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Supporting Organizational Change in Command and Control: Approaches and Metrics



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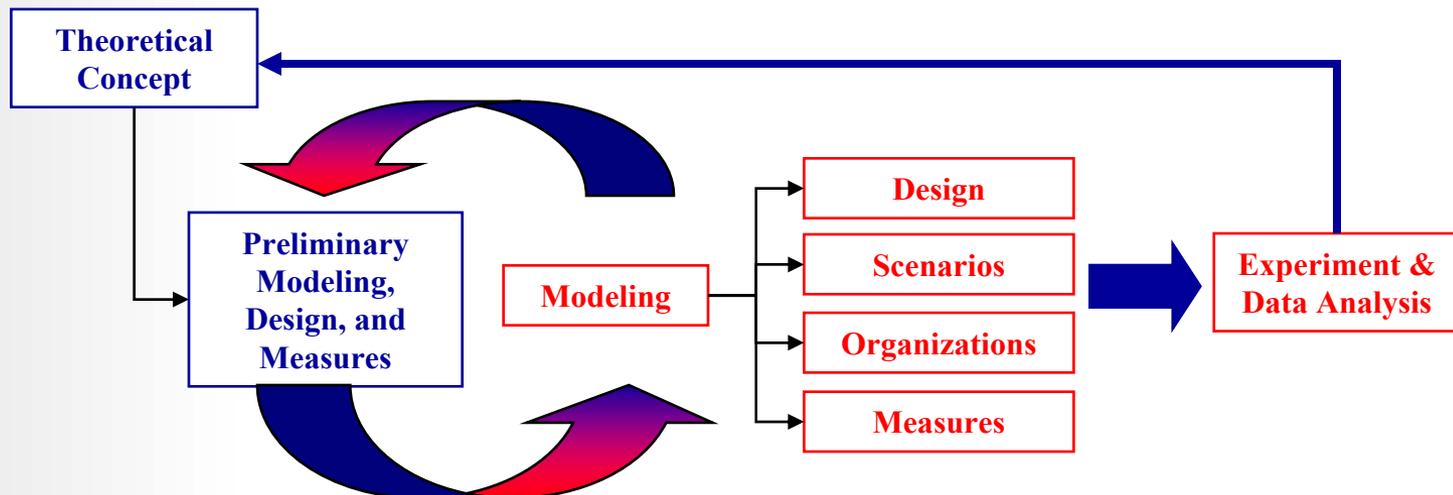
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The A2C2 Project

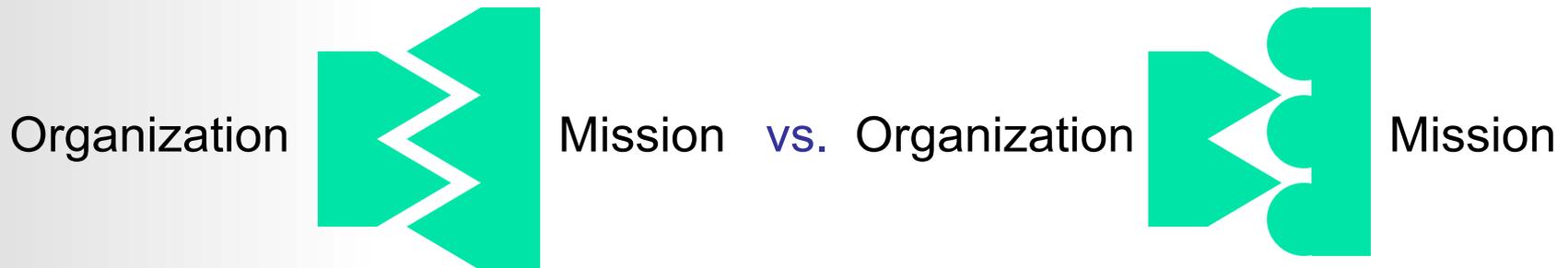
■ Objectives

- Develop & test theory of adaptive architectures
- Investigate fit between organizational structures & mission scenarios
 - Incongruence as a motivation to alter organizational structure
- Create conditions of incongruence & observe the adaptation process
 - Facilitators & inhibitors



■ Congruent teams outperform incongruent teams

- Model-based organizational design for congruence (Diedrich et al., 2003)



■ Mission effectiveness would be enhanced through organizational adaptation.

