INFORMATION SUPERIORITY

&

NETWORK CENTRIC WARFARE

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JCS J-6

December 14, 1999

Purpose

- Review the Basics of Information Superiority and Network Centric Warfare
- Provide Examples of the Growing Body of Evidence
- Discuss IS and NCW-related Experimentation

Agenda

- **Purpose**
- 

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- **Thoughts on Experimentation**

Information is Different

- Develop Once - Use Many Times - and Simultaneously
- Value is Not Created Until the End of the Last Mile

Value Enhancers	Value Detractors
Sharing	Lack of Interoperability and Disconnects
Timeliness	Delays
Assured Availability	Disruptions and Lack of Reliability
Security and Confidence	Compromise
Context and Fusion	Stovepiped Information
The Wheat	The Chaff and Overload
Accuracy and Completeness	Poor Quality

- A Vulnerability Created by One is a Vulnerability Imposed upon All
- A Deficiency Created by One is a Deficiency for All

DoD-Wide Solution is Necessary to Create and Protect Value

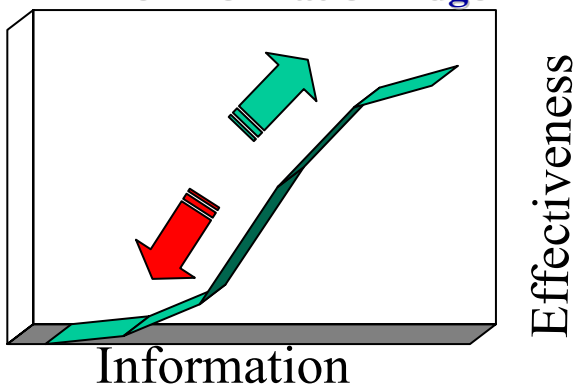
Information Superiority: *What it is?*

The capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same. ***DPG and Joint Pub 3-13***

The **RIGHT** Information from Sources to People at Time and Place in Format. ***DPG***

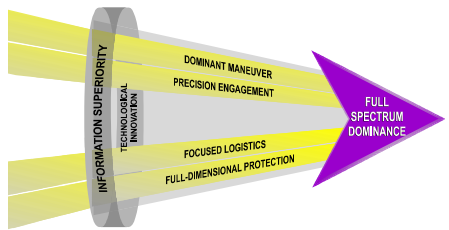
Assured Information on Demand Anywhere in Real Time with Zero Error

The Information Edge



Information Overload

Seamless Joint and Combined Interoperability



Joint Vision 2010: The band where the miracle happens.

Different Perspectives, the Same Bottom Line: More for Us; Less for Them

Two Sides of Information Superiority

A Relative State that is Achieved when a Competitive Advantage is Derived from the Ability to Exploit an Information Advantage

Information Superiority

A ***Relative State***

achieved when a

Competitive Advantage

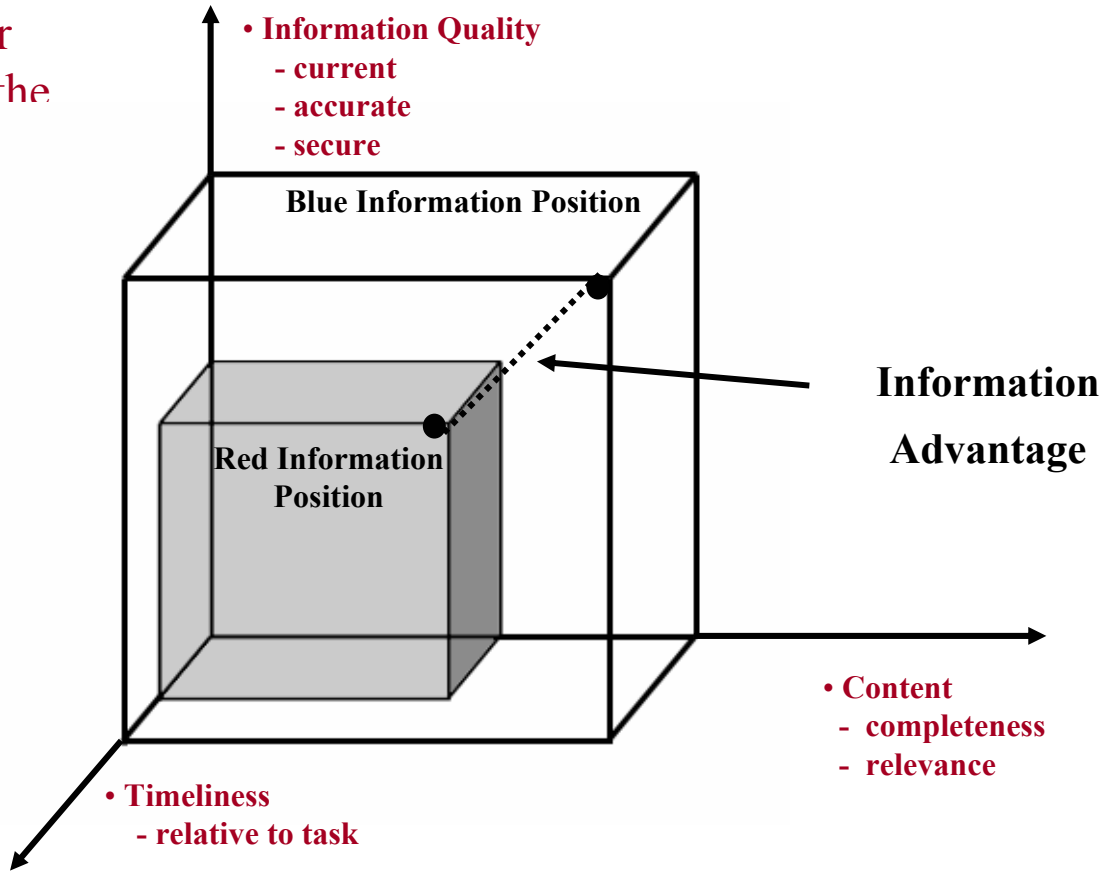
is Derived from the
Ability to Exploit an

Information Advantage

The ability to develop and use information
while denying an adversary the same capability

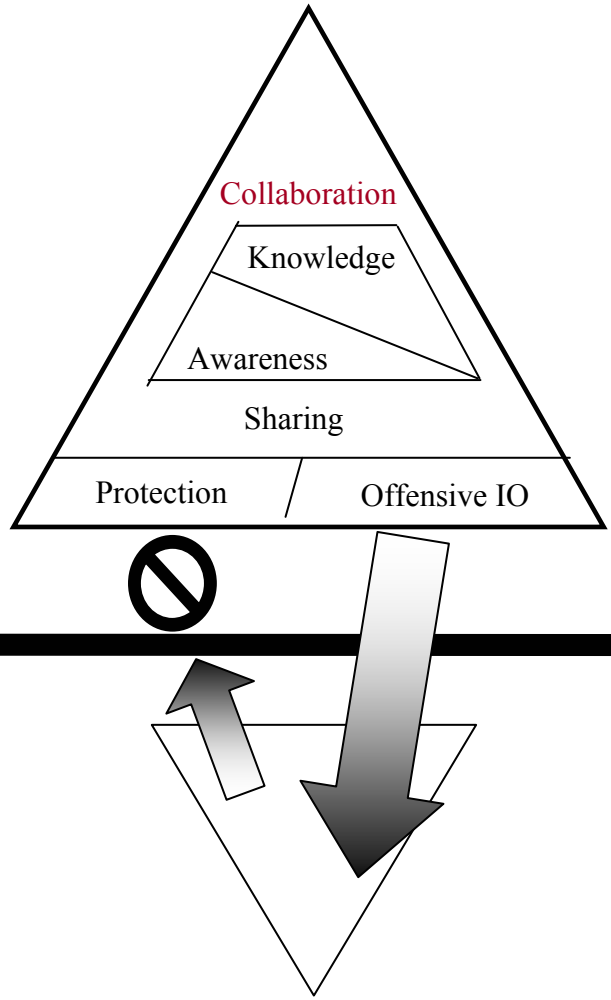
Information Advantage

An ***Information Advantage*** is Achieved When One Competitor Outperforms its Competitors in the Information Domain



The Fourth Dimension (not shown) Involves the Information Topology (Degree of Sharing)

Elements of Information Superiority



Information Superiority

Information Inferiority

Awareness & Knowledge

- Battlespace Awareness results from the fusion of key elements of information which characterize the battlespace
  - Explicit Information (e.g. position of forces, geography, and weather)
  - Requires Little Interpretation
  - Can be communicated quickly and easily

Network-intensive

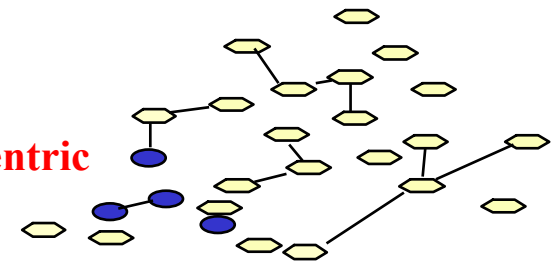
- Battlespace Knowledge yields predictive ability based upon interpretations based upon experience and a priori knowledge
  - Tacit Information (e,g,. capability and tactics of an adversary, local customs, intent)
  - Supporting facts can be easily transferred, the underlying organizing logic can seldom be transferred quickly and easily.

