

Enabling Effective Decisions

Tom “Buck” Buchanan - C2 Program Area Manager, Precision Engagement Business Area

Tim Galpin - Business Area Executive, Infocentric Operations

Jim Hillman - Joint C2 Group, Warfare Analysis Business Area

Bob Leonhard - National Security Analyst, National Security Analysis Department

John Nolen - Principal Professional Staff Analyst, National Security Analysis Department



APL

The Johns Hopkins University
APPLIED PHYSICS LABORATORY

Outline

- **Purpose**
- **Background**
 - Key definitions
 - Operational Environment
- **JHU APL C2 Concept**
 - Features
 - Advanced Situational Awareness/Knowledge
 - Decision Making
 - Planning
 - Execution
- **Summary**

Why JHU APL Developed a Command Concept

- To inform and focus the Lab's research and development efforts
- To offer hypotheses for testing and experimentation
- To facilitate further collaboration with the larger defense community

Key Definitions

- **Command:** The authority that a commander in the armed forces lawfully exercises over subordinates by virtue of rank or assignment. Command includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating, and controlling military forces for the accomplishment of assigned missions.
- **Control:** ...the regulation of forces and battlefield operating systems to accomplish the mission in accordance with the commander's intent.
- **C2 System:** The arrangement of personnel, information management, procedures, and equipment and facilities essential for the commander to conduct operations.
- **Operational Environment:** A composite of the conditions, circumstances, and influences that affect the employment of military forces and bear on the decisions of the unit commander.

The operational environment is what it is, not what we want it to be—and it will change

- **Decision Makers must address opposing considerations – often within the same conflict, campaign, or moment in time**
 - **Conventional warfare v. unconventional warfare**
 - **Hierarchy v. anarchy**
 - **Centralized control v. decentralized control**
 - **Concentration of forces v. dispersion of forces**
 - **Knowledge v. ignorance (certainty v. uncertainty)**

Conventional Warfare v. Unconventional Warfare

Conventional Warfare

- Conventional forces
- Defined combatants
- Linear battlefield
- Terrain objectives

Examples:

- Desert Storm, 1991
- Iraqi Freedom, 2003
- ...but each had unconventional components



Unconventional Warfare

- Irregular forces
- Undefined combatants
- Non-linear battlefield
- Non-terrain objectives

Examples:

- Enduring Freedom, 2001
- Iraqi Insurgency, 2003-5
- ...but each had conventional components

Desert Storm

OIF

Panama 89

Kosovo 99

OEF

Iraqi
Insurgency

Global War
On Terror

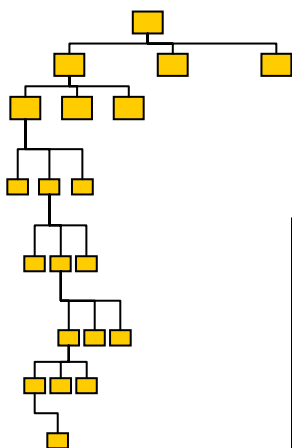
Conventional

Unconventional

Hierarchy v. Anarchy

Hierarchical relationships

- Senior
- Subordinate
- Supporting
- Supported



“Anarchical” relationships

- **Coalitions**
- **Cooperation across organizations**
- **Liaison with central or local officials**
- **Ties with national or local religious or tribal organizations**
- **...**

Conflict	Troops (Millions)
Panama 89	0.5
Desert Storm	0.5
OIF	0.5
OEF	0.5
Iraqi Insurgency	0.5
Kosovo 99	0.5
Global War On Terror	1.5

Conflict	Troops (Millions)
Panama 89	0.5
Desert Storm	0.5
OIF	0.5
OEF	0.5
Iraqi Insurgency	0.5
Kosovo 99	0.5
Global War On Terror	1.5

A horizontal timeline bar with a color gradient from dark blue on the left to green on the right. It contains seven labels for military operations in chronological order from left to right: Panama 89, Desert Storm, OIF, OEF, Iraqi Insurgency, Kosovo 99, and Global War On Terror.

