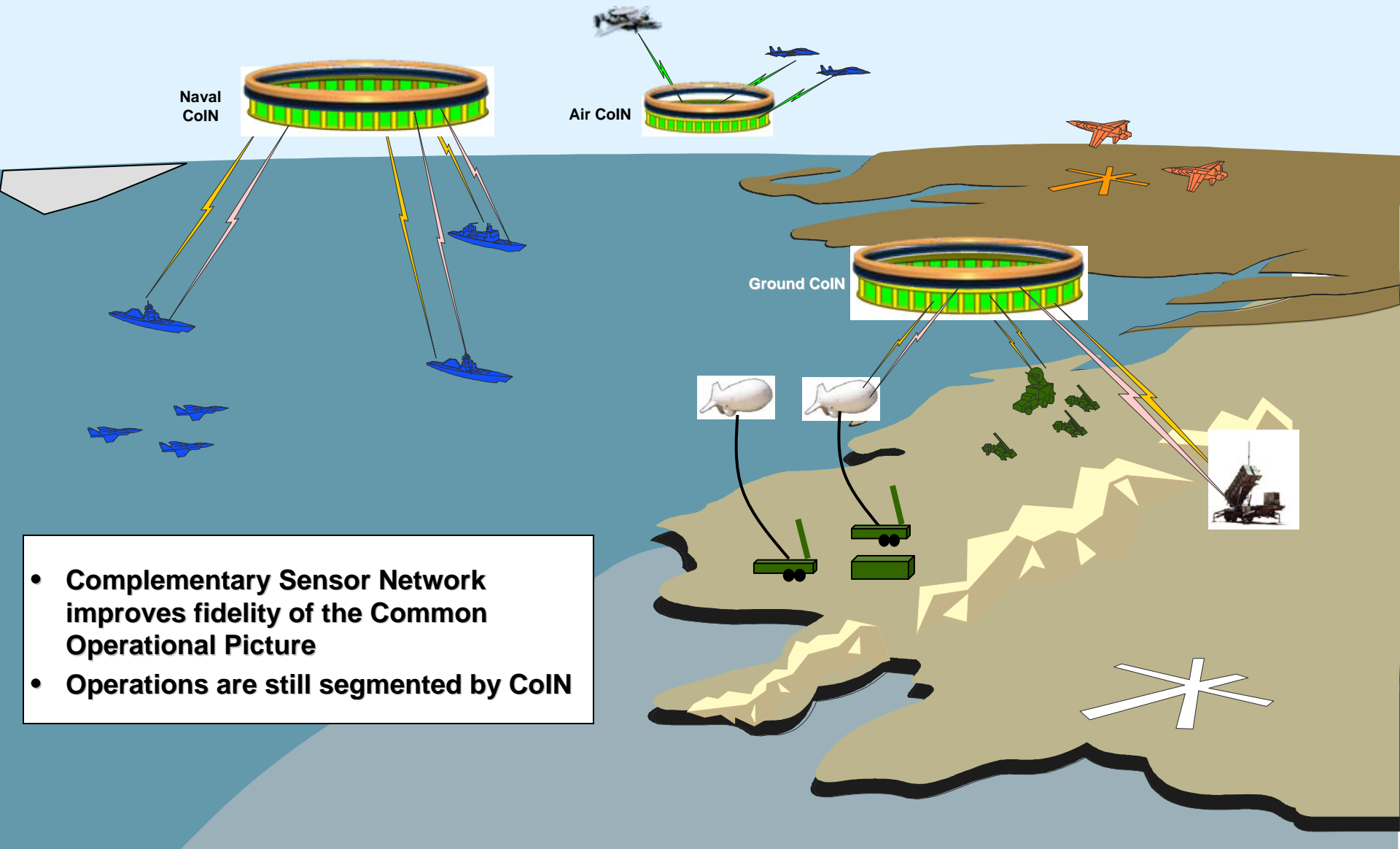
- **Complementary Sensor Network improves fidelity of the Common Operational Picture**
- **Operations are still segmented by CoIN**

# Advanced Sensor Netting

- **The network framework that provides for increased flexibility that meets the challenge of advanced threats and tactics**
    - **Adds a Multi-Network capability to Sensor Netting that:**
        - **Enables Joint Interoperability and manages data exchange between independent Community of Interest Networks**
        - **Improves Common Operating Picture survivability and robustness**
    - **Increased Interoperability enables more effective management of sensors and weapons against evolved tactics and threats (mass raids/asymmetric threats)**
- **Joint Force Multiplier**

