AIR FORCE RESEARCH LABORATORY

Knowledge Centric Warfare: Next Evolution of Network Centric Warfare

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Outline

- **Premise**

- **Transition Path**

  - **Platform Centric Warfare**

  - **Network Centric Warfare**

  - **Information Centric Warfare**

  - **Knowledge Centric Warfare**

- **Technologies Required**

- **Summary**

Premise

- **Conduct of Warfare is ever evolving – No Surprise**

- **Incorporation of computer systems have "revolutionized" the conduct of warfare – No Surprise**

- **Doctrine is ever changing to incorporate new technologies – No Surprise**

**Basic Premise of Paper:
Network Centric Warfare is
just one step in the evolution or conduct of warfare**

**And the Next Steps are Information
and Knowledge Centric Warfare**

The Air Force Vision:
Battlespace Dominance through Information Superiority

"The area with the greatest potential payoff... is in C4ISR... [to] ensure our commanders have the best information for rapid battlefield decision-making"

Gen Richard B. Meyers, CJCS, SASC testimony, 5 Feb 02

"Command and control systems—based on information and communications technology—and precision-guided munitions are critical to all stages of the Pentagon's efforts to transform itself to deal with 21st century threats."

Paul Wolfowitz, DSECDEF at AIAA lunch, 19 Feb 02

Platform Centric Warfare

WW II: Formation of 1000
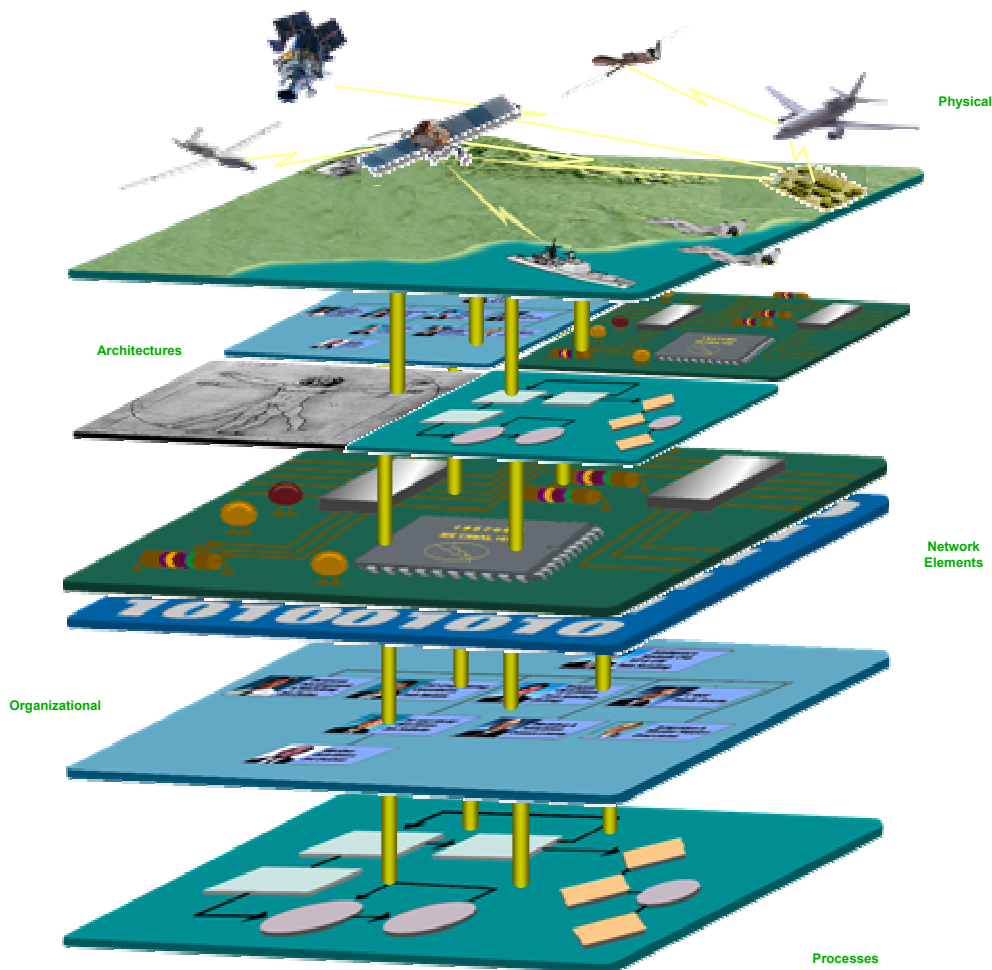

Desert Storm I: Formation of 1

Vietnam: Formation of 4-6

1940s to 1990s

Network Centric Warfare

Physical

Architectures

Network Elements

Organizational

Processes

BUILD the Net

POPULATE the Net

PROTECT the Net

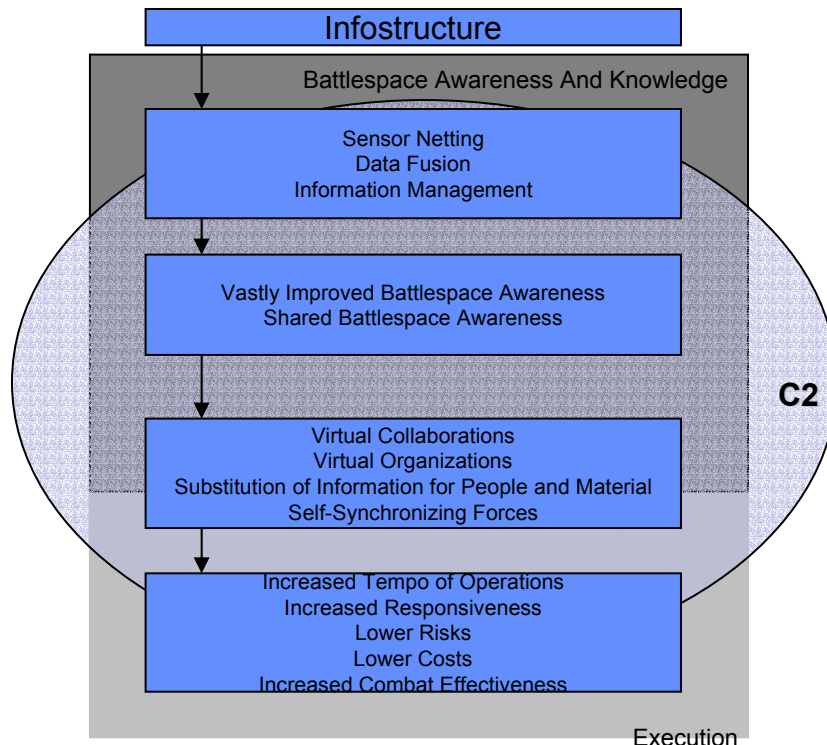**Power TO the Edge**

1990s to 20XXs

1999 NCO Conceptual Framework

Tenets of NCW (*DoD Report to Congress on Network Centric Warfare*):

- A robustly networked force improves information sharing

- Information sharing and collaboration enhances the quality of information and shared situational awareness

- Shared situational awareness enables collaboration and self-synchronization, and enhances sustainability and speed of command