Operation	Approximate Year
Panama 89	1989
Desert Storm	1990-1991
OIF	2001-2011
OEF	2001-2011
Iraqi Insurgency	2003-2011
Kosovo 99	1999
Global War On Terror	2001-2011

Conflict	Troops (Millions)
Panama 89	0.02
Desert Storm	0.05
OIF	0.1
OEF	0.15
Iraqi Insurgency	0.2
Kosovo 99	0.25
Global War On Terror	0.3

Conflict	Relative Troop Count (approximate)
Panama 89	1
Desert Storm	2
OIF	3
OEF	4
Iraqi Insurgency	5
Kosovo 99	6
Global War On Terror	7

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Iraqi Insurgency	2003-2011
Kosovo 99	1999
Global War On Terror	2001-2011

Conflict	Troops Deployed (Approximate)
Panama 89	10,000
Desert Storm	20,000
OIF	10,000
OEF	10,000
Iraqi Insurgency	10,000
Kosovo 99	10,000
Global War On Terror	100,000

Hierarchy

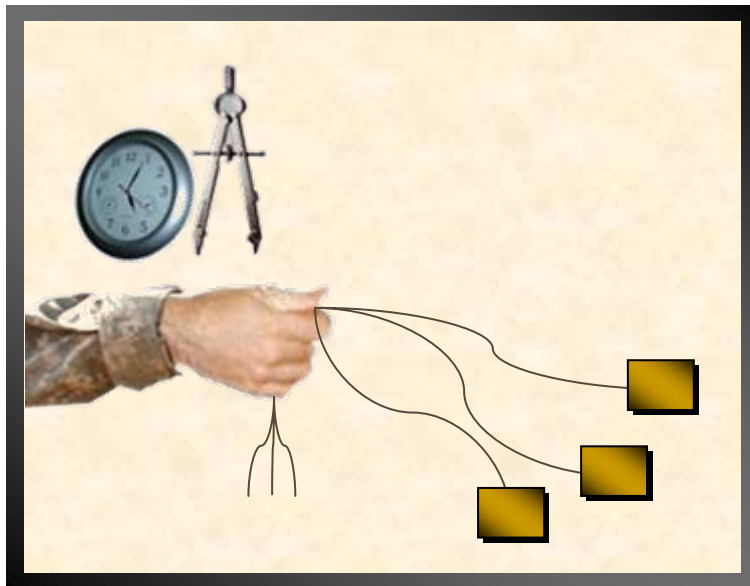
Anarchy

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Centralized Control v. Decentralized Control

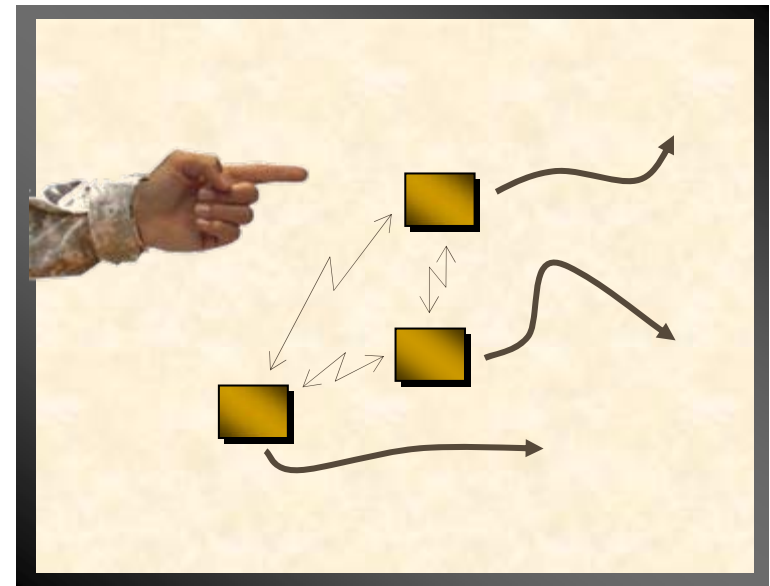
Centralized control

- TPFDD execution
- Air Tasking Orders
- Air Defense Zones
- Bandwidth allocation
- Rules of Engagement
- ...