- However, teams are reluctant to change their structures to achieve congruence (Entin et al., 2004)
 - Adaptations observed were modest and variable
 - Most changes were small, some not adaptive
 - Participants often recognized the need for organizational change, but were reluctant to do so

■ How can structural adaptation be supported?

- **Lack of Authorization:** Organizations may feel that they lack the authority to make alterations to their structures.
 - *Provide Targeted instruction*
- **Lack of Training:** Organizations may lack the training to make organizational changes effectively, and will therefore be reluctant to change.
 - *Provide Fully formed, sound organizational designs*
- **Lack of Sensitivity:** Organizations may resist organizational change even when it is indicated.
 - *Provide “Congru-o-meter” to signal change*
- **Lack of Familiarity:** Organizations may feel uncomfortable switching from established structures to those that are less well known.
 - *Model based prospective performance measures*

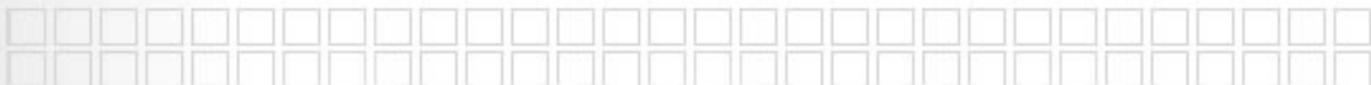
Organizational Structures

Divisional (D)

Functional (F)

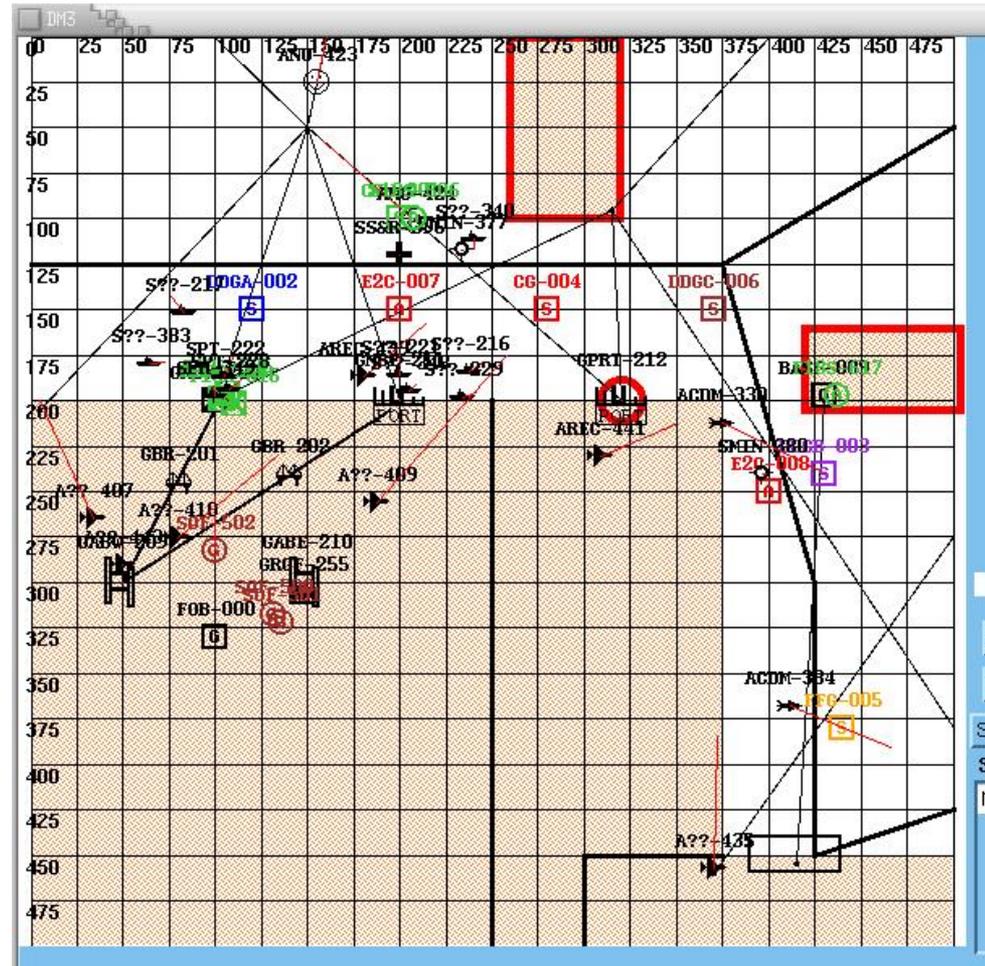
		1	2	3	4	5	6
	Platform	STRIKE	BMD	ISR	AWC	SuWC/MINES	SOF/SAR
1	CVN	2F18S	xxx	1UAV	2F18A, E2C	1FAB, 1MH53	1HH60
2	DDGA	8TLAM	3ABM,4TTOM	1UAV	6SM2	1FAB, 2HARP	1HH60,1SOF
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4	CG	8TLAM	3ABM	1UAV	6SM2	1FAB,2HARP,1MH53	1HH60
5	FFG*	2F18S	xxx	1UAV	2F18A,E2C,4SM2	1FAB,2HARP,1MH53	1HH60
6	DDGC	8TLAM	3ABM,4TTOM	1UAV	6SM2	1FAB, 2HARP	1HH60,1SOF