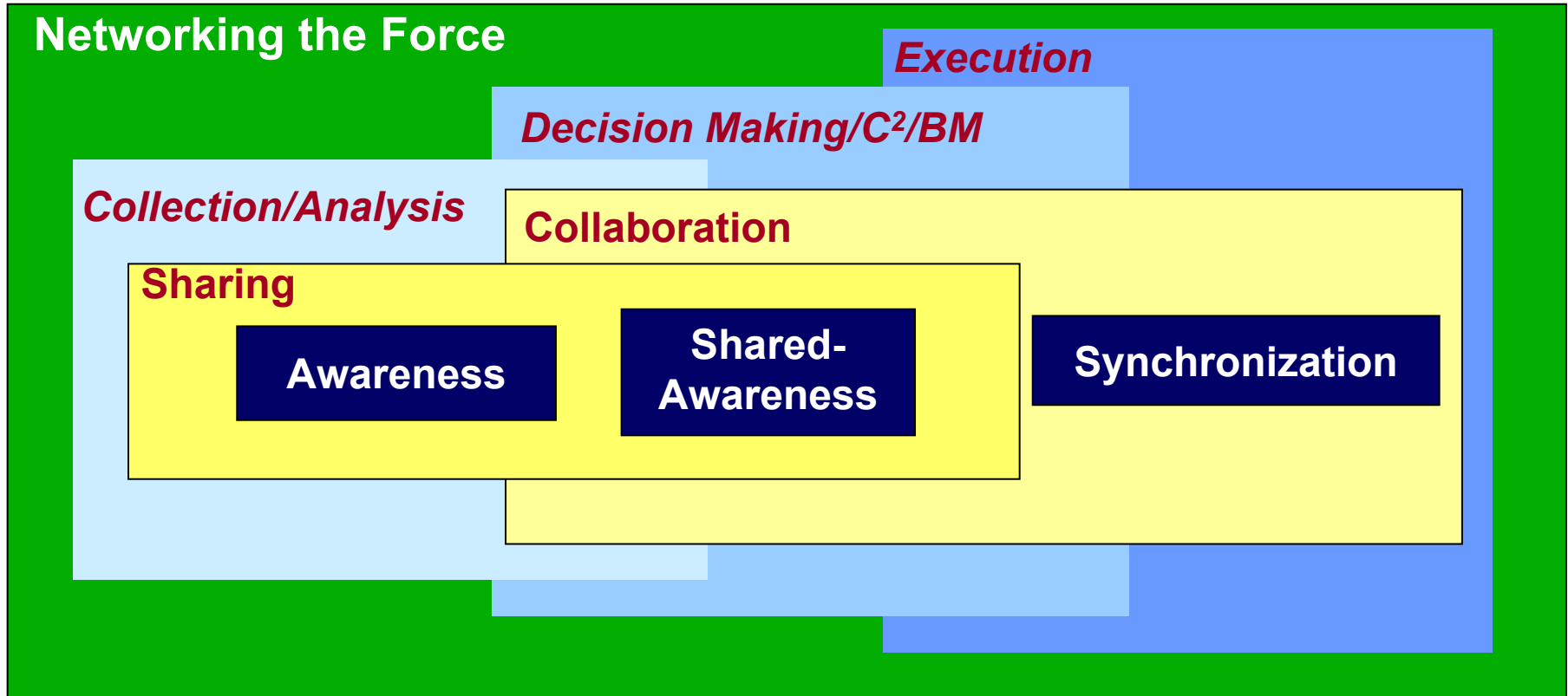- These in turn dramatically increase mission effectiveness

Infostructure

Battlespace Awareness And Knowledge

Sensor Netting
Data Fusion
Information Management

Vastly Improved Battlespace Awareness
Shared Battlespace Awareness

C2

Virtual Collaborations
Virtual Organizations
Substitution of Information for People and Material
Self-Synchronizing Forces

Increased Tempo of Operations
Increased Responsiveness
Lower Risks
Lower Costs
Increased Combat Effectiveness

Execution

**Predominately
Related to Networking the Force
With goal of Self-Synchronization
To increase Combat Effectiveness**

Network Centric Operations
New Mental Model

Networking the Force

Execution

Decision Making/C²/BM

Collection/Analysis

Collaboration

Sharing

| **Awareness** | **Shared-Awareness** | **Synchronization** |

Information Superiority and Network Centric Warfare serve to integrate military operations, providing opportunities to employ new C2 approaches and warfighting concepts

Information Centric Warfare
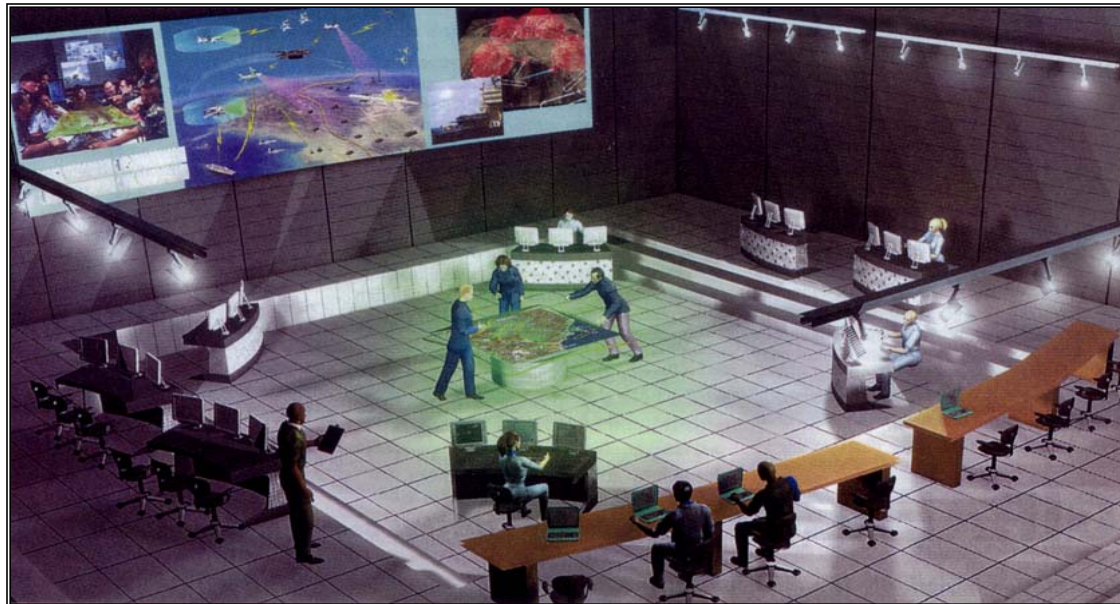
Centers of Gravity Become Centers of Information