Decentralized control

- Commander's intent
- Mission orders
- Areas of Operation
- Self-defense
- Subordinate initiative
- ...



Concentration of Forces v. Dispersion of Forces

Concentration of forces

- Focus combat power
- Seize key objectives
- Take decisive action



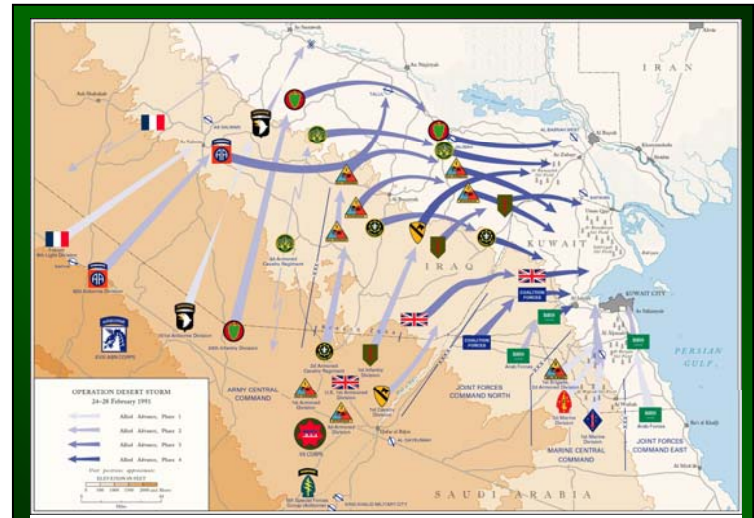
e.g., Airland Battle

Examples:

- Main attack, Desert Storm
- Faluja, Spring 2005

Dispersion of forces

- Control more area
- Reduce target profile
- Hide intent



e.g., Distributed Operations

Examples:

- Afghanistan, 2001
- Iraqi Insurgency

Knowledge v. Ignorance: Decision Makers Must Act with Imperfect Information

Knowledge

- Drawn from credible information about
 - Friendly forces
 - Enemy forces
 - Terrain & weather
- Acquired from many sources

Examples from OIF:

- Friendly strength
- Enemy weapons
- Enemy tactics
- Terrain analysis
- Weather forecasts



Ignorance

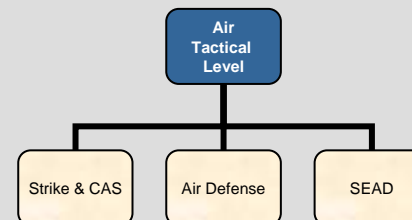
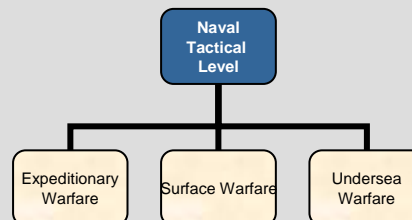
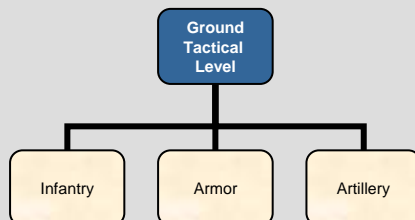
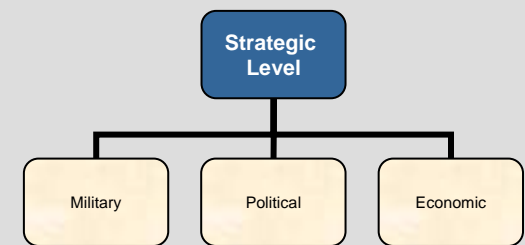
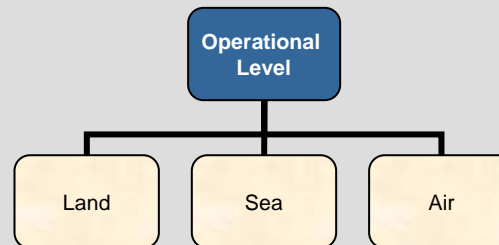
- Unacquired information
- Incorrect information
- Misinformation

