



Measuring Command and Control (C2) Effectiveness

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- What is Effectiveness?
- What is C2 Effectiveness?
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What is Effectiveness?

- Effectiveness means impact on the operating environment
- NATO hierarchy of Measures of Merit (MoM)
 - Dimensional Parameters (DP)
 - Measures of Performance (MoP)
 - Measures of C2 Effectiveness (MoCE)
 - Measures of Force Effectiveness (MoFE)
 - Measures of Policy Effectiveness (MoPE)
- Military mission accomplishment classically sought to keep selected values in an acceptable range
 - E.g., casualty ratios, territorial gains...
 - Destroy the adversary capability and will

What is C2 Effectiveness?

- C2 Effectiveness focuses on the impact of a system on its operating environment
 - Adversary forces
 - Neutrals
 - Terrain and other environmental factors
 - Friendly forces
- Mission accomplishment is the crucial element in C2 effectiveness
- Command and Control is never an end in itself—it is a means to an end—it only makes sense in a context

- What is the dependent variable?
 - How is it measured?
 - What measurement error is relevant?
- How is time brought into the analysis?
- How to separate Command and Control performance from commanders' decision making?
- How are linkages across functional areas (logistics, intelligence, operations...) handled in the analysis?

Three Classic Approaches

- Doctrinally driven C2 Assessments
 - Requires authoritative doctrine
 - Typically judgmental (observer/controllers, senior mentors)
- Process oriented measurement
 - Assumes quality process results in quality C2
 - Requires predetermination of desirable processes
- Empirical measurement
 - Requires underlying theory and data collection apparatus
 - Assumes C2 determines effectiveness
 - Only as good as the environment observation or simulation used to adjudicate outcome
- Analysts must be capable of using all three

- Preferred application in training and large forces
- Joseph Olmstead (1978) evaluated brigade C2 structures and processes using the results of US Army Training and Evaluation Program (ARTEP)
 - First empirical documentation of the need to change processes and structures as situations changed
 - Relied on doctrine and observer/controllers
- Used in US Army Warfighter Exercises for divisions and brigades
- Adopted by US JFCOM for many of their experiments
- Largely measures of performance (MoP)

- Separates outcomes from processes
 - Assumes C2 processes determine outcomes
 - Requires definitive link between process and C2 quality
 - Primarily based on small group psychology and organizational research
- Adopted by US Second Fleet for Battleforce In-Port Training (BFIT) at fleet and battlegroup levels
- Built into Adaptive Architectures for Command and Control (A2C2) in US Navy research
- Broadly used in experimentation research as well as training staffs
- Seldom validated for military applications

- Typical measures
 - How many perspectives were involved in situation assessment or planning?
 - How many alternative courses of action were considered?
 - How many echelons were involved in planning?
 - What was the decision style of the commander (e.g., collaborative, directive...)?
 - How was time allocated across processes and echelons?
- Appropriate processes depend on the quality, training, and experience of the force
- Largely measures performance (MoP)