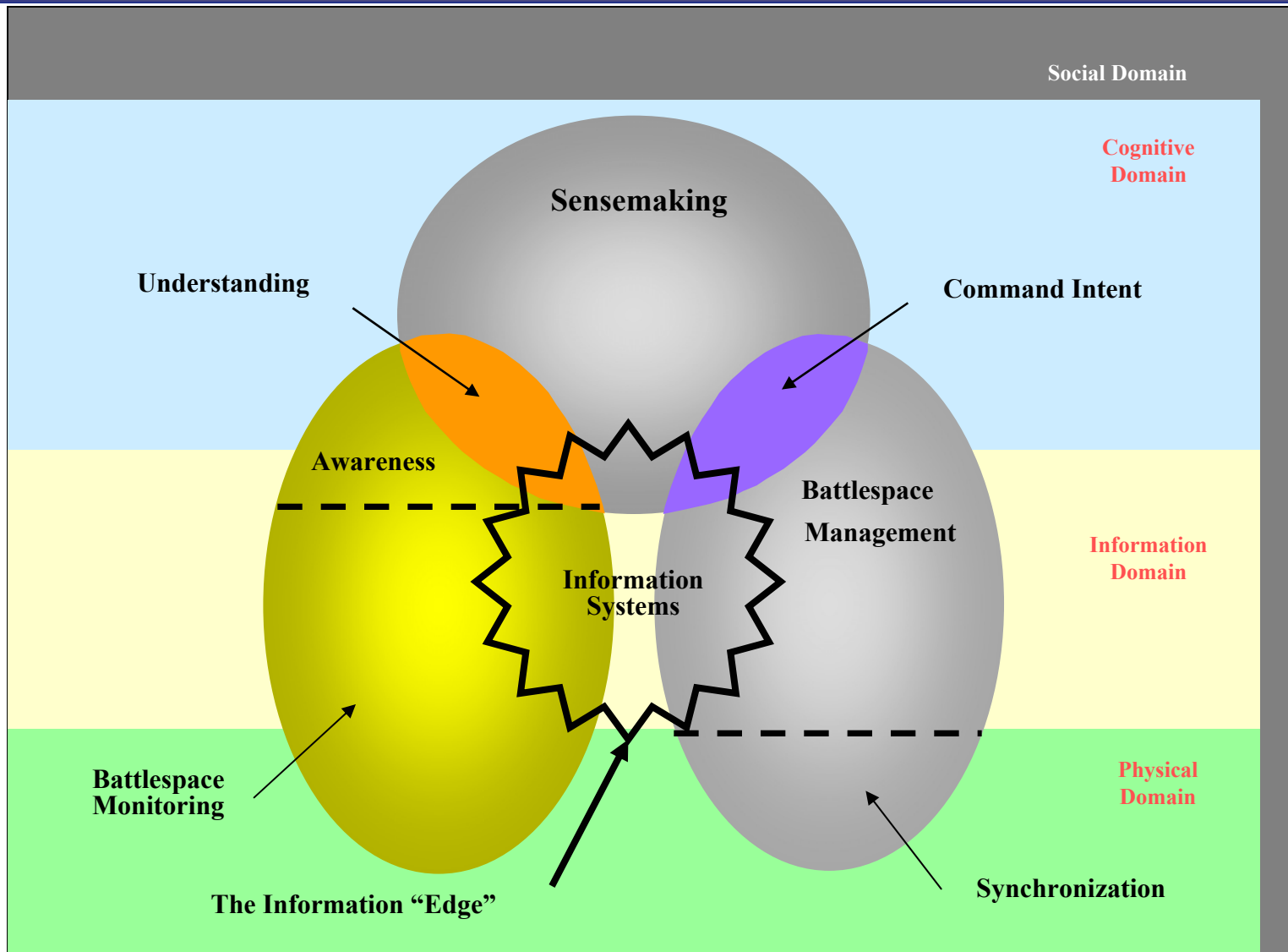**Effects Based Operations and Effects Based Assessments Become Centerpiece**