Examples from OIF:

- Hussein's location
- Absence of WMD
- Persistence of Baath militias and irregulars
- Delays caused by sand storms

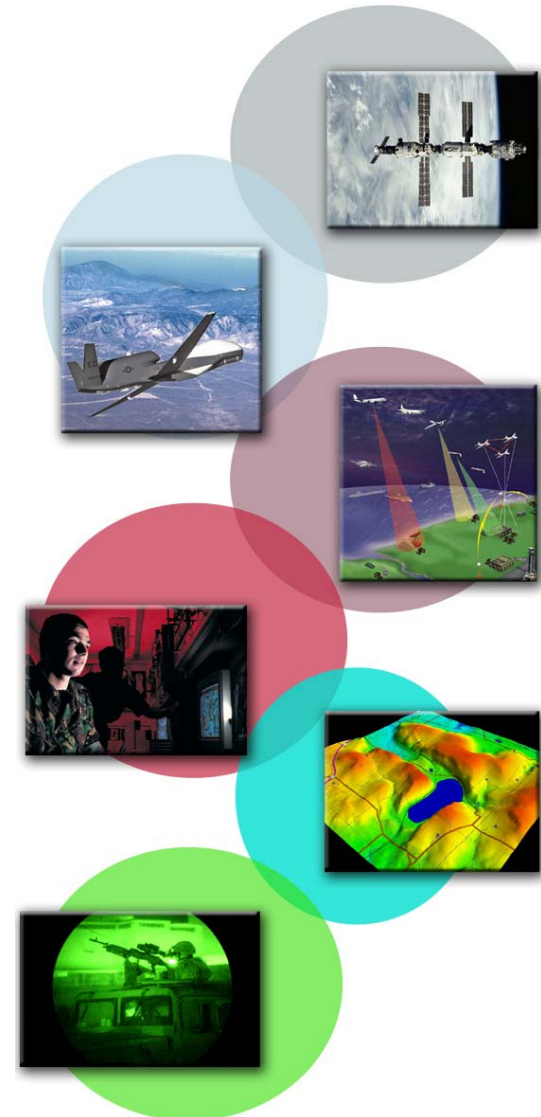
Decision Makers at Different Levels Face Both Common and Different Considerations

- **Common considerations:**
 - Achieve national objectives
 - Direct ISR capabilities
 - Integrate disparate elements to maximum effect
- **Different considerations:**
 - Resources
 - Operational environments
 - Information needs
 - Time frames