- Asset “ownership” and control shape team structure:
 - Multi-function vs. single-function responsibilities
 - Geographic Area of Responsibility: Local vs. Global
- Heterarchical, not Hierarchical, organization

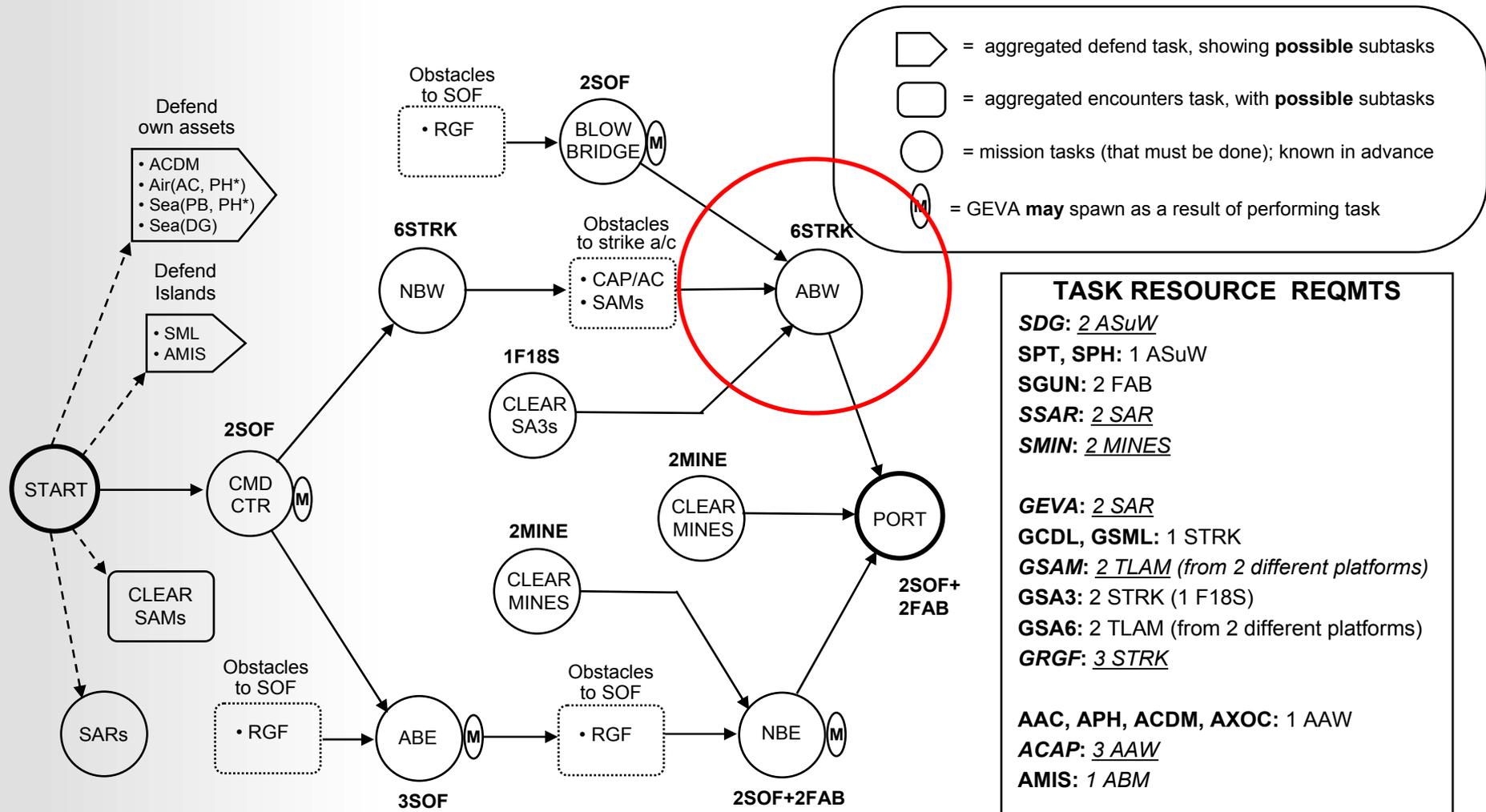


Manipulating Congruence

- Congruence Manipulation
 - Capitalizes on Roles and Geography (task and asset locations)
- Strategies for Manipulation of Congruence
 - Coordination Requirements
 - Task Phasing
 - Limited Assets



Example: Functional (f) Scenario



* indicates that these must be distinguished from neutral (or decoy) counterparts

- Study run at the Naval War College
 - July & August, 2004
- Four teams of highly trained consultants
 - Three Naval Reserve teams
 - One NWC student team

<i>Rank</i>	<i>#</i>
Captain	2
Commander	10
Lieutenant Commander	7
Lieutenant	3
Chief Petty Officer	1
Petty Officer 2nd Class	1

<i>Session</i>	<i>Description</i>	<i>Team Structure</i>
Congruent	Team Structure and Mission Task Requirements in alignment	Divisional or Functional
Incongruent 1	Team Structure and Mission Task Requirements in discord	Divisional or Functional
<i>Planning Session: Opportunity to Change Structure in Response to Incongruence</i>		
“Incongruent” 2	Congruence between Team Structure and Mission Task Requirements <i>dependent</i> on Chosen Team Structure	<i>Divisional</i> <i>D2 - Divisional/Functional Hybrid</i> <i>Regional</i> <i>F2 – Functional/Divisional Hybrid</i> <i>Functional</i>