# Common Tactical Picture
# Advanced Sensor Net Operational View

**Naval CoIN**

**Air CoIN**

**Ground CoIN**
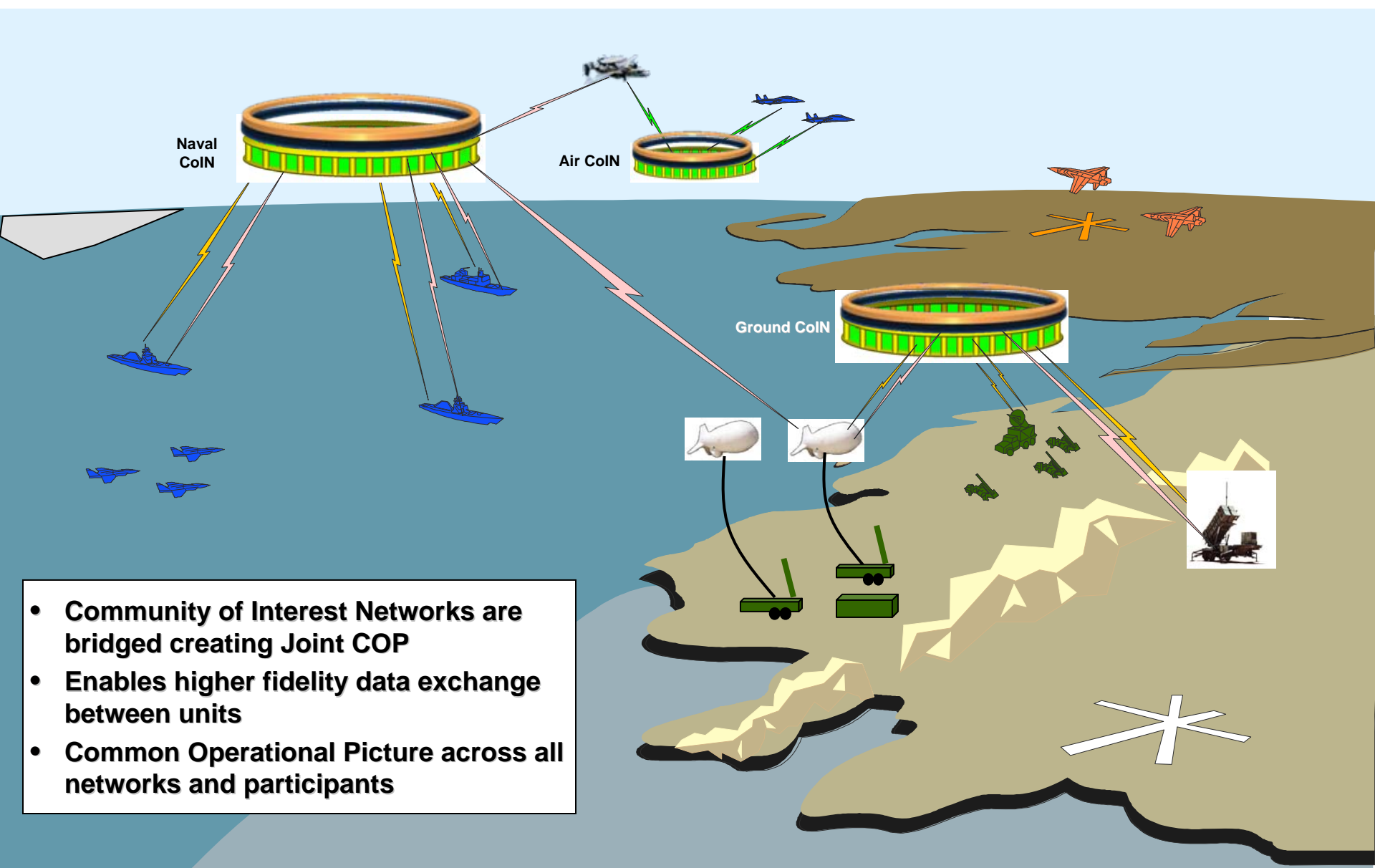
- **Community of Interest Networks are bridged creating Joint COP**
- **Enables higher fidelity data exchange between units**
- **Common Operational Picture across all networks and participants**

# Advanced Sensor Netting Benefits

- **Extensibility of open interface allows greater population of potential participants/ contributors**
- **Expanded collaboration between Community of Interest Networks**
  - **Improves continuity on difficult targets**
  - **Enables the Joint Common Operational Picture at a tactical level**
  - **Enables more effective sensor/weapon resource management**
- **Scalability/ Efficiency**
  - **Processing and bandwidth requirements are driven by the track population versus number of partipants**
  - **Comms-neutral allows inexpensive, non-invasive integration of broad range of assets**