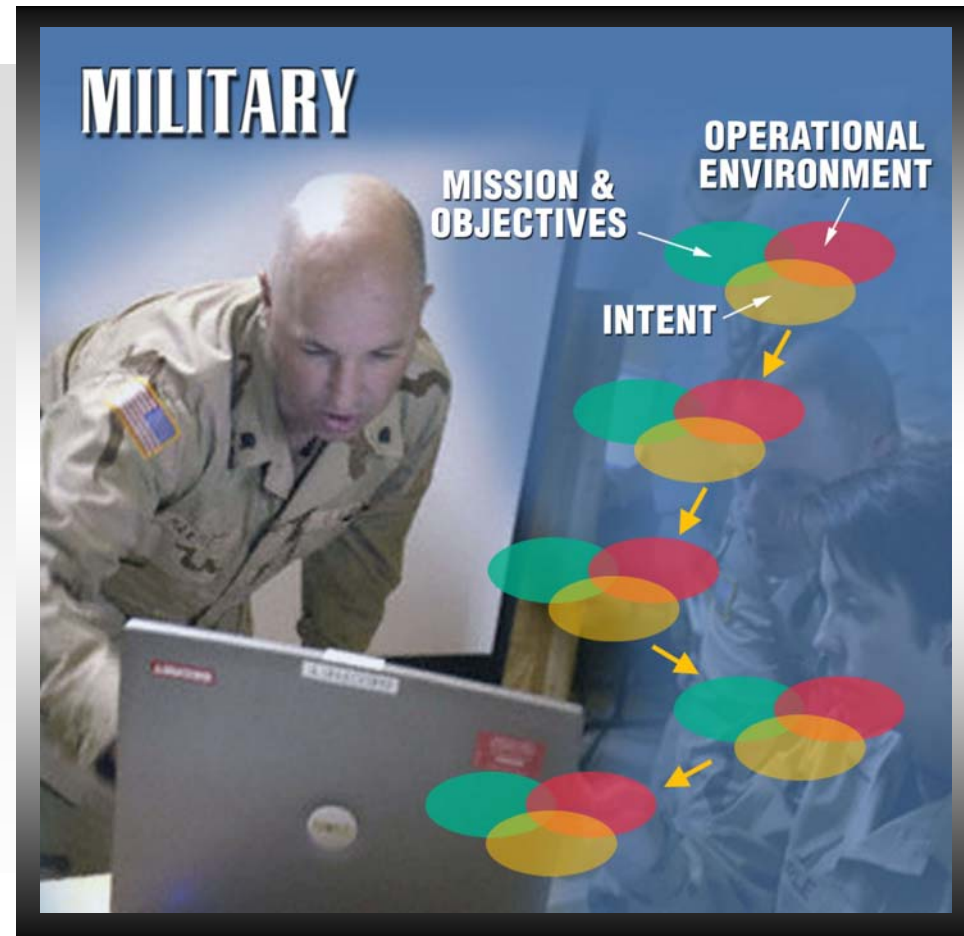
Decision Makers At All Levels Must Direct, Manage, and Exploit Their Information Sources

- Direct assets to address their critical information needs
- Manage assets for best allocation across the force
- Exploit information through timely execution



All Decision Makers Must Instill a Common Understanding Among Subordinates

- Mission and objectives
- Operational environment
- Intent
- ...appropriate to the level of operations and local conditions



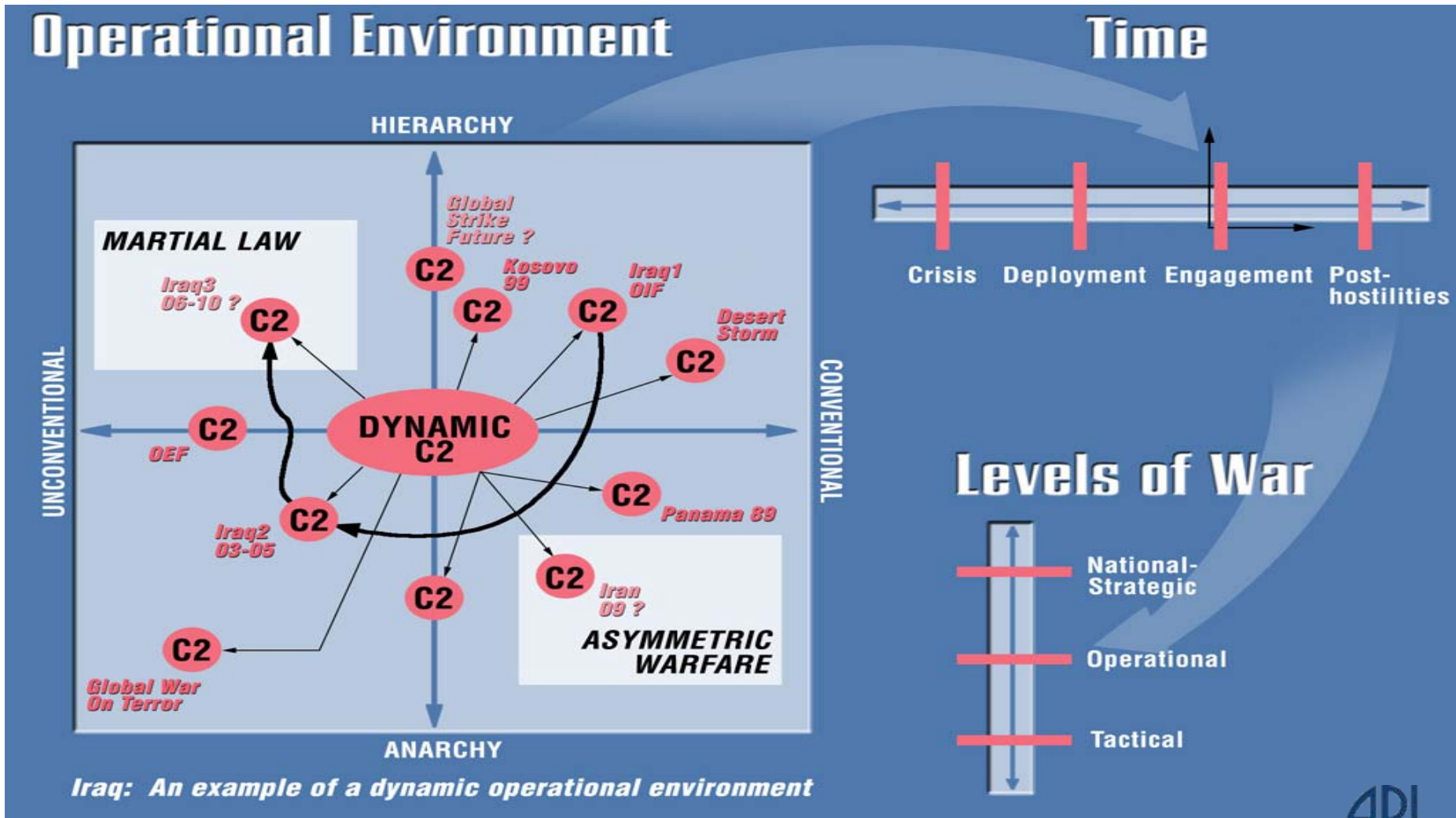
All Decision Makers Must Be Able To Integrate or Collaborate With Other Organizations