People-intensive

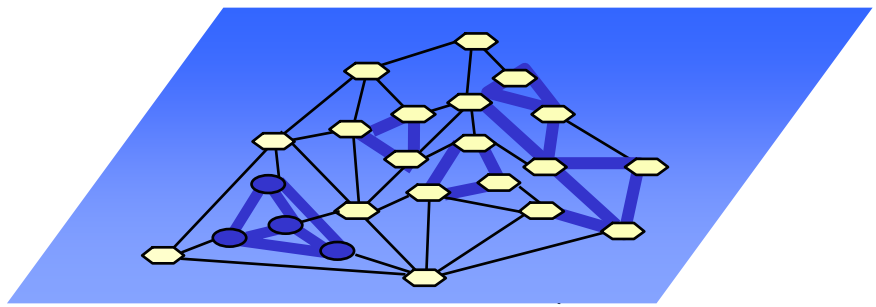
Requires a Knowledge-Based Workforce

Sharing

- Sharing Lies at the Core of IS & NCW
- Entry Fee is the "Network" (the GIG)
- Sharing Has an Organizational, a Behavioral, and a Technical Component
  - Interoperability v. Cooperability
  - Technical Component Enables
  - Organizational and Behavioral Components Generate Value



Platform-Centric



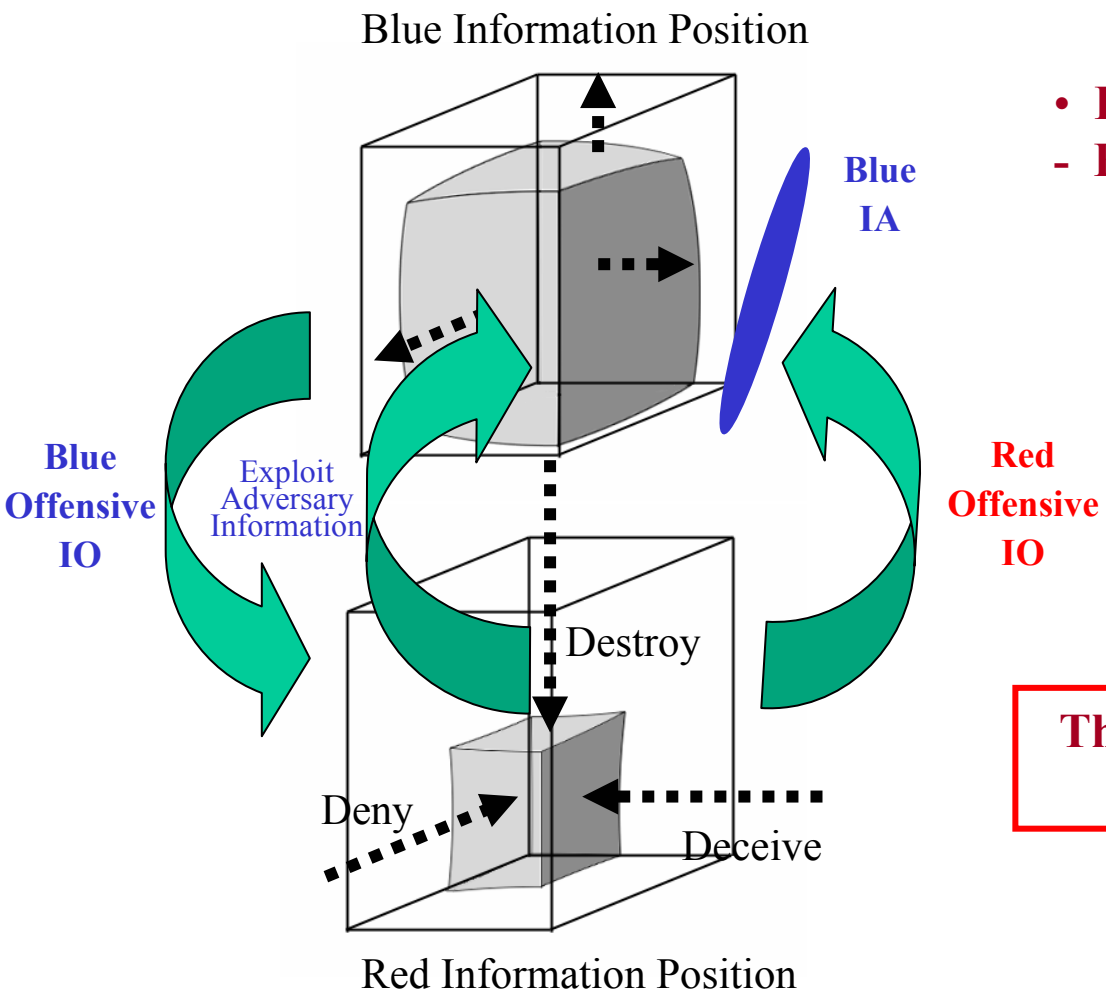
Network-Centric

A Basic Paradigm Shift in Dealing With Information

Collaboration

- Collaboration in the Information Domain Creates an Information Advantage
- Collaboration in the Operational Domain Creates Value by Exploiting an Information Advantage to Create a Competitive Advantage
- Collaboration Takes Places “on the Net”or is Reflected “in the Net”
- The Ability to Share Creates New Forms of Collaboration
  - e.g., Self-Synchronization

Protect, Deny, and Exploit



- **IO is Dynamic and N-Sided**
  - **Blue, Red, Others (e.g. CNN)**

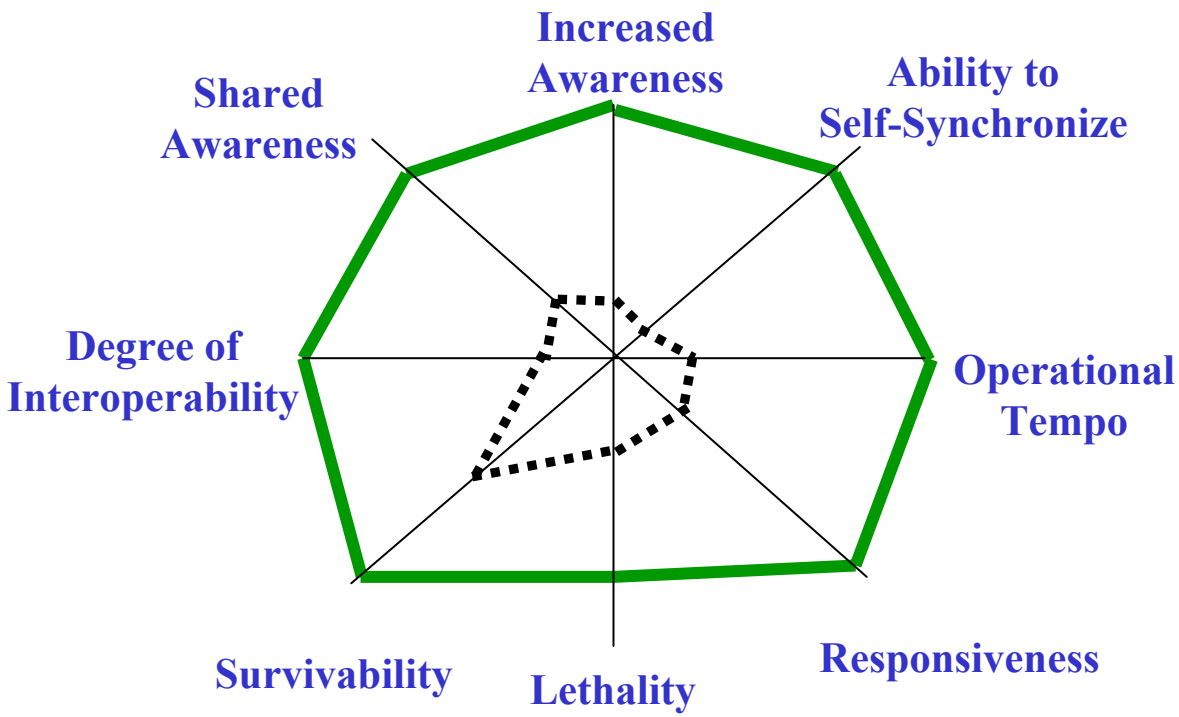
The Objective is to Improve Blue's Relative Information Position

Agenda

- **Purpose**
- INFORMATION SUPERIORITY
- NETWORK CENTRIC WARFARE
- **Thoughts on Experimentation**

Network Centric Warfare

A Warfighting Concept that Enables a Network Centric Force to Significantly Increase Combat Power by Achieving

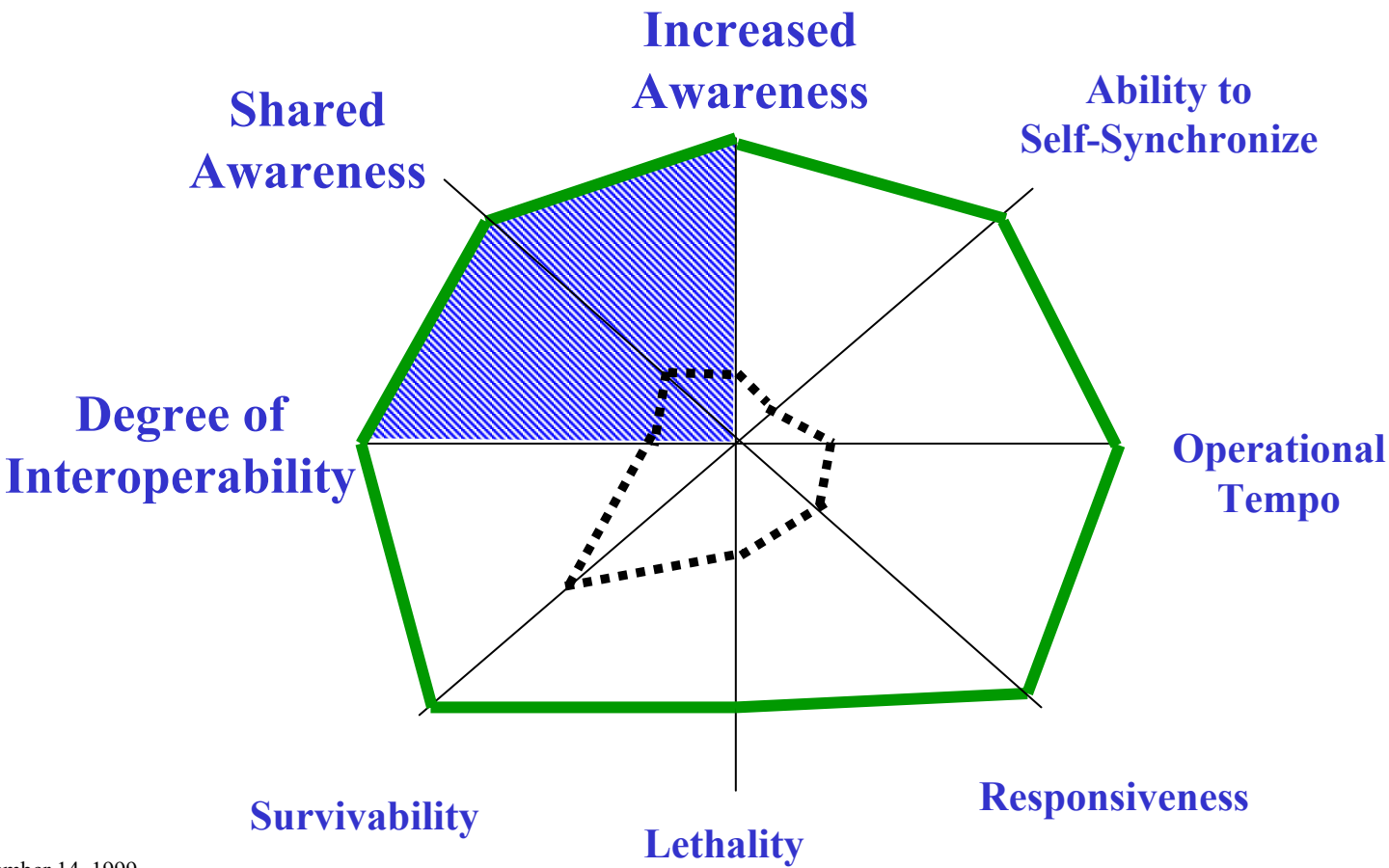


Attributes of Platform-Centric Operations

Attributes of Network-Centric Operations

NETWORK CENTRIC WARFARE **Translates $ into Combat Power**

Information Advantage



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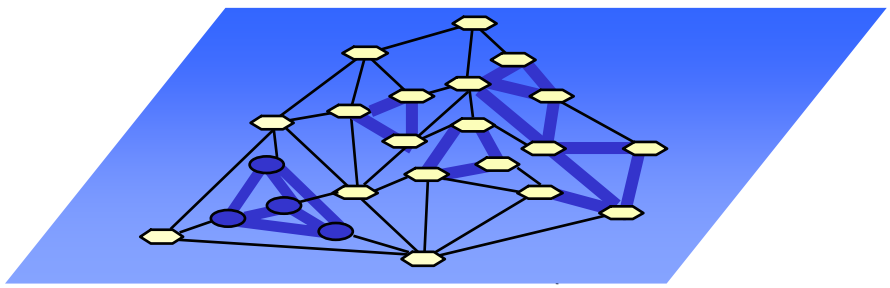
Networking the Force