Predictive Battlespace Awareness Becomes Standard Process

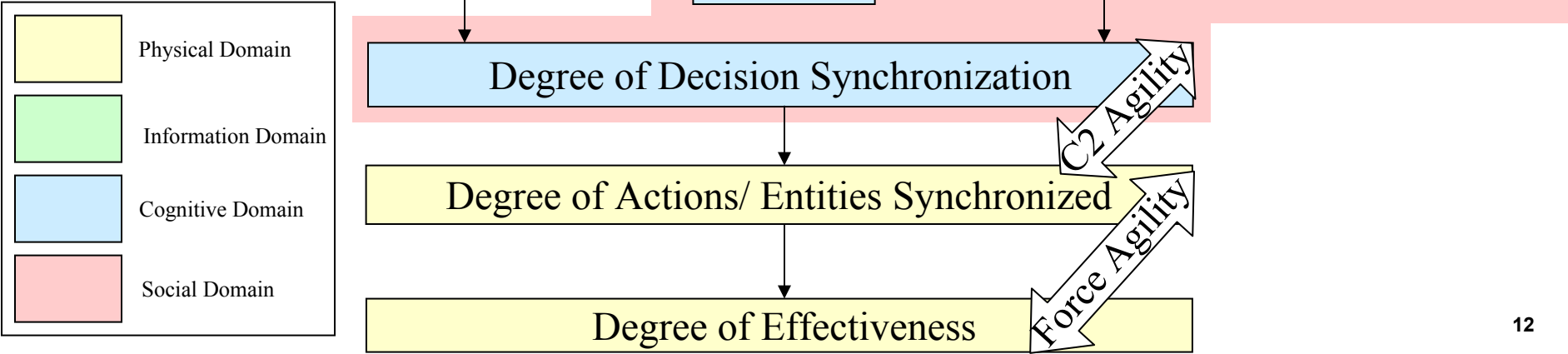**Single Integrated Family of Operational Pictures at All Levels**

20XXs to 20XXs

Command and Control "Egg"

Social Domain

Cognitive Domain

Sensemaking

Understanding

Command Intent

Awareness

Battlespace Management

Information Systems

Information Domain

Battlespace Monitoring

Synchronization

The Information "Edge"

Physical Domain

Command the Forces, Control the Battlespace

2003 NCO Conceptual Framework

Information Sources	*Value Added Services*	Force	*C2*	*Effectors*

Quality of Organic Information

Quality of Networking
- Degree of Networking
- Net Readiness of Nodes

Degree of Information "Share-ability"

Quality of Individual Information ↔ | Quality ↔ **Degree of Shared Information**

Quality of Individual Sensemaking | Quality inter actions | Degree of Shared Sensemaking