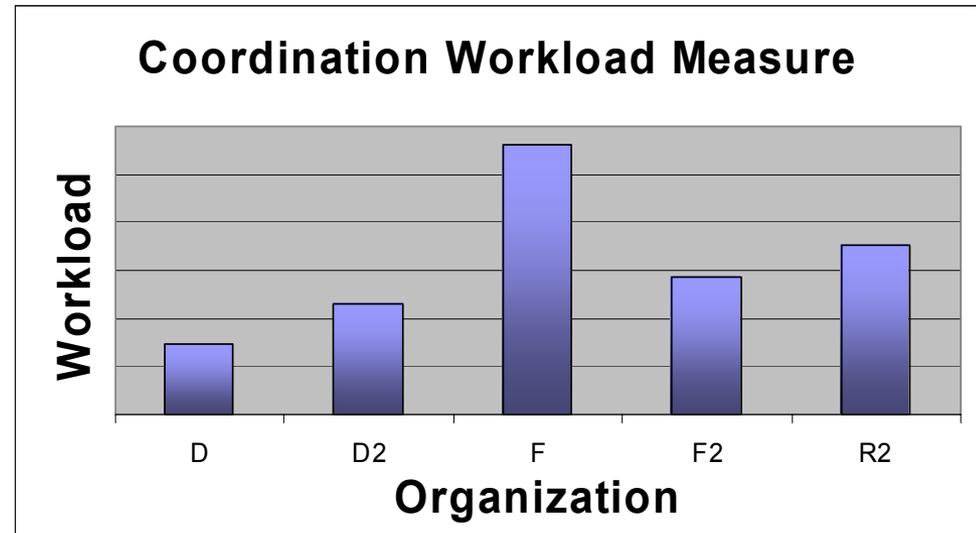
Organizational Structures

- **Divisional** – Each participant controls a single platform
- **D2 – Divisional/Functional Hybrid** – Four participants control of a single platform each; two players control functional assets across the theatre
- **Regional** – Theatre is divided into two geographic regions. Groups of three participants divide the assets functionally within those two regions.
- **F2 – Functional/Divisional Hybrid** – Four participants control functional assets across the theatre; two players control of a single platform each