- A network-centric force is an *interoperable* force
- A network-centric force provides Commanders with the capability to dynamically network (connect, share, and collaborate)
  - Sensors (regardless of platform)
  - Decision-makers (regardless of location)
  - Shooters (regardless of service)



Networking The Force

Sensor / Awareness

Shooter / Transaction

Information Timeliness

Sub-seconds

Seconds

Minutes

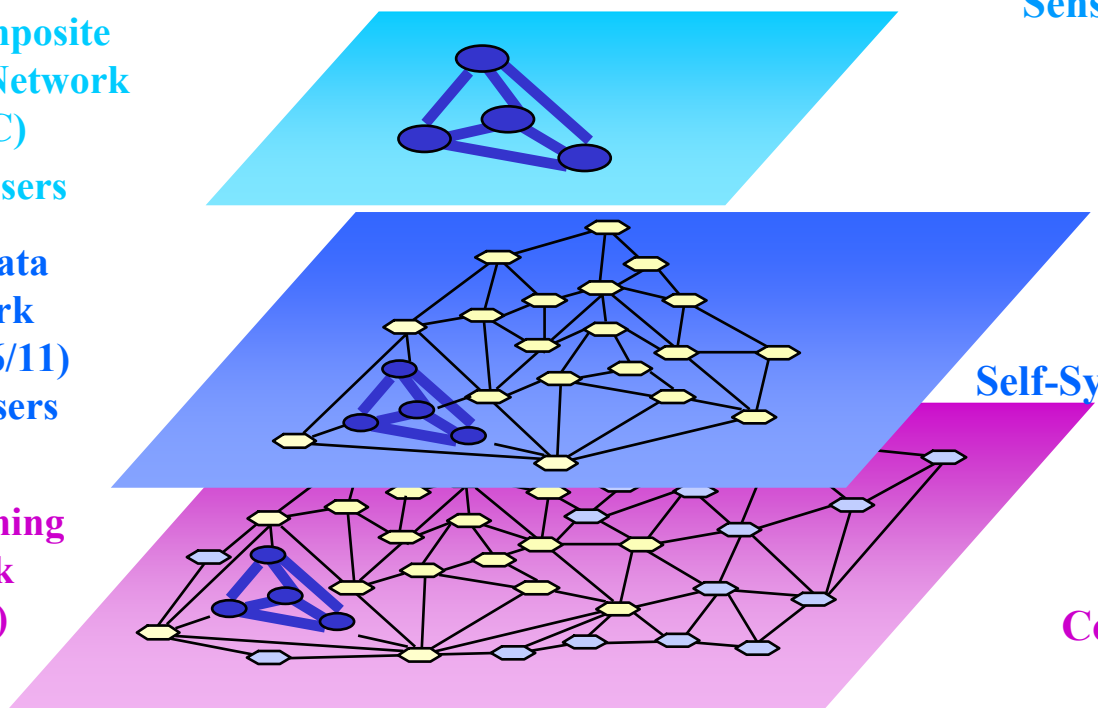
Information Accuracy

Sensor Networks:

Joint Composite Tracking Network (CEC)
< 100 Users

Joint Data Network (Link 16/11)
<500 Users

Joint Planning Network (GCCS)
~1000 Users



Sensor Fusion

Weapons Control

Force Control

Self-Synchronizing Forces

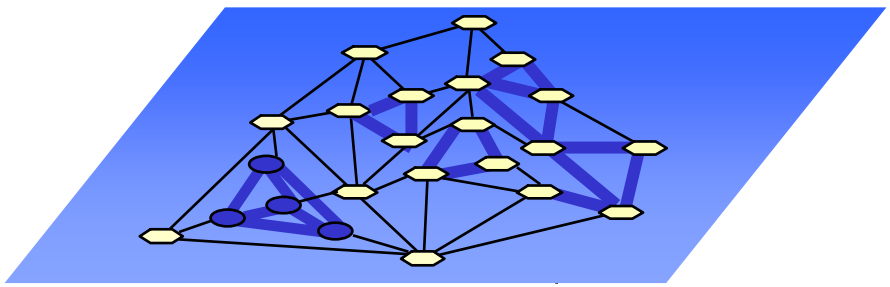
Force Coordination

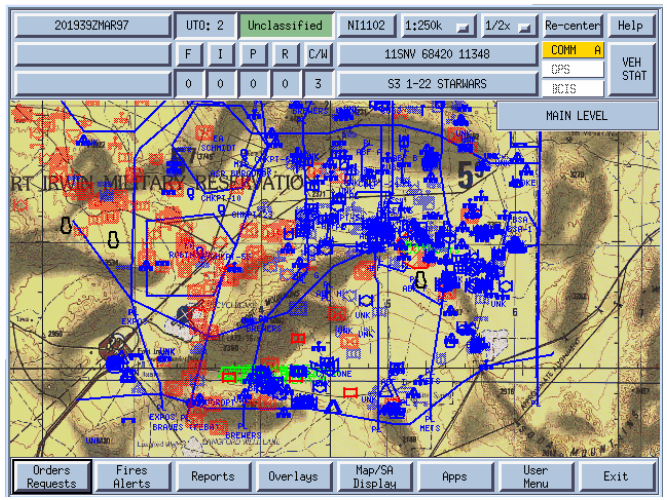
CEC: Cooperative Engagement Capability
GCCS: Global Command and Control System

Variable Quality of Service

Shared Awareness

- A network-centric force has the capability to generate shared battlespace awareness

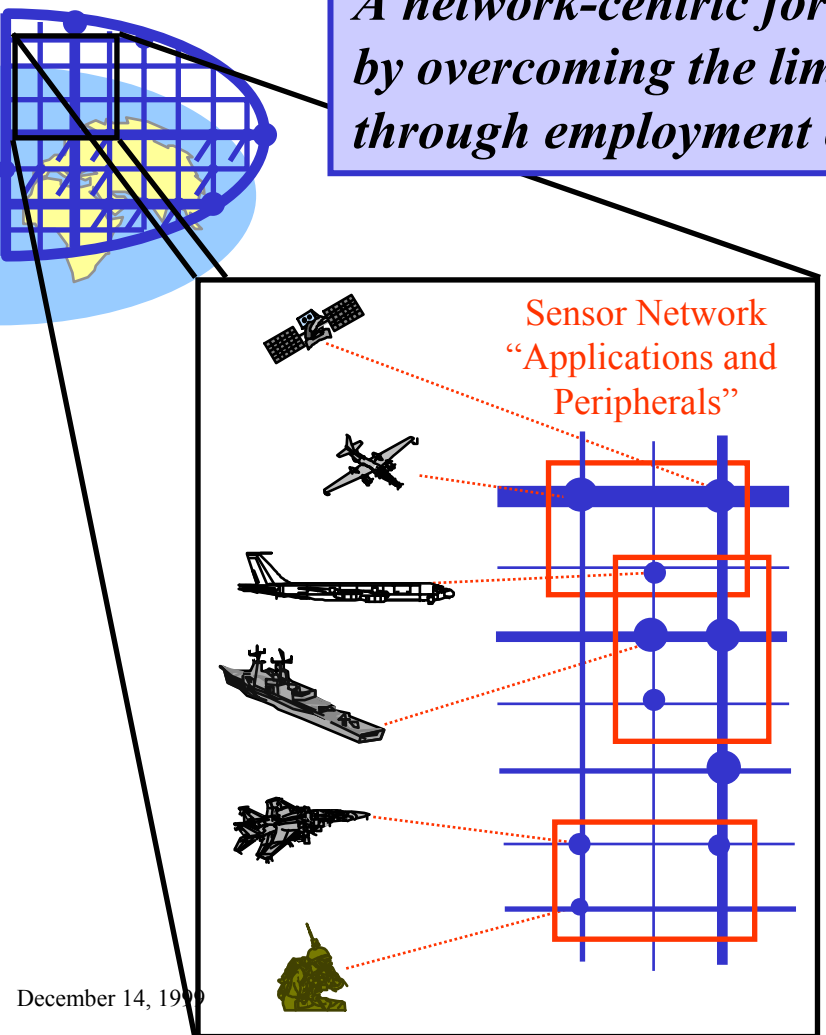




The generation of shared battlespace awareness requires the ***robust*** networking of the blue force.