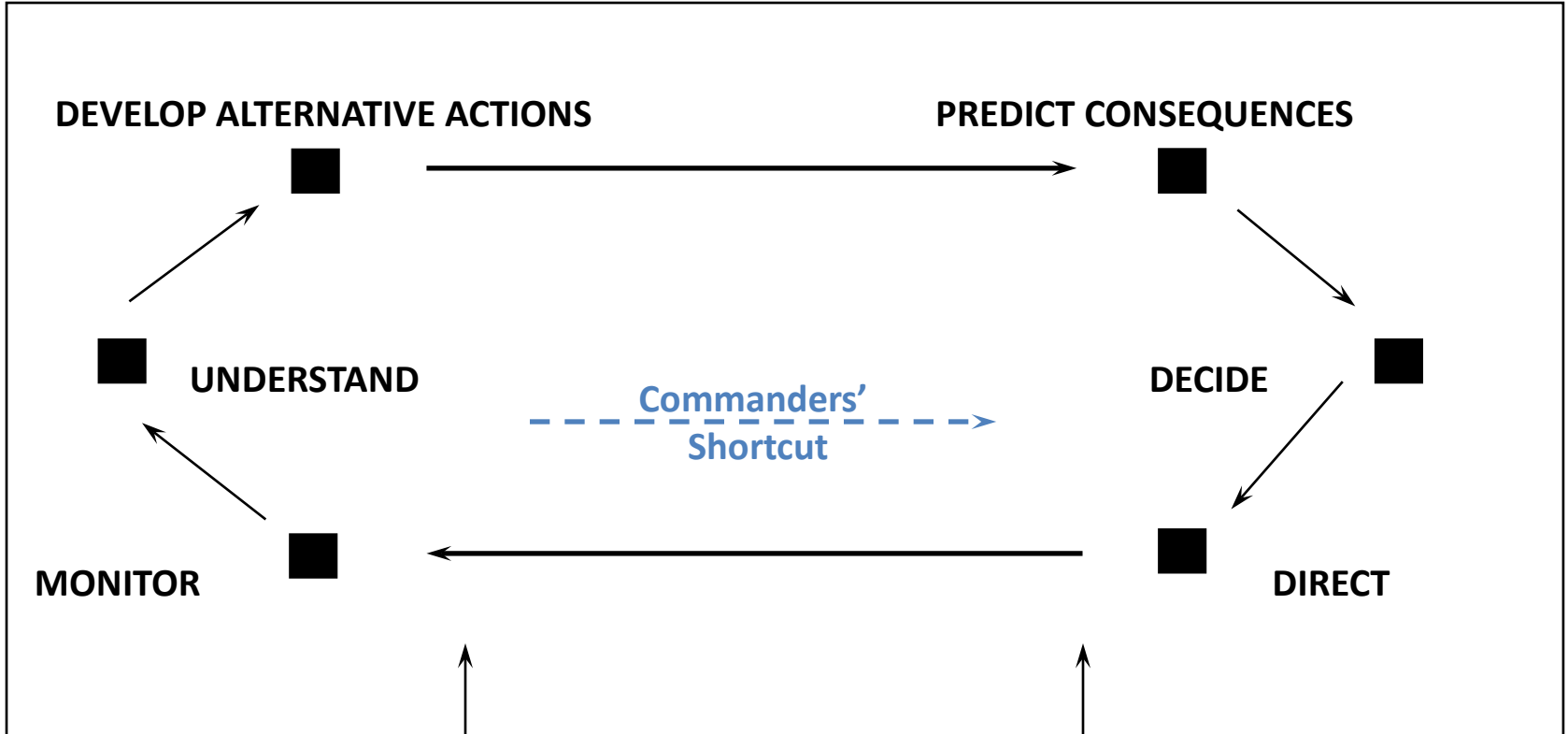
- Empirical measurement requires an objective metric
- USMC Battalion Combat Effectiveness (1980) used expert opinion about mission accomplishment, which correlated 0.92 across individuals with experience commanding battalions in combat
- HEAT (Headquarters Effectiveness Assessment Tool) used decisions to alter plans (written and oral) to determine the quality and effectiveness of C2
 - Plan life compared to expected plan life (MoE)
 - Time required to accomplish C2 functions (MoP)
 - Includes process measures of performance (MoP)

- Army Command and Control Evaluation System (ACCES)
 - Translation of HEAT methodology into US Army language
 - Focus of analysis on quality of staff performance at division and brigade levels
 - Database generated across several exercises
 - Used to assess prototypes for Maneuver Control System (MCS) and All Source Analysis System (ASAS)
- US Army National Training Center and USMC 29 Palms also allow direct measurement of unit performance
 - Instrumented ranges
 - Databases of comparative unit performance



HEAT

Headquarters Effectiveness Assessment Tool



ENVIRONMENT:

- OWN & ENEMY FORCES
- PHYSICAL
- POLITICAL & ECONOMIC

**QUERY
INFORM**

What Have We Learned?

- Doctrinal approaches are inflexible and often out of touch with current operations
- Doctrinal approaches may be necessary for training
- Process measurement can lead to false conclusions
 - Gary Klein's Recognition Prime Decision-making (RPD) demonstrated the weakness and (often) irrelevance of the deliberate planning process
 - Most small group and organizational research is conducted outside the context of military problems, the stresses of military operations, and trained (hardened) groups
- Process measurement can be an effective training tool

- Empirical measurement requires substantial planning and investment
 - Instrumentation
 - Observer training and inter-coder reliability
- Many organizations are unwilling to make the investments needed to support empirical measures of C2 Effectiveness
- Correctness of situation awareness is the strongest single determinant of successful C2 performance
- Measures of C2 Effectiveness need to be flexible



What's Different?

21st Century Operating Environments

- Adversaries are more diverse
 - National armies to insurgents, terrorists, religious fanatics, and criminals
 - Adaptive strategies and tactics
- Battlespaces include more dimensions
 - International media
 - Cyberspace
- Conflicts cut across national boundaries
 - Safe havens
 - Global dispersion of cultural and ethnic populations



What's Different? 21st Century Missions

- Missions have expanded to include greater emphasis on
 - Disaster response
 - Nation building
 - Peace operations
- Coalition operations dominate
- Complex Endeavors are commonplace and imply performance that may be very difficult to measure empirically
 - Attitudes within a population
 - Impact of psychological operations
 - Cultural factors