- **Functional** – Each participant controls a single function across the theatre

Prospective Information and Congru-o-meter

- Performance feedback provided the second and third missions to encourage adaptation.
- Several Measures Presented
 - Performance (Percent Tasks Completed)
 - Perceived Workload
 - Gain

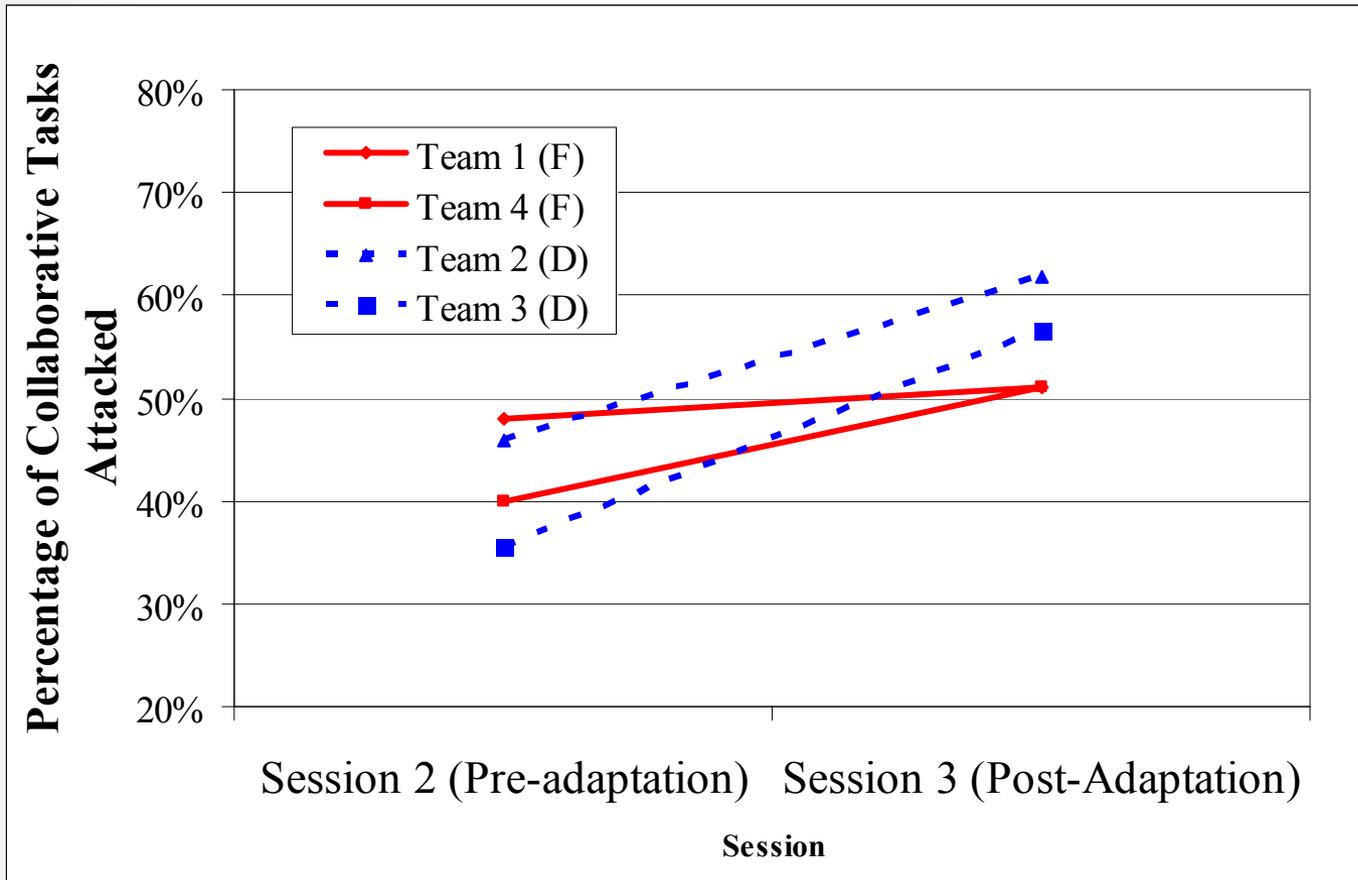
- Prospective information given before Planning Session, based on models
 - Gain
 - Coordination Workload