Predominately Information Focused

- Individual Understanding
- Individual Decisions

- Shared Understanding
- Collaborative Decisions

Degree of Decision Synchronization

C2 Agility

Degree of Actions/ Entities Synchronized

Force Agility

Degree of Effectiveness

Legend
- Physical Domain
- Information Domain
- Cognitive Domain
- Social Domain

Information-Age Warfare

Conveyed Commander's Intent

Cognitive Domain
Cognitive Advantage

Plan, Organize, Deploy, Employ and Sustain Cycle

Shared Awareness

Compressed Operations

Information Centric Warfare

Information Domain
Information Advantage

Precision Force

Physical Domain
Force Advantage
Position Advantage

Speed and Access
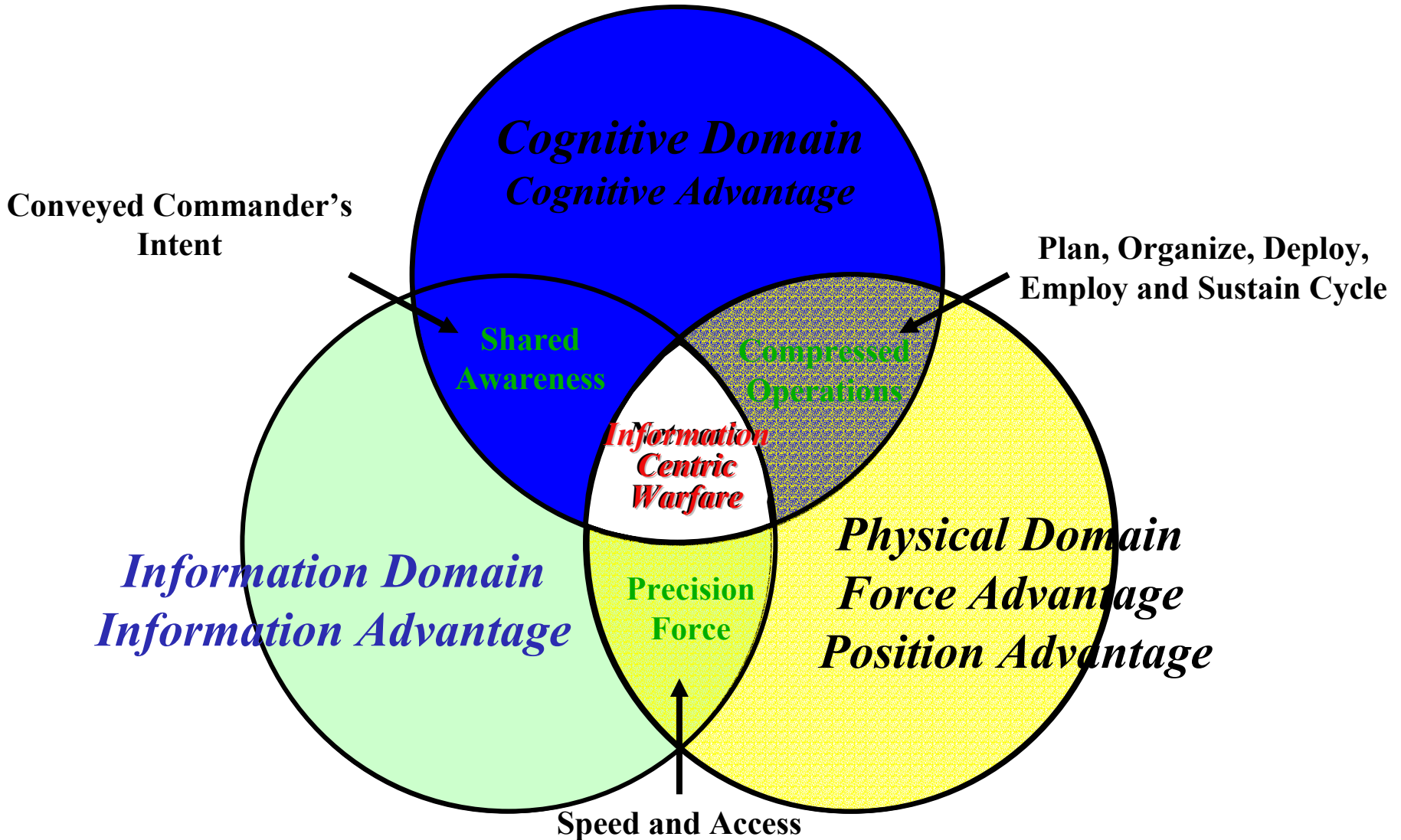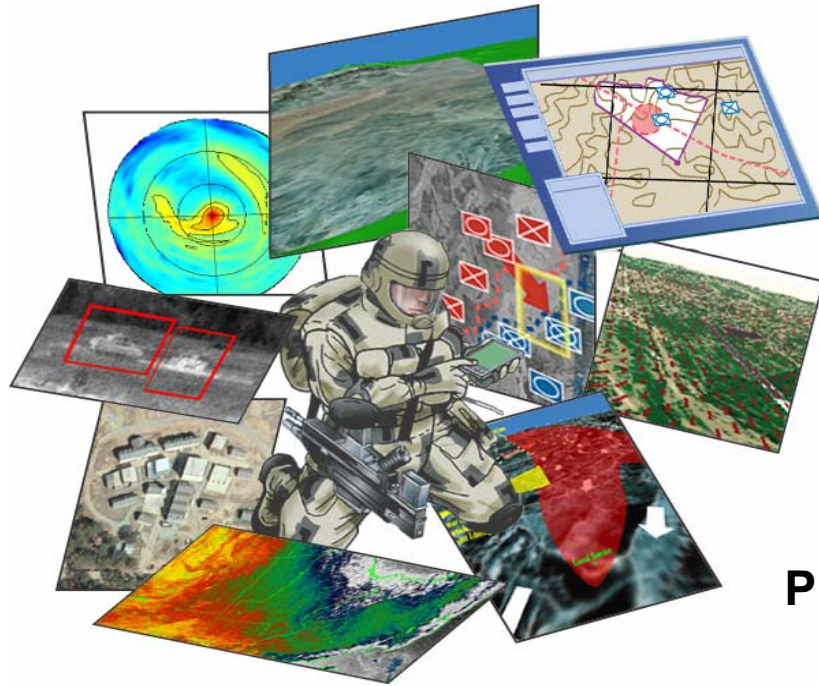
Have We Already Transitioned to Information Centric Warfare?