Increased Awareness

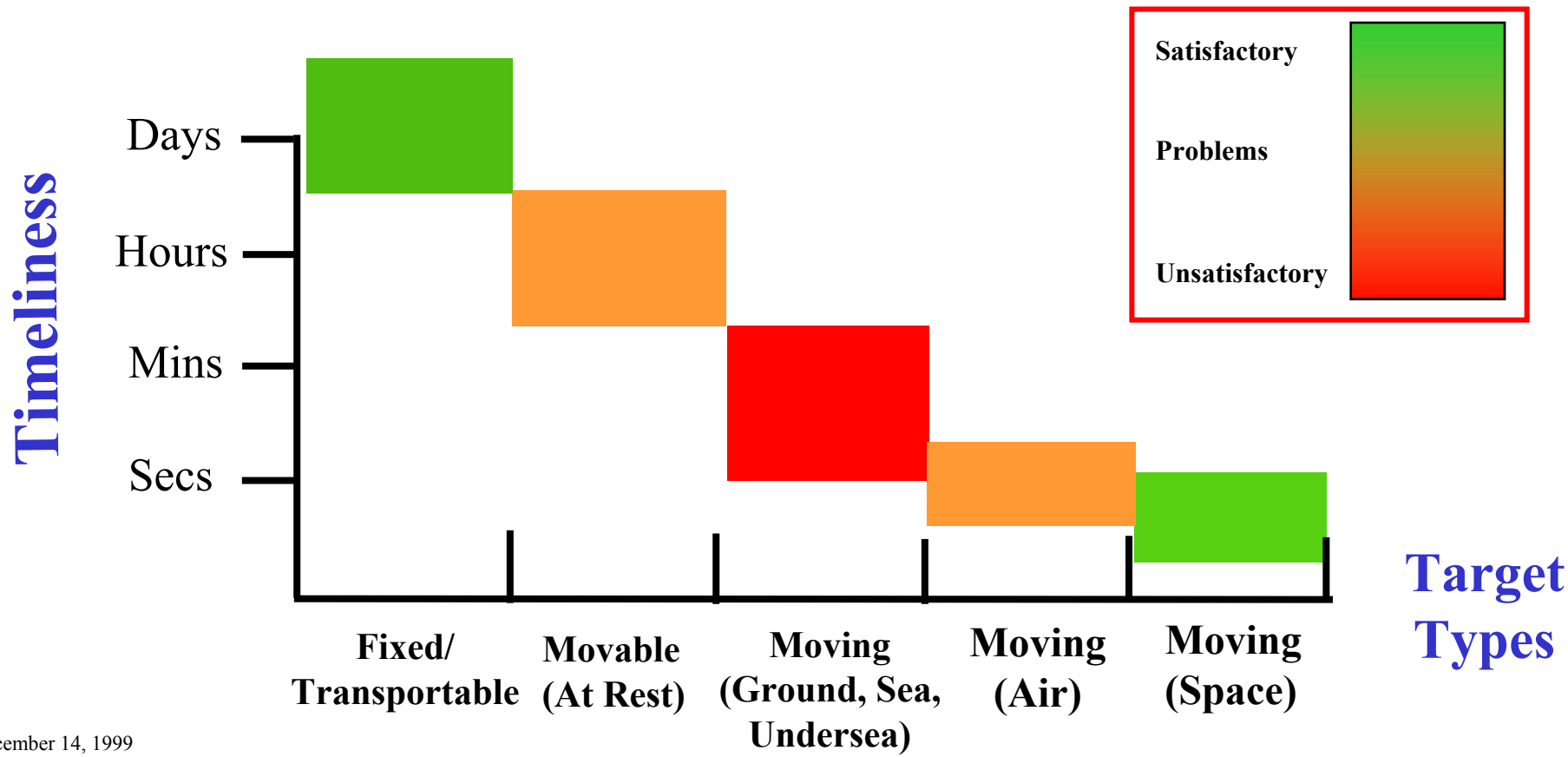
A network-centric force increases battlespace awareness by overcoming the limitations of standalone sensors through employment of sensor networks



- **Sensor Networks enable Commanders to**
  - Rapidly generate Battlespace Awareness
  - Synchronized with operations
- **Components of Sensor Networks**
  - Space, Air, Sea, Ground and Cyberspace Based Sensors
- **Operational Capabilities**
  - Improved Data Fusion
  - Dynamic Sensor Tasking
  - Universal Sensor Recruitment

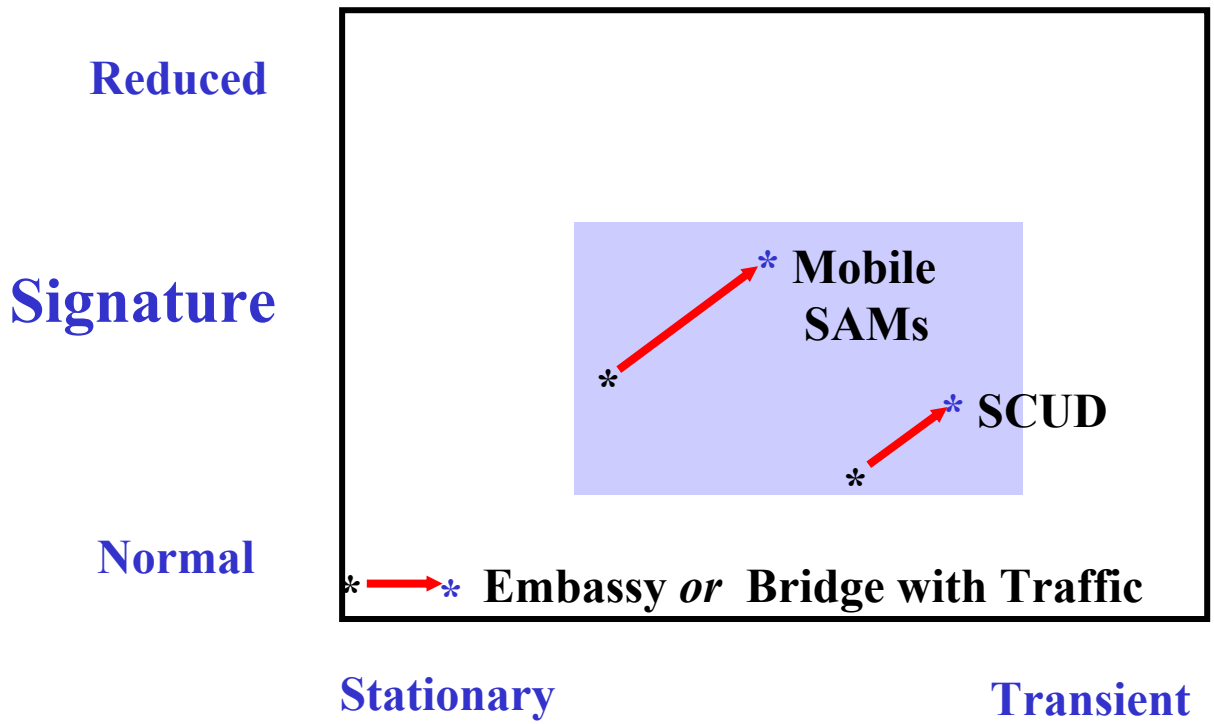
Increased Battlespace Awareness

Current Capabilities to Generate Engagement Quality Awareness Against Adversary Forces Across Various Battlespaces

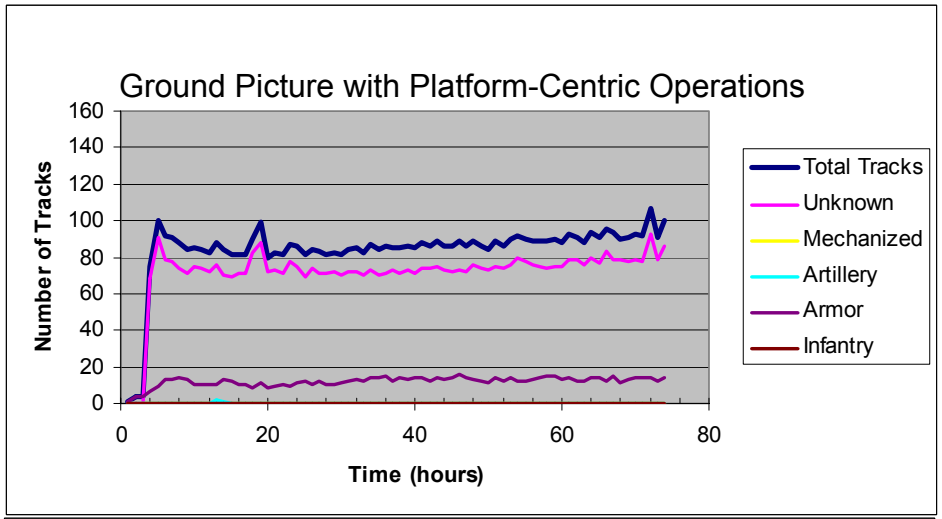


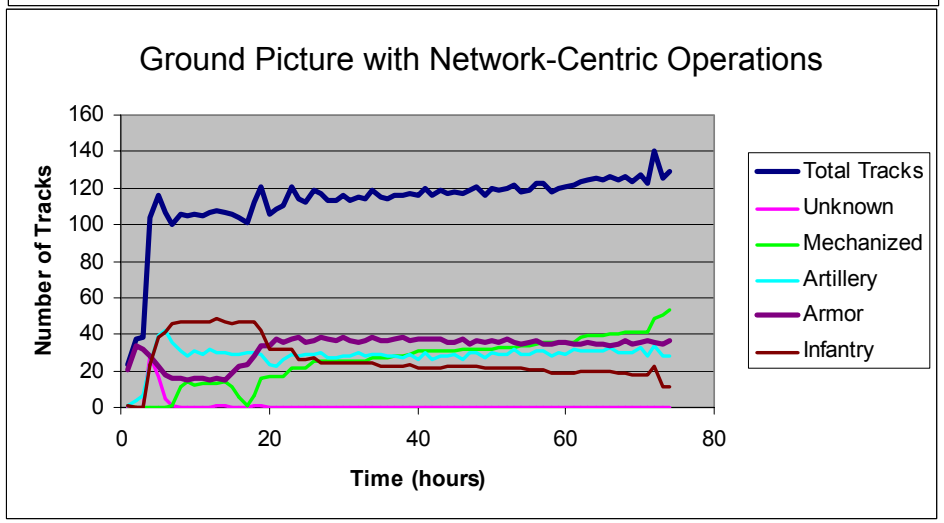
Threat Trends

Signature and "Volatility" Trends Stress Both Sensing and Engagement Time Lines



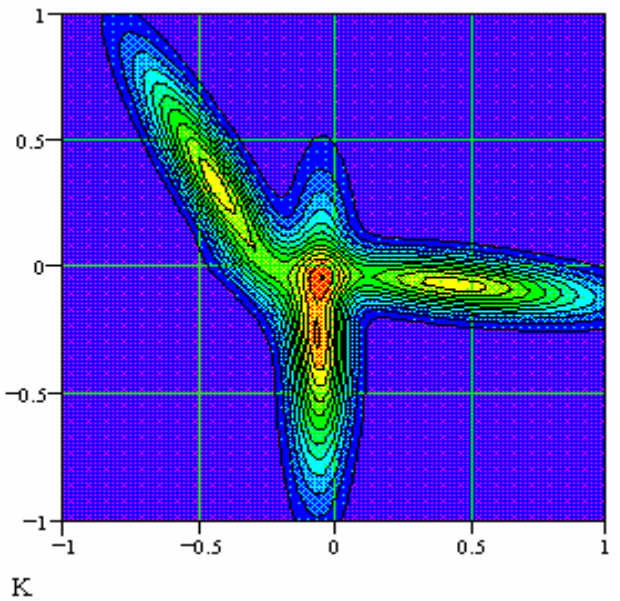
Increased Awareness



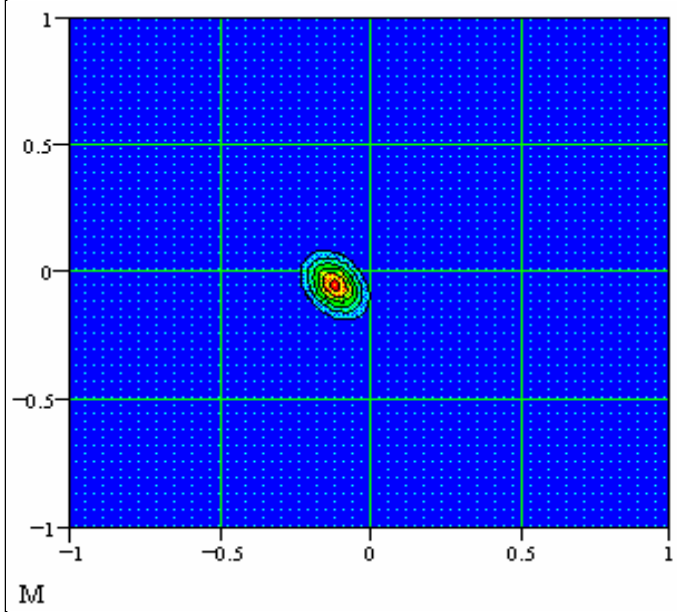


Payoff of Sensor Fusion

- TThree (3) Sensor Position Estimates ("Hits")
  - DDown-Range Error (σ_{dr}) = 5
  - CCross-Range Error (σ_{cr}) = 1