Results: Adaptation

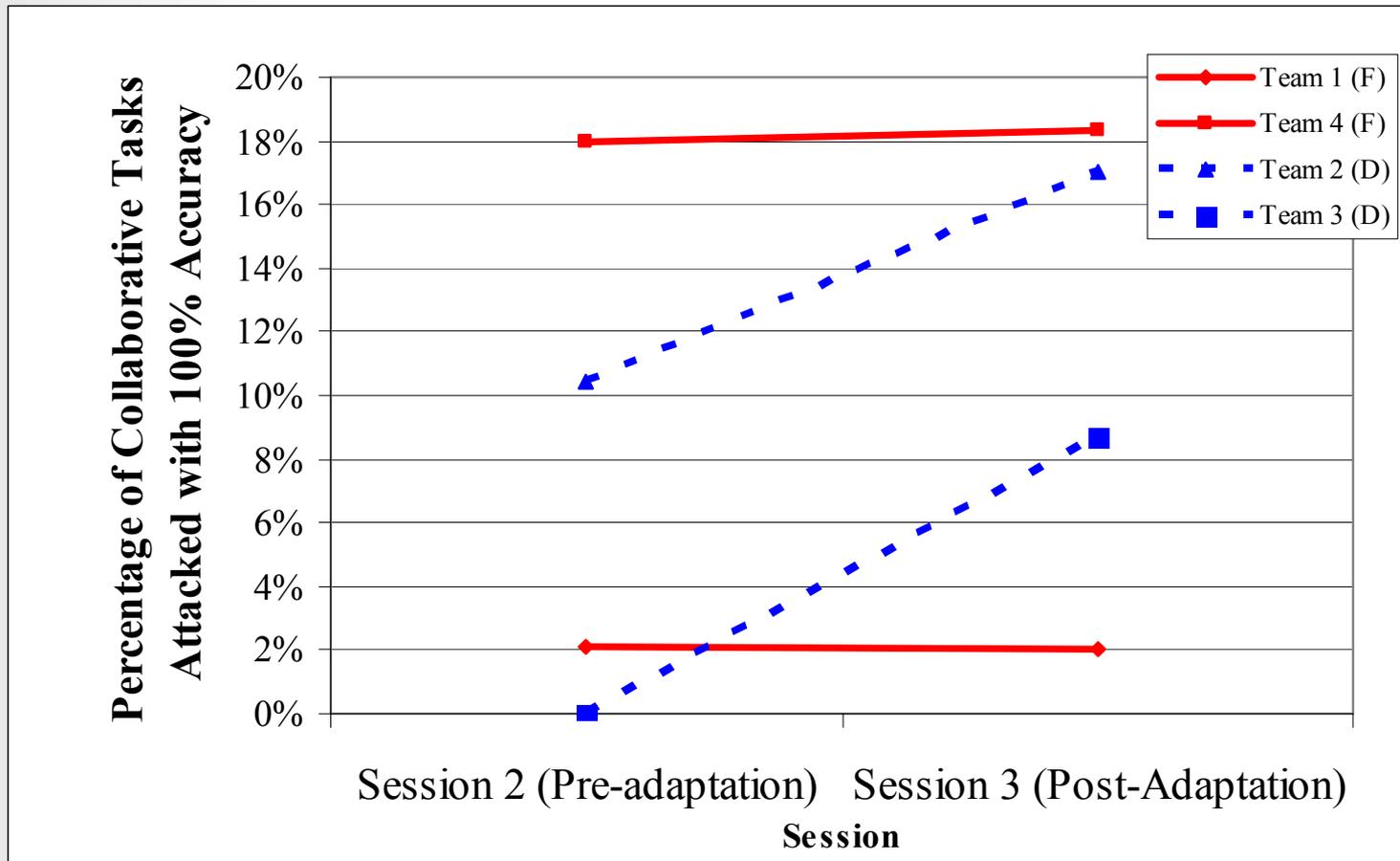
<i>Team</i>	<i>Original Structure</i>	<i>Chosen Structure</i>	<i>Comments</i>
Team 1	Functional	D2	Nearly congruent
Team 2	Divisional	Functional	Fully congruent
Team 3	Divisional	Functional	Fully congruent
Team 4	Functional	D2	Nearly congruent