Knowledge Centric Warfare

BUILD the Net -- USE the Net
- Surfing the Net becomes Commonplace

POPULATE the Net -- KNOW the Net
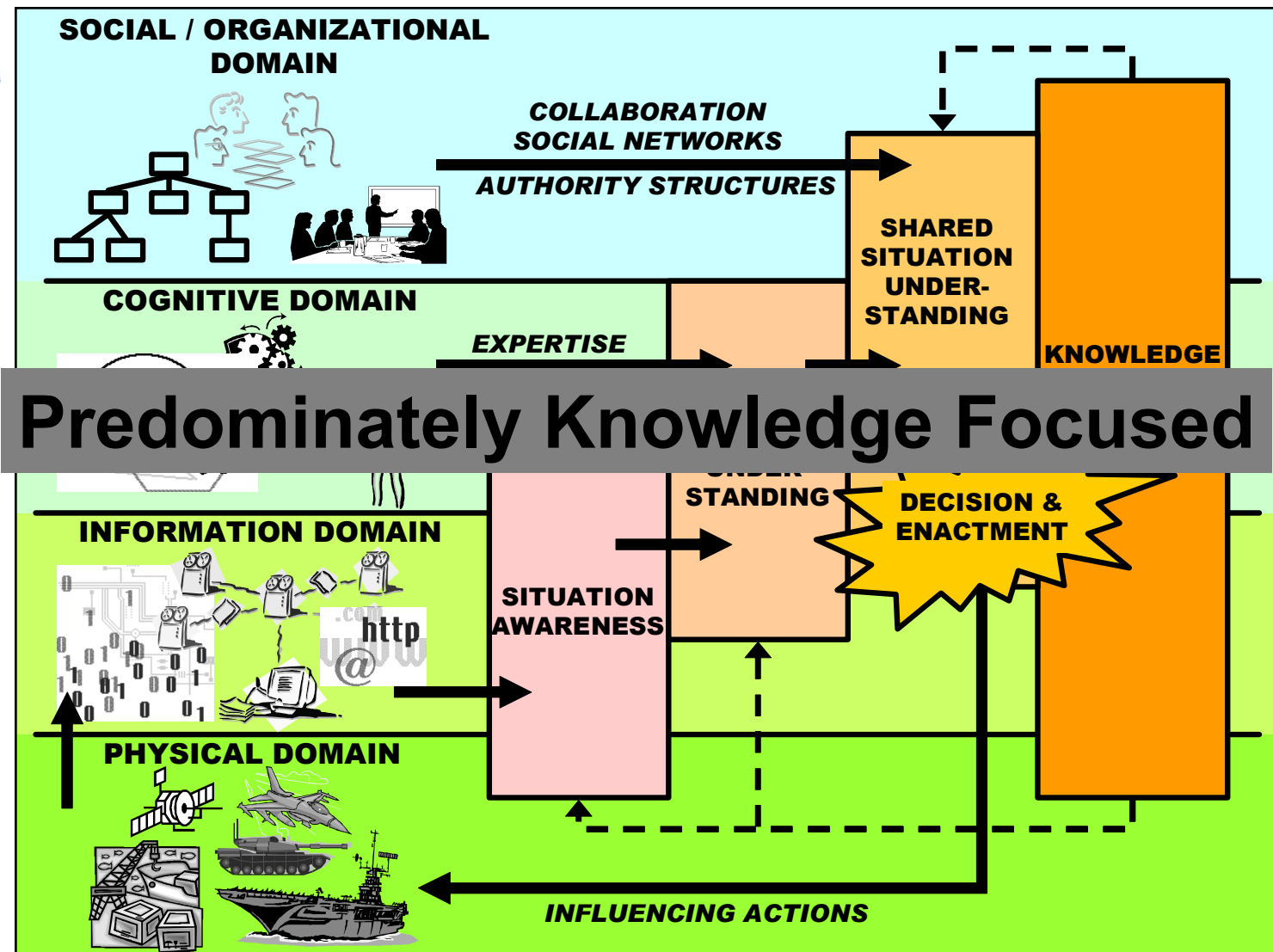**- Knowledge Centers of Gravity -**