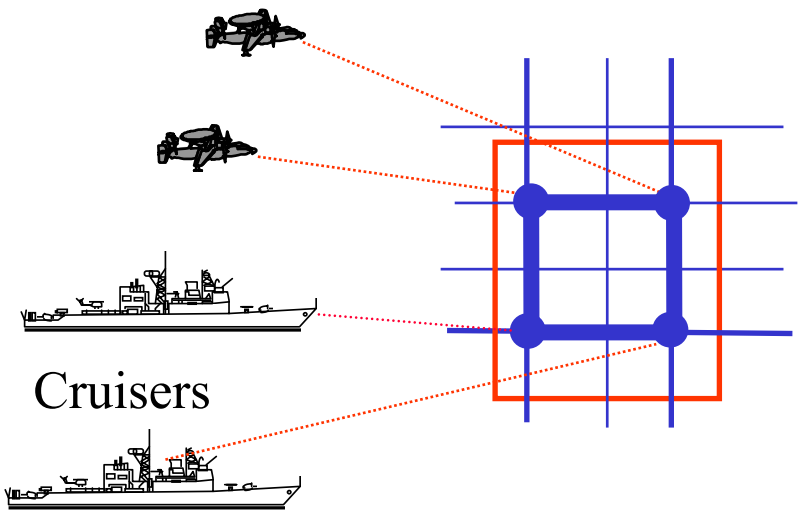
- FFused Sensor Position Estimate
  - DDown-Range Error (σ_{dr}) = 1.00
  - CCross-Range Error (σ_{cr}) = 0.67



Cooperative Engagement

Sensor Network

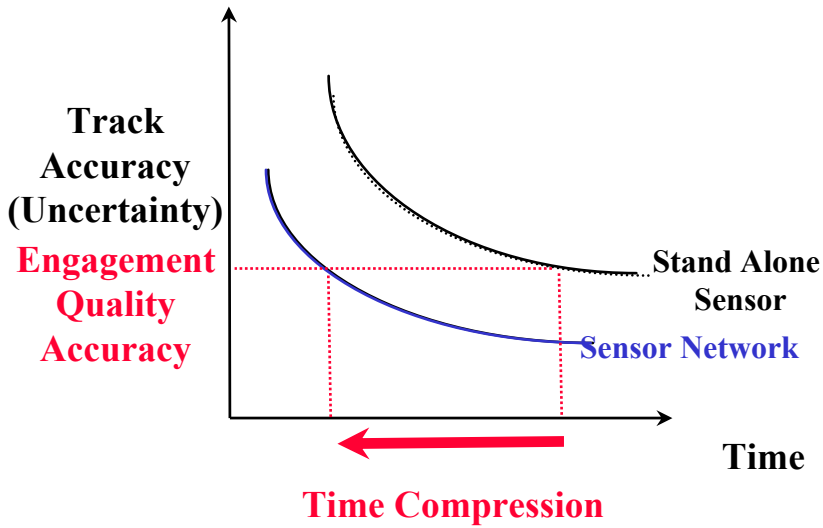
E-2C Hawkeyes



Cruisers

- Generates *engagement quality* Battlespace Awareness with reduced timelines
- Fuses multi-sensor data
- Quantum improvement in track accuracy, continuity, and target identification
- Extends detection ranges

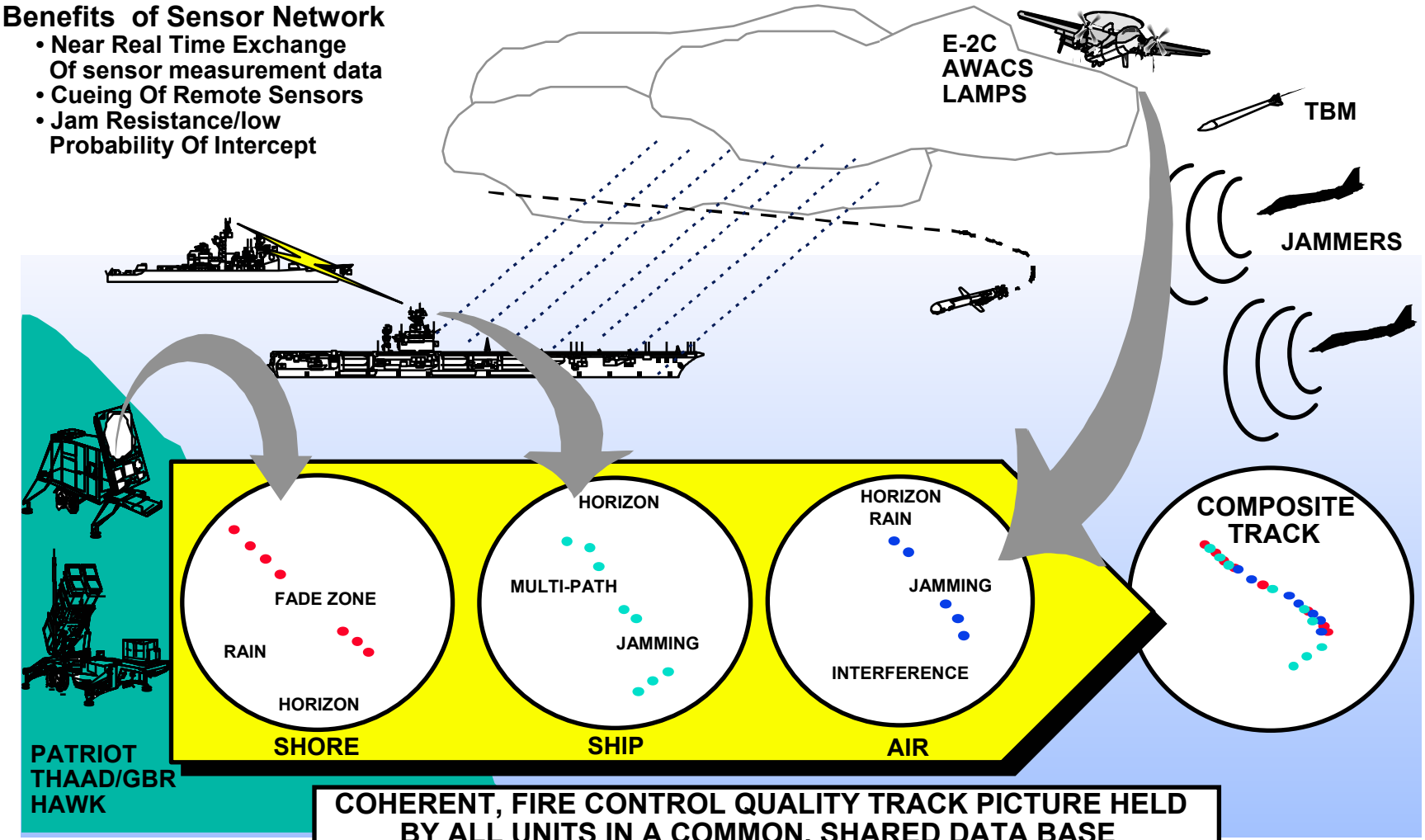
Sensor Data Fusion Decreases ***Time*** Required to Generate Engagement Quality Awareness



Benefits of Real-Time Fusion

Benefits of Sensor Network

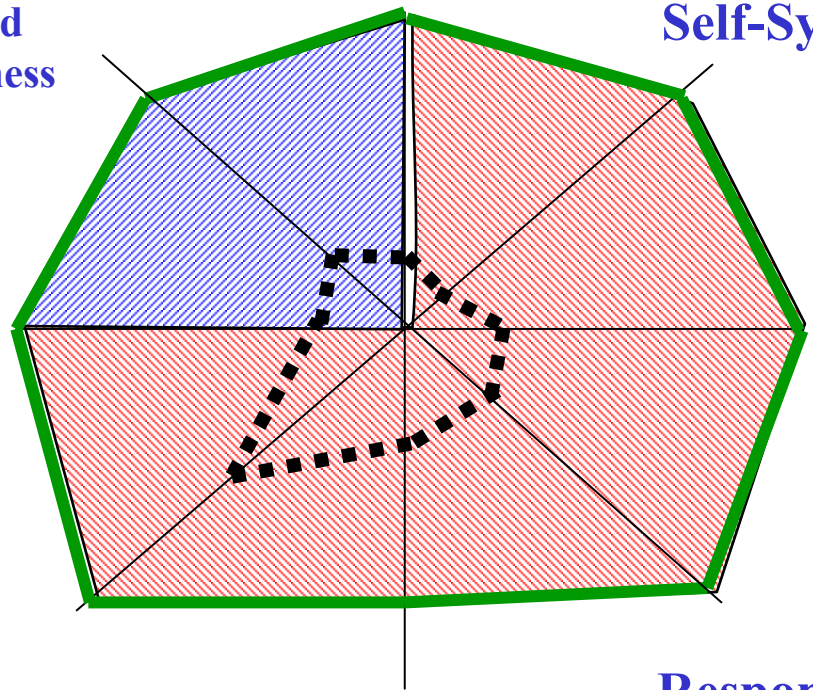
- Near Real Time Exchange Of sensor measurement data
- Cueing Of Remote Sensors
- Jam Resistance/low Probability Of Intercept