- **Defense organizations**
 - Combatant Commands
 - Services
 - Defense agencies
- **Other departments and agencies**
 - Departments of State, Treasury, Homeland Security
 - FBI
 - CIA
 - ...
- **Coalition partners**
- **United Nations**
- **Non-governmental Agencies**
- **Local governments and police**
- **Religious and political leaders**



The Operational Environment is Dynamic; Command Must be Dynamic

- **C2 is influenced by the operational environment**
- **C2 varies over time and levels of war**





The C2 Concept

Salient Features

The JHU APL C2 Concept:

- **Acknowledges the complexity and diversity of conflicts/crises – the interaction of opposing considerations within unique operational environments**
- **Contemplates the full spectrum of military activities**
 - **Presence, peacekeeping, and armed conflict**
 - **Coalition and interagency operations**
 - **Homeland defense**
- **Focuses on conceptual flexibility – the expectation that any operational environment is dynamic and that future C2 must also be dynamic**
- **Assumes that future C2 must integrate emerging operating concepts with emerging technologies in four key areas:**
 - **Advanced Situational Awareness/Understanding**
 - **Decision Making**
 - **Planning**
 - **Execution**

Situational Awareness: Decision Makers Will Want to Manage It

- **Current concepts assume:**
 - That a common picture translates into common understanding
 - That common understanding is always a good thing
- **Decision Makers will want to manage the picture they develop for their subordinates and superiors**
 - For reasons of time and efficiency
 - For reasons of operational security
 - For the purposes of deceiving the enemy
 - For coalition and interagency operations that demand discretion and lower levels of classification
- **Depending upon how it is implemented, a “common operating picture” will influence concepts of authority, command, and organizational structure**

The Concept for Advanced Situational Awareness/Understanding

- **Create an on-demand, tailorable operational picture: the state and actions of friendly forces, enemy forces, and their environments**
 - **Shared awareness of the battlespace**
 - **Enable users to rapidly develop a clear understanding of the situation in the battlespace**
- **Leverage information**
 - **Find, and fuse relevant information**
 - **Reduce or eliminate poor-quality data**
 - **Characterize the confidence level of the data portrayed**
 - **Minimize conflicting information**
 - **Present the right information to users at the right time**
 - **Visualize information at multiple security levels**
 - **Support derivation of situational understanding**