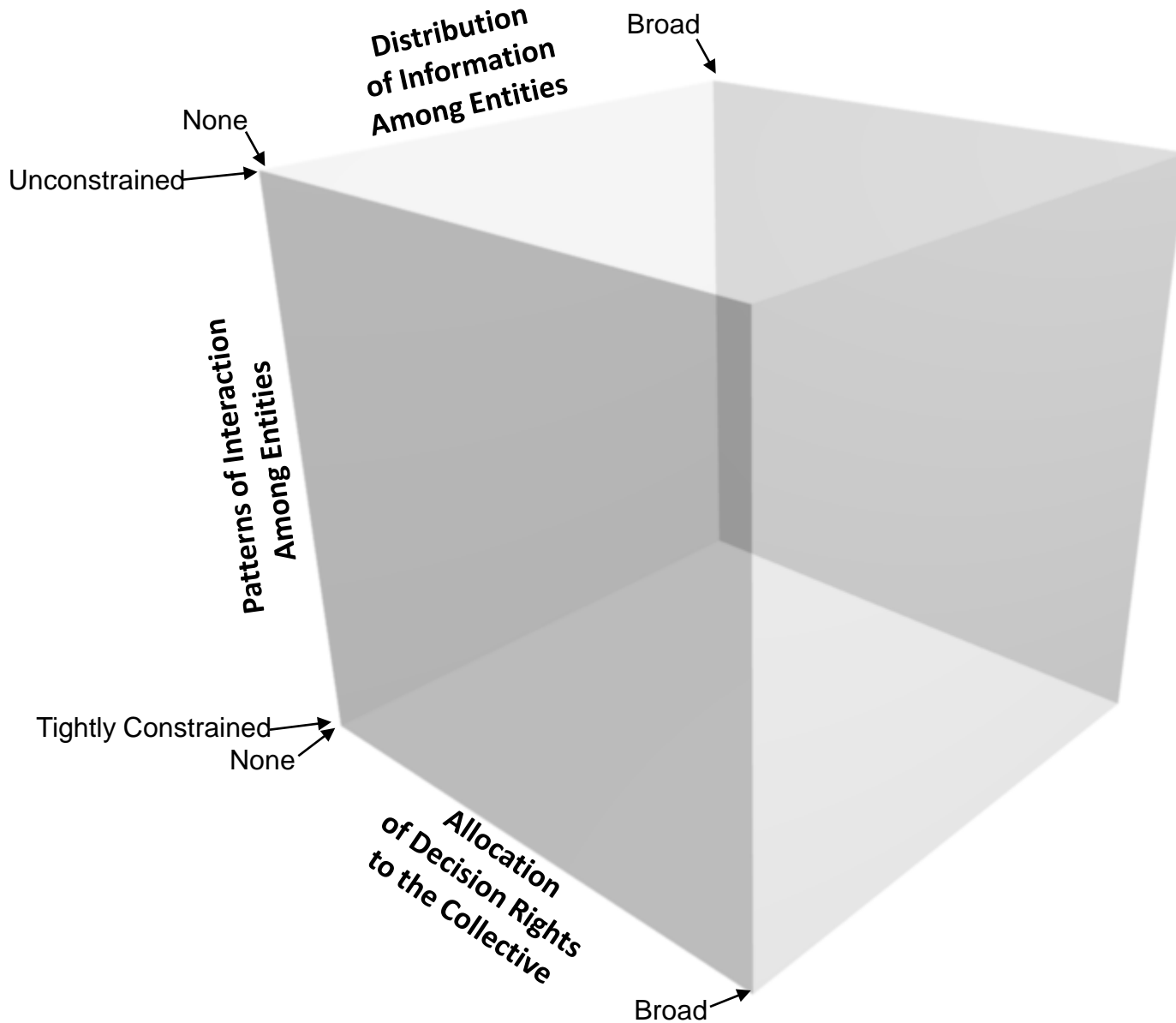
What's Different?

Military Capabilities (ours and theirs)