COHERENT, FIRE CONTROL QUALITY TRACK PICTURE HELD BY ALL UNITS IN A COMMON, SHARED DATA BASE

Competitive Advantage

Information Advantage



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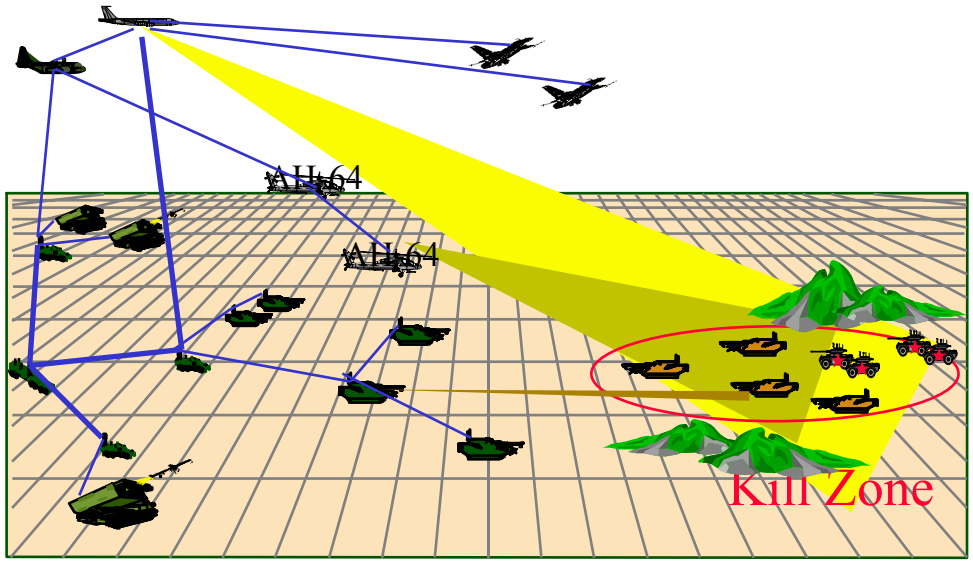
Attributes of Platform-Centric Operations

Attributes of Network-Centric Operations

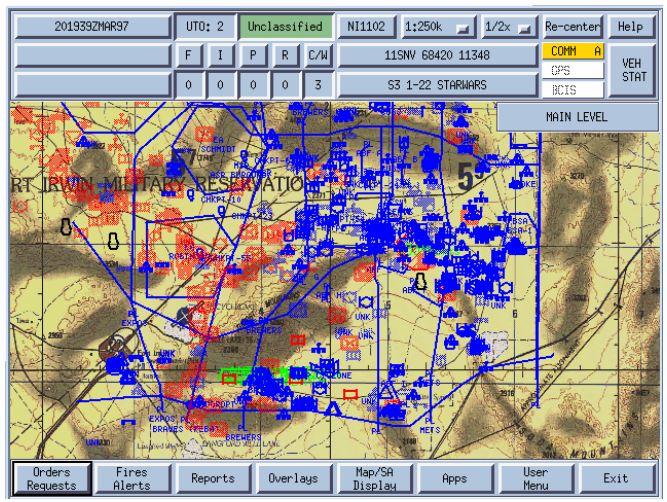
Competitive Advantage

Task Force XXI AWE



Increased Battlespace Awareness

- **Where Am I?**
- **Where Are My Buddies?**
- **Where Is the Enemy?**



Increased Combat Effectiveness

	Before/After	OPTEMPO	Lethality	Survivability
• Plan Development (Div)	72 vs 12 hrs.	■		
• Call for Fire	3 vs 0.5 min		■	
• Deliberate Attack (Co)	40 vs 20 min	■	■	■
• Hasty Attack (Co)*	39 x 112 Red Loss	■	■	
• Defense in Sector*	Loss vs Win		■	■
• Movement to Contact*	91 vs 128 Red Loss		■	■

Source: Army Digitization overview - BG William L. Bond, 20 May 98

The Bottom Line is: The EXFOR Division killed over *twice* the enemy in *half* the time, over *three times* the Battlespace, with *25% fewer* Combat Platforms using Information Age Technology

* Task Force XXI AWE Integrated Report: Post-NTC Modeling of Opportunities

Source: Military CIS '98 - BG William L. Bond, 20 April 1998

Counter SOF

Network-Centric Warfighting Concept:

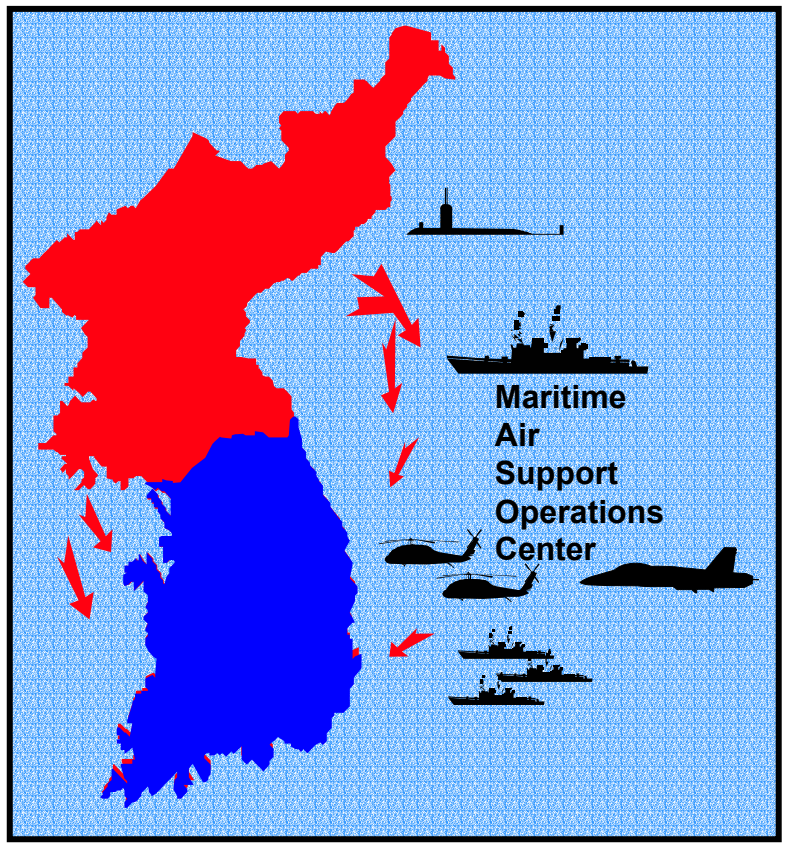
Land - Sea engagement network
- – Shared awareness
- – Increased engagements

• Efficient resource allocation
- – Weapon-target pairing
- – Self synchronization

• Multi-service solution
- – Coordination at "the seams"

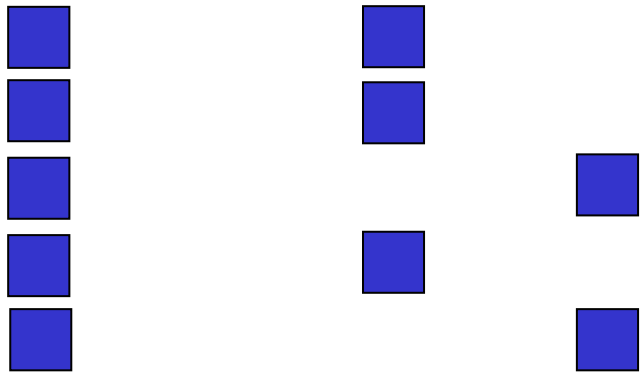
Source: NWDC Briefing to DRB for RMA Oversight - 14 Jan 99
FBE Delta Quick Look Report

Navy Component Commander's Number One Problem



FBE Results and Implications

	Before/After
• Avg Decision Cycle	43 vs. 23 min
• Mission Timeline	50% Decrease
• Shooter Effectiveness	50% Increase
• Assets Scrambled	15% Decrease
• Leakers	10x Decrease



The Bottom Line:

FBE Delta demonstrated the potential for a networked force provided with *shared awareness* to *self-synchronize* and to accomplish the CSOF mission in *half* the time and to reduce SOF leakers by an *order of magnitude*.

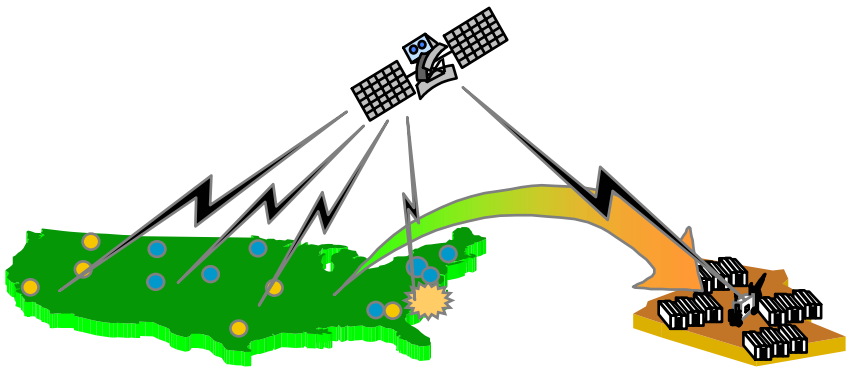
Source: Fleet Battle Experiment Delta Quick Look Report
An Assessment of IT-21 Warfighting Value-Added

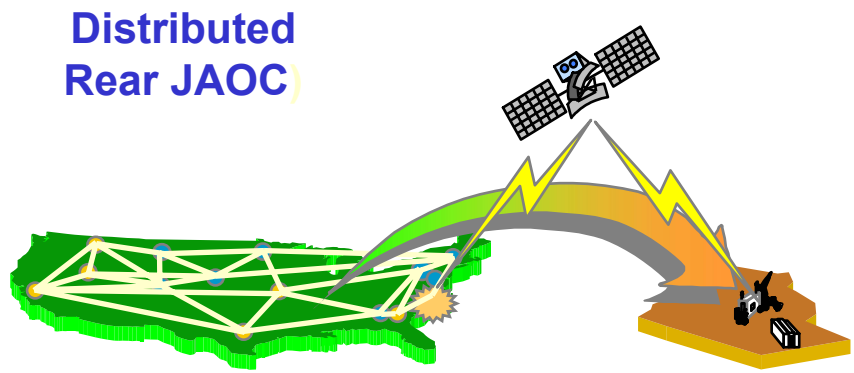
EFX‘98” Sharing and Collaboration

Before/After

- **Deployed Footprint** 1500-2000 vs. 100-300
- **Deployment Timeline** 10-15 Days vs. 1-2 Days
- **Air Lift Required** 25 C-17 Loads vs. 2 - 3 C-17 Loads