PROTECT the Net -- Protect the KNOWLEDGE
- Next Generation Information Assurance -

Power TO the Edge --- Power OF the Edge
- Single Entity Becomes Knowledgeable of All -

20XXs to 20XXs
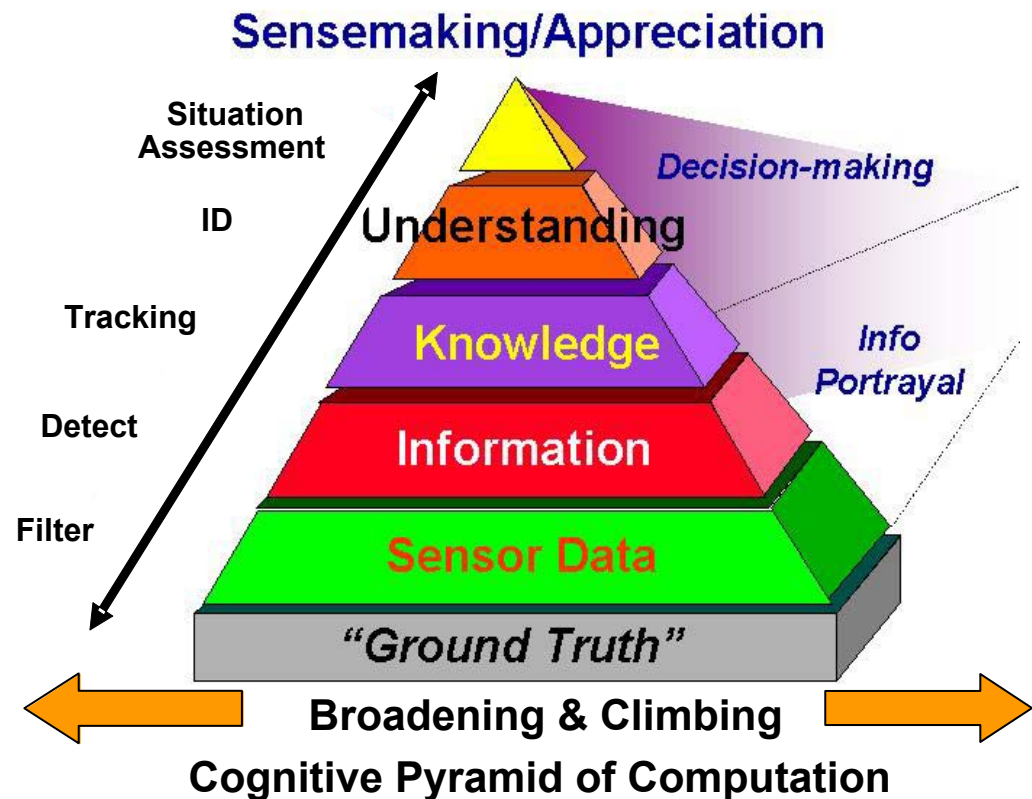
Predominately Knowledge Focused

"Knowledge" Technologies

- **Publish/Subscribe/Broker**
- **Predictive Battlespace Awareness**
- **Effects Based Operations**
- **Distributed Decision Making**
- **Cognitive Reasoning**
- **Behavioral Modeling**
- **Advanced Simulations ("Holodeck")**
- **Knowledge Reasoning**
- **Intelligent Agents**
- **Modeling and Simulations**
  - **Pattern based**
  - **Real-time**
  - **Self-organized**
- **Multi-domain information fusion**
- **Knowledge Pedigree**
- **Information Assurance**
- **Self-learning Knowledge Extraction**

Sensemaking/Appreciation

Situation Assessment

ID

Tracking

Detect

Filter

Decision-making

Understanding

Knowledge

Info Portrayal

Information

Sensor Data

"Ground Truth"

Broadening & Climbing

Cognitive Pyramid of Computation

Summary

- **Network Centric Warfare is just one step in the evolution or conduct of warfare**

- **Evolutionary Steps**

  - **Platform Centric Warfare**

    - **Network Centric Warfare**

      - **Information Centric Warfare**

        - **Knowledge Centric Warfare**

- **What's the next step?**

  - **Understanding Centric Warfare????**

Questions?

"Information superiority becomes a precondition for fighting to achieve air and space superiority."

LtGen Liu Shunyao

Chief, China Peoples Liberation Army Air Force

28 Feb 2000