*Advanced Sensor Network enables existing assets to improve Joint mission effectiveness*

# Advanced Sensor Network Allows Evaluation of Advanced C2 CONOPS Issues

- **Network topology and CoIN interface design**
- **Sensor resource management**
- **Joint and Coalition operations considerations**
- **Integration of new resources – elevated sensors, unmanned platforms, national assets**
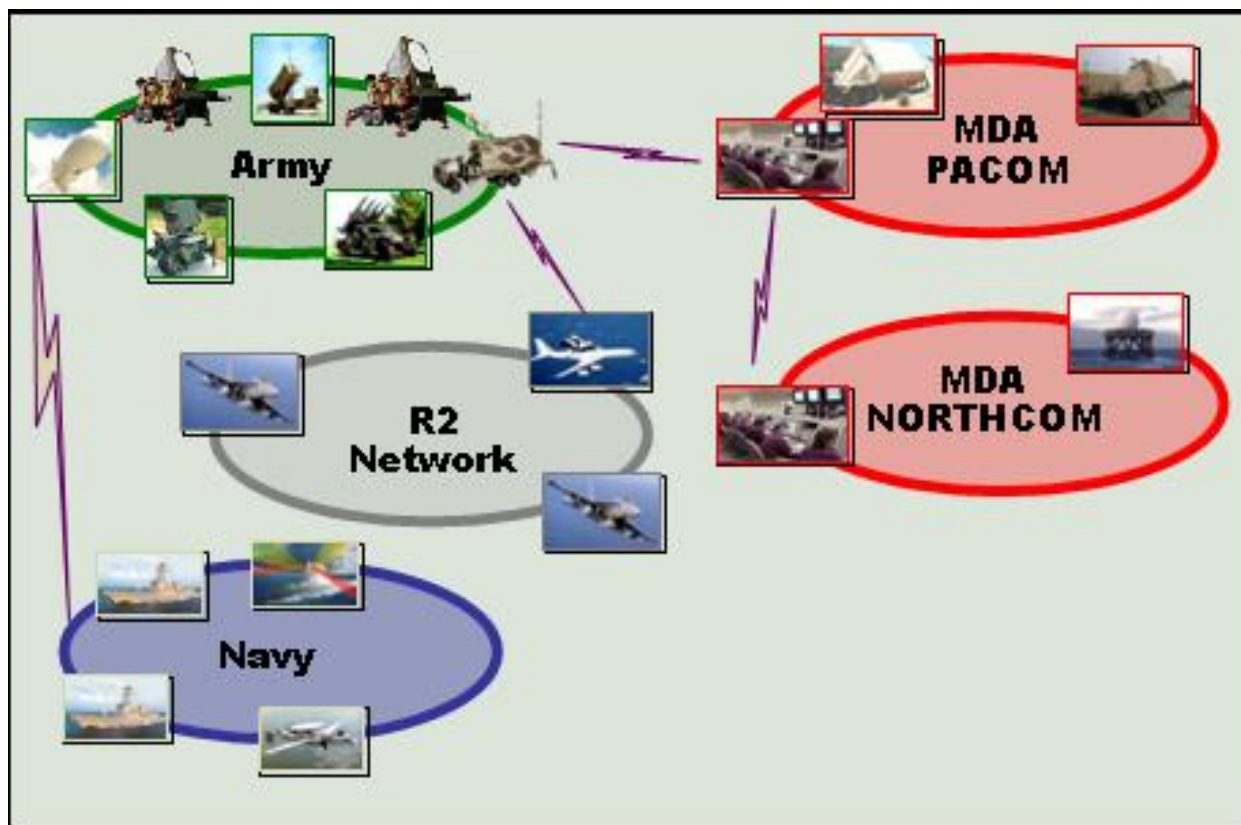
# TCN is an Enabling Technology for Advanced C2 Networks

- **Command and Control Infrastructure Requires Critical Attributes**
  - **Extensibility**
  - **Flexibility**
  - **Scalabilty/ Efficiency**

- **The power of existing technologies can be leveraged to meet tomorrow's operational challenges through incorporation of emergent capabilities**

- **TCN is a government-owned, off-the shelf technology that will allow forces to effectively and efficiently leverage newly available resources**

- **The key requirement of C2 infrastructure is to empower the warfighter with the broadest scope of available information**

*Tomorrow's threats will only be met by implementing C2 designs that will integrate tomorrow's resources*