Virtual Collaboration:
Moving Information - Not People





Source: EFX ‘98 Final Report

Network-Centric Attack Ops

F15-C Air Ops: Active Missile Counter Tactics

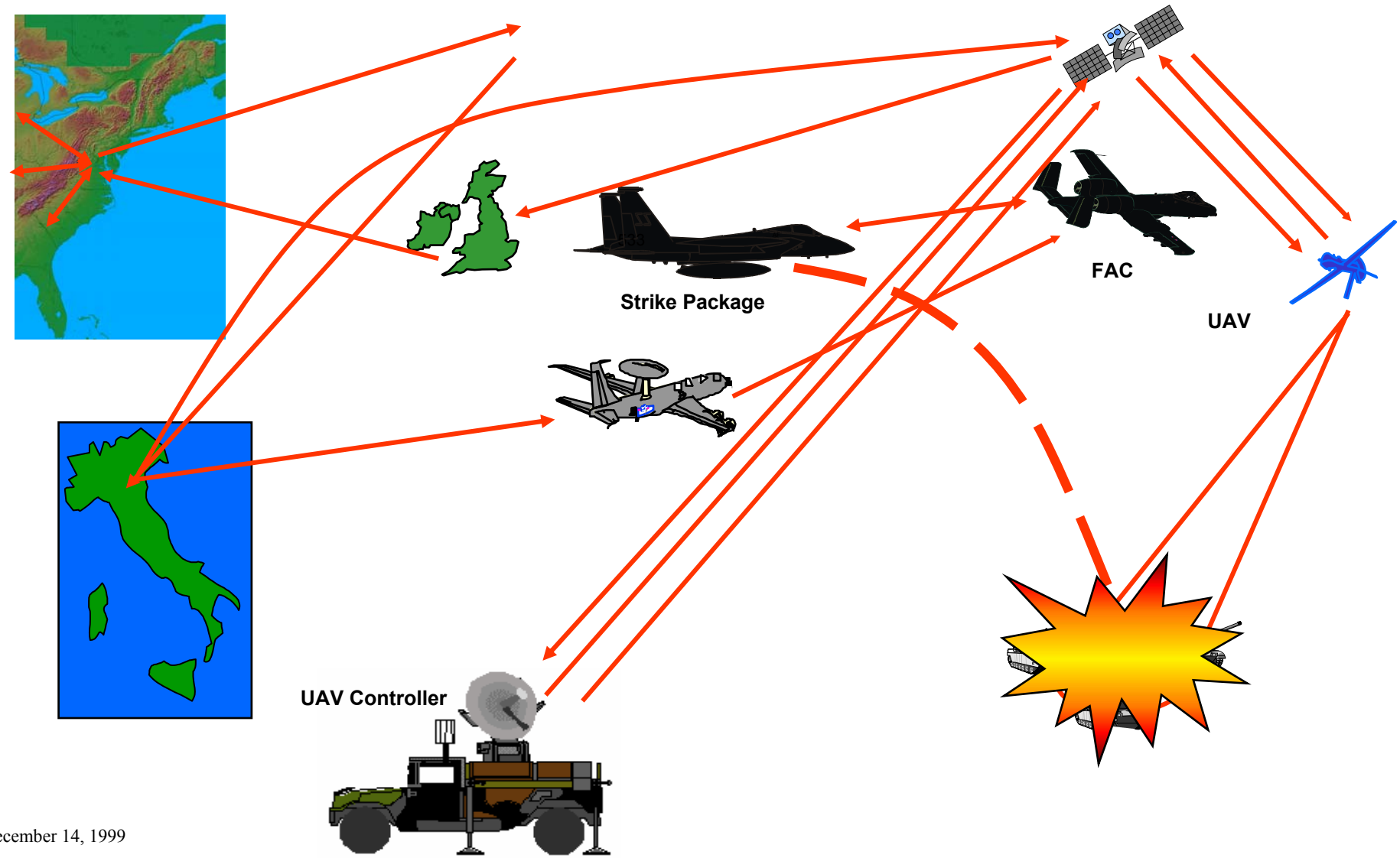
	Without JTIDS/With JTIDS
• Information Advantage	Voice Only vs. Shared Tactical Picture
• OODA Loop	Baseline Compressed with Self-Synchronization
• Kill Ratio	3.10:1 vs. 8.11:1

The Bottom Line:

JTIDS Operational Special Project demonstrated networked air crews fighting with *shared awareness* could increase combat power by over *100 %*

Source: JTIDS Operational Special Project - Report to Congress

Network Centric Operations



Summary of Emerging Evidence

Task Force XXI Advanced Warfighting Experiment

Faster, precision maneuver for lethal, evasive engagement of enemy ground force based on shared battlesspace awareness & tactical synchronization

Fleet Battle Experiment (FBE) Delta

Internetting of AEGIS and Firefinder radars for counter-battery fires.
Aggressive prosecution of Special Operations Forces (SOF) threat based on shared awareness and rapid, self-synchronized engagement

Expeditionary Force Experiment (EFX)‘98

Joint Forces Air Component Commander (JFACC) Enroute
Bombers linked into tactical info grid for beyond-line-of-sight retargeting
Reduced Joint Air Operations Center (JOAC) forward footprint

JTIDS Operational Special Project

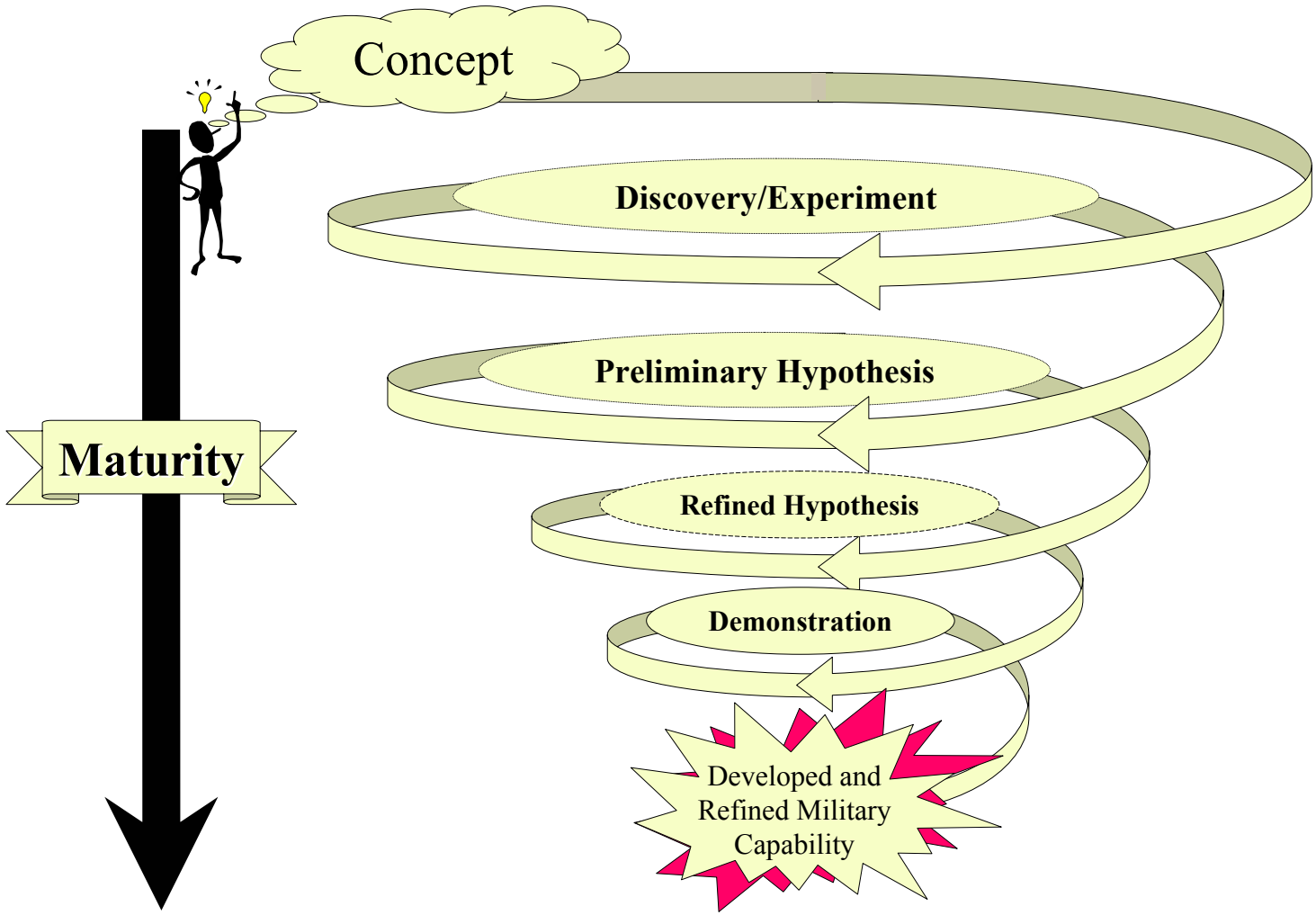
Attack Operations with Tactical Data Links

Operation Allied Force

Agenda

- **Purpose**
- INFORMATION SUPERIORITY
- NETWORK CENTRIC WARFARE
- **Thoughts on Experimentation**