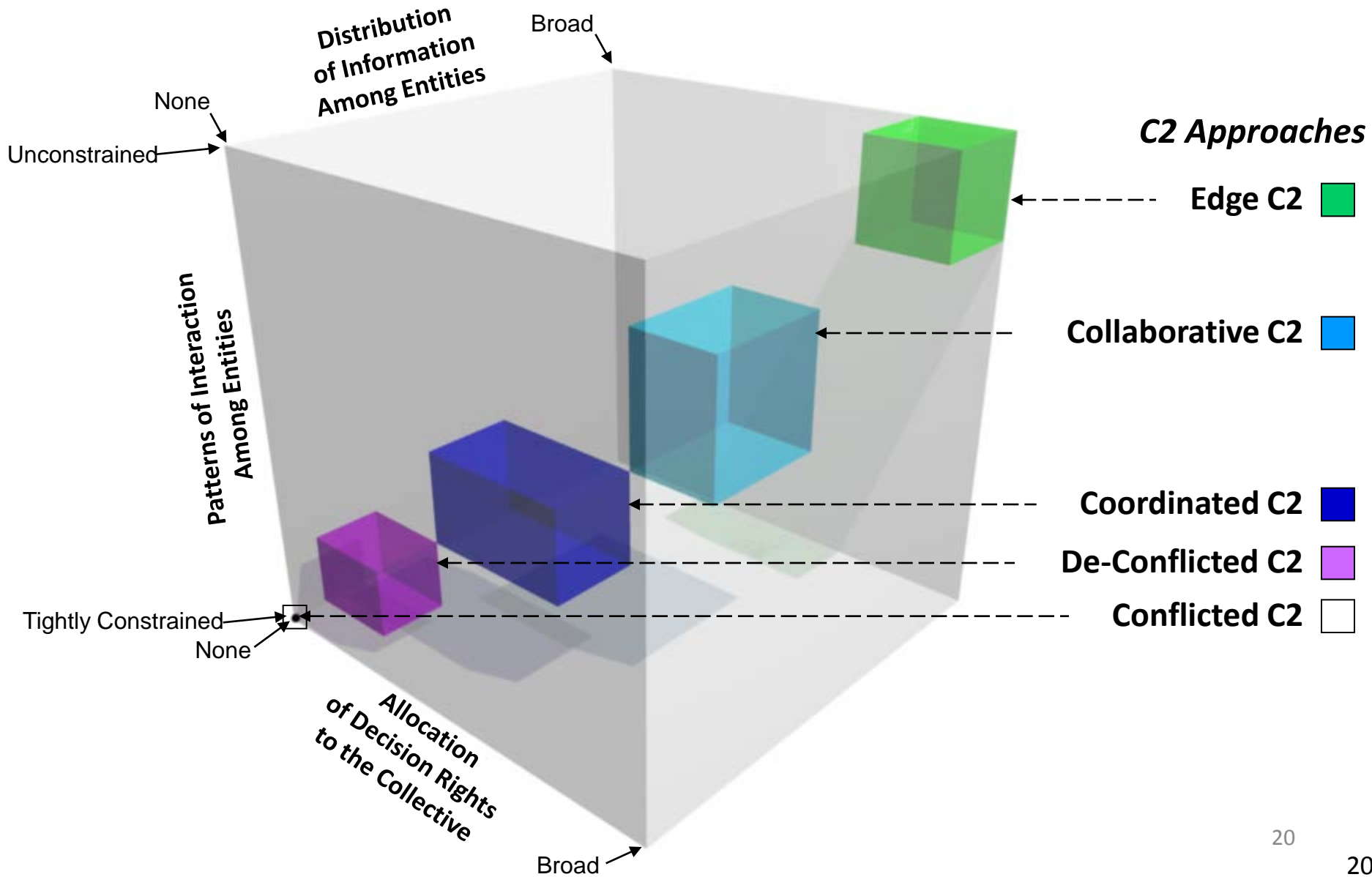
- Enhanced Information Technology (IT) capabilities
 - Communications networks
 - Sensor capabilities
 - Databases and data processing
 - Decision support tools
- Increased pace and integration of operations
 - Collapse of echelons (strategic corporal)
 - Adaptive planning processes
 - Planning merging with execution
- Power to the Edge
 - Broad information distribution
 - Collaborative processes

- Edge C2: Self-synchronizing, multi-connected with broad information sharing
- Collaborative C2: One integrating plan, collaborative decision making, broad connectivity and information sharing
- Coordinated C2: Limited cooperation on specific issues, limited connectivity and sharing of information
- De-Conflicted C2: Each entity independent, only boundaries agreed and supported
- Conflicted C2: No connectivity, no C2

C2 Approach Space



C2 Approaches



- Agility is the capability to successfully effect, cope with, and/or exploit changes in circumstances (SAS-085).
- Measurement of C2 Agility requires a variety of cases drawn from properly instrumented or documented:
 - Comparable operational experiences
 - Exercises
 - Experiments
 - Simulations
- Measures of C2 Effectiveness (MoCE) are merging with Measures of Force Effectiveness (MoFE)



Measuring C2 Agility in 21st Century Missions

- **Versatility:** the ability to maintain effectiveness across a range of tasks, situations, and conditions.
- **Responsiveness:** the ability to react to a change in the environment in a timely manner.
- **Resilience:** the ability to recover from or adjust to misfortune, damage, or a destabilization.
- **Innovation:** doing new things or old things in new ways.
- **Flexibility:** the ability to employ multiple ways to succeed and to move seamlessly between them.
- **Adaptation:** the ability to change work processes and the ability to change the organization.

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* www.dodccrp.org



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