The Concept for Advanced Situational Awareness/Understanding (Cont'd)

- **Compress into fewer, tailorable displays what is currently provided on multiple devices**
 - **Adaptable to the specific user's environment (e.g., fighting position, cockpit, headquarters,...)**
 - **User-selected or tailored formats and media**
 - **Provide an intuitive means of visualization interaction adaptable to user preferences**
- **Exploit a cognitive interface between commanders at all echelons**

Guiding Principle: Decision Authority Must Match Access to Relevant Information



Matched:

Decision Authority has access to relevant information

Example: Allocating theater air power based on theater-level ISR

Mismatched:

Decision Authority does not have access to relevant information

Example: Allocating close air support without knowing current tactical situation

Example: Late reaction to levy breach in New Orleans

The Concept for Decision Making

- **Foster distributed, collaborative decision making across echelons, services, agencies and coalitions**
- **Adapt to individual decision-making styles ("stylized" decision aids)**
 - **Utilize a profile of the user's behavior and cognitive process, based on their demonstrated information requirements, as well as their specification of criteria and preferences to facilitate the development, selection, and presentation of options**
 - **Support diverse user environments and operating conditions**

The Concept for Decision Making (Cont'd)

- **Provide a very rapid means for conducting the assessment component of the decision-making process, a process that includes a comparison of the current situation to the expected state and the projected state of both friendly and enemy forces iteratively throughout planning and execution**
 - **Conduct comparative analytic tasks that reveal variances in the execution of the plan, facilitate rapid and effective decision making, and enable the synchronization of forces necessary to support selected options**
 - **Based on an understanding of the current, expected, and projected states, develop and portray options that will either overcome the current and projected challenges or enable the force to exploit emerging opportunities**
 - **Support an autonomous or collaborative evaluation of these options**

Planning and Execution: Decision Makers Must Be Both Reactive and Proactive

Proactive

- Used against an easily anticipated enemy
- Normally requires information superiority
- The preferred way to fight in the American military—but not always possible



DECIDE - DETECT - DELIVER

Reactive

- Used against an enemy that defies templating
- A sound approach when information is scarce
- Often the precursor to or successor to proactive measures

DETECT - DECIDE - DELIVER

A dynamic Command Concept must not default to one or the other...but facilitate both

The Concept for Planning

- **Define Command relationships dynamically, based on changing circumstances: who is supported, who is supporting, ...**
- **Reduce dependencies on manual processes to acquire, process, and quantify information; freeing decision makers to focus on the implications of that information**
- **Analyze and predict the consequences of courses of action**
 - **Rapid means to quantify potential outcomes**
 - **Perform sensitivity analysis**
- **Reduce manpower requirements for routine bookkeeping tasks**

The Concept for Execution

- **Enable the regulation of forces and operating systems**
 - **Exploit functionality common to entities (maintain situational awareness, receipt of instructions, formulation of instructions, dispatch of instructions, etc.)**
 - **Preserve functionality unique to particular entities (targeting, maneuver, sensor management, bandwidth allocation, asset visibility, law enforcement,...)**
- **Foster dynamic communities of interest**
- **Incorporate both the control of sensors and the integration of sensor output as part of C2 capability**
- **Anticipate and adapt to changing conditions**
 - **Forecast and report changes in friendly, enemy, or environmental conditions**
 - **Identify variances in performance from the Commander's concept of operation**
- **Degrade gracefully (maintain essential functionality)**

Summary: Empower Decision Makers

Future C2 systems must support the ability to:

- **Gain and maintain Situational Awareness/Understanding**
- **Enable decision making in diverse operational environments**
- **Enable distributed, collaborative decision making across echelons, services, agencies and coalitions**
- **Define relationships dynamically, based on changing circumstances**
- **Regulate the elements of the force, both military and non-military**
- **Support the interaction of dynamic communities of interest**