From Concept to Capability



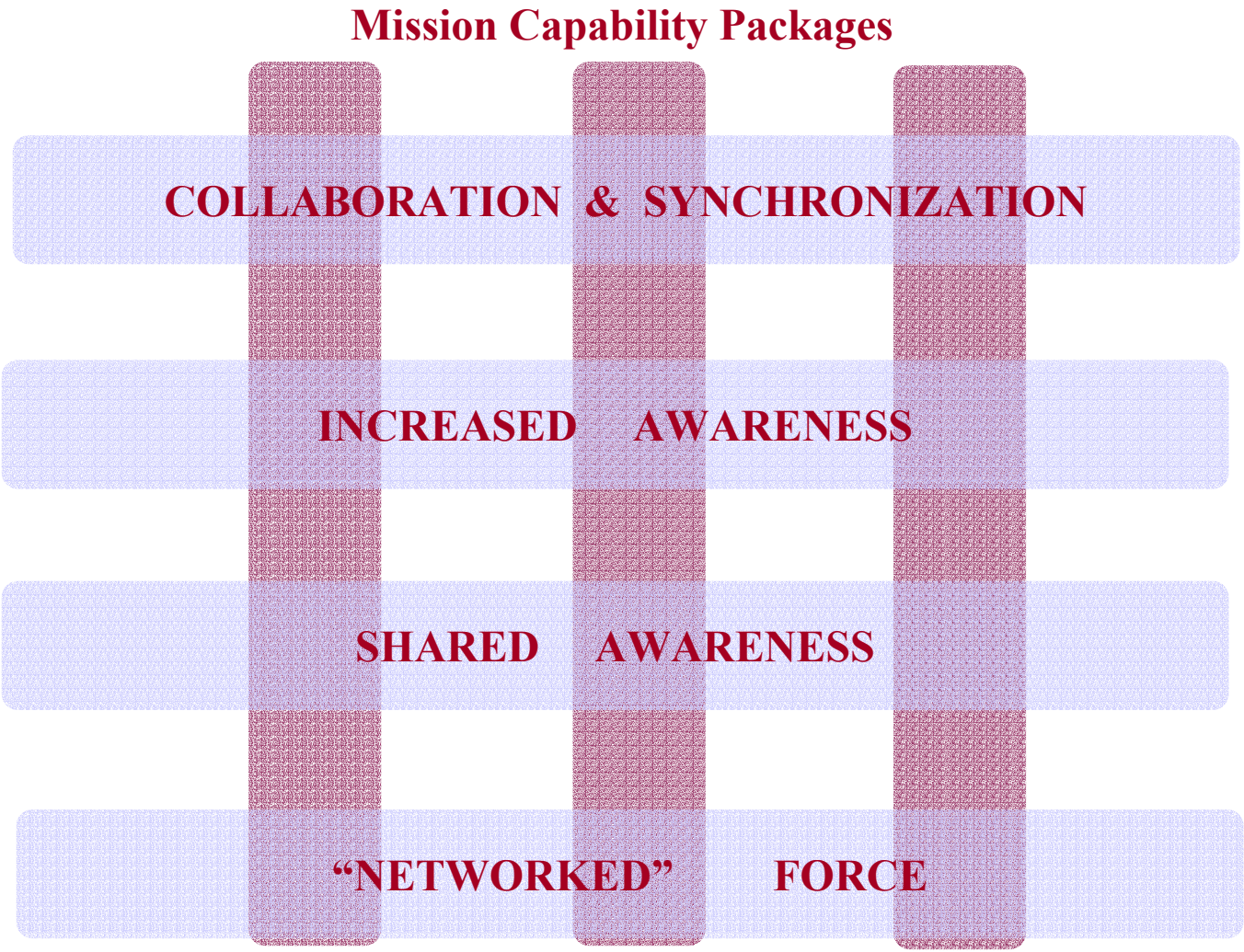
Organizing Logic for Experimentation

- IS and NCW Concepts Provide an Organizing Logic for Concept-Based Experimentation Based upon
  - Elements of Information Superiority
  - Attributes of a Network-Centric Force
- This Organizing Logic Gives Rise to an Integrated and Coherent Set of
  - Hypotheses
  - Metrics (dependent variables)
  - Key Independent Variables ("treatments" and "conditions")

Evidence of Convergence

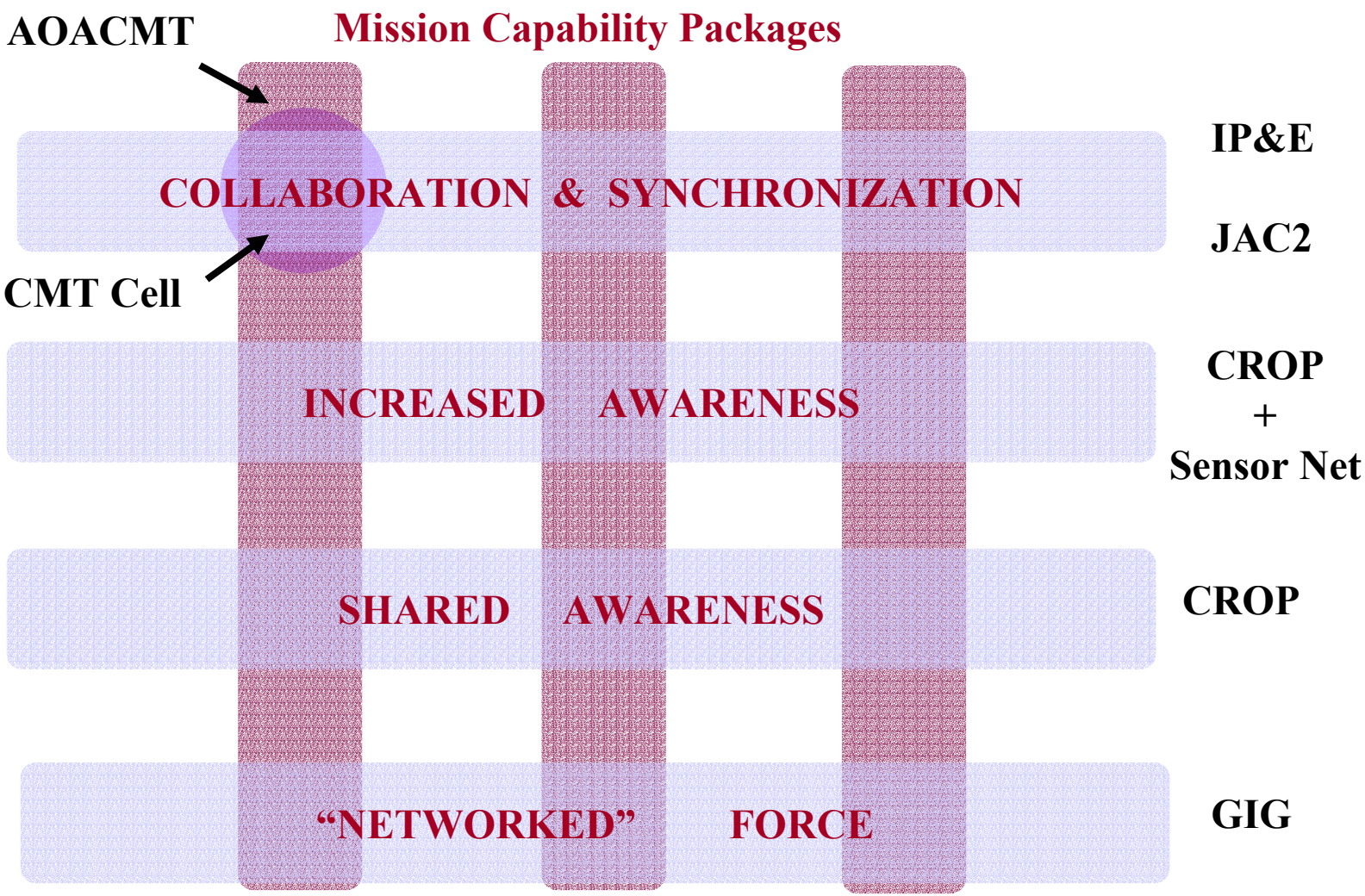
- The AOACMT Hypothesis
  - "IF we can establish a multi-spectral, cross-cued sensor network -- linked by a responsive decision mechanism to precision engagement means -- THEN we will be able to ……."
- and the Decomposed Version
- Represent Evidence of Intellectual Convergence with respect to Core IS and NCW Concepts and Metrics
- But We Need to Complete the Convergence
  - Separate Means from Ends (e.g. Sensor Networks from Awareness)
  - Develop Common Understanding of Key Cross-cutting Concepts and Metrics (e.g. Shared Awareness)

Experimental Space



Core IS / NCW Concepts

Experimental Space



Power of IS / NCW Core Concepts

- They Get at the Fundamentals
- Facilitate Sharing of Experimental Results Across Missions and Contexts
- Enable Creation of a Useful Body of Knowledge
- Bottom Line: More Bang for the Experimental Buck

Hypothesis Template

THEN

COLLABORATION & SYNCHRONIZATION

INCREASED AWARENESS

SHARED AWARENESS

IF

"NETWORKED" FORCE

fill in the mission

Success with

- ☑ **Higher Probability**
- ☑ **More Quickly**
- ☑ **More Efficiently**

Impact of NCW

Goals

-Shape security environment
- Deter aggression or abort conflict
- Deny occupation and defend friendly assets
- Neutralize or degrade an adversary's capabilities
- Across the spectrum of conflict

Enabling

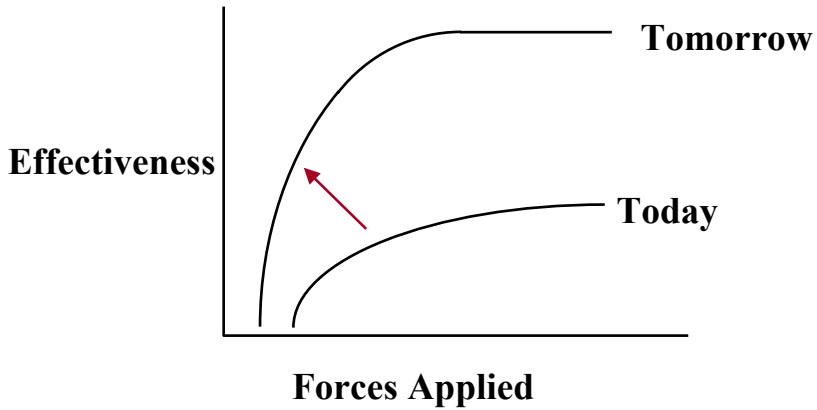
- Preemptively foreclose adversary COA
- Shock and Awe (Paralyze, Shatter, Disintegrate)
- Increased Speed and Lethality
- Reduced Risk and Increased Survivability

NCW Characteristics and Capabilities

-Increased Battlespace Awareness and Knowledge
- Adaptive C2 Approaches and Organizational Structures
- Self-synchronizing Forces

There is a growing body of evidence that

NCW Enables an Isoquantal Shift



Adapted from: "An Evolutionary Cornerstone for JV2010" 3/9/99 prepared for the J6 by Roy Evans

Illustrative Metrics

Completeness
Consistency
Correctness of Classification
Currency
Distribution
Location Accuracy
Location/Vector Precision
Low Uncertainty
Timeliness

Shared& Increased Awareness

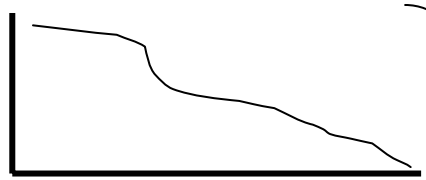
Speed of Command Functions
(e.g., prioritization and assignment)
Targets at Risk
Weapon Utilization

Collaboration / Synchronization

100% − Destroyed
Damaged
Degraded
Suppressed
Rendered
Ineffective

=

% of Target Population Active



Time

Neutralize Targets

Experimentation Lessons "Recorded"

- There is a Learning Curve
  - What Future Technology Can Do
  - How to Co-Evolve MCPs
- The Value of the "Pre" and the "Post"
  - Importance of Focus
  - Value of Analysis
- Projecting Future Technology is Necessary to Stay Ahead of the Power Curve
  - - Information Superiority Advanced Technology Plan

Summary

- INFORMATION SUPERIORITY & NCW Translates into COMBAT POWER
- It is All About Creating and Leveraging an Information Advantage
- Sharing and Collaboration are the Key Processes
- "The emerging evidence for Network Centric Warfare as the intellectual basis for Joint Vision 2010 is compelling"

  General Hugh Shelton, CJCS, June 22, 1999

- IS and NCW Core Concepts Provide an Effective Organizing Logic for Concept-Based Experimentation