Results: Performance



Percentage of Collaborative Tasks Attacked in Sessions 2 & 3

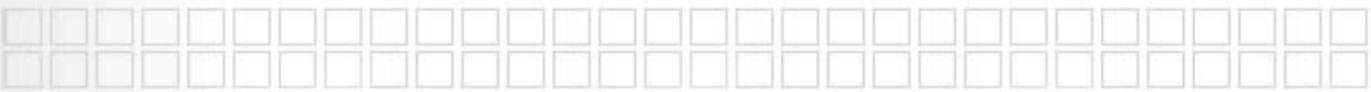
Results: Performance



Percentage of Collaborative Tasks Attacked with 100% accuracy in Sessions 2 & 3

- **Supporting Adaptation for Mission Effectiveness**
 - Teams will adapt their organizational structures if given the authority, education, incentive, and information to do so effectively
- **Library of Organizational Designs**
 - Creation of several model-based organizational structures allowed rapid adaptation
- **Measuring Adaptation**
 - The extent and impact of adaptation can be measured using tailored metrics

Thank You



Extra Slides

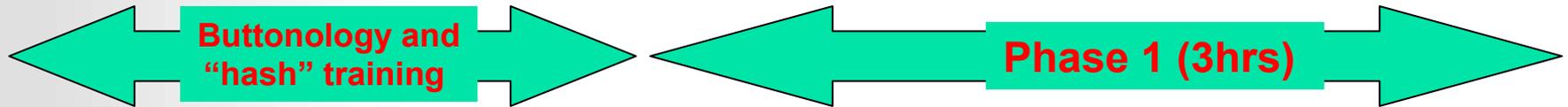


Experiment 9 Pilot

Experiment 9 Pilot

- Teams of participants at the Naval Postgraduate School
- Follow directly from Experiment 8 results
 - Observe and assess adaptation in response to *incongruence*
 - Will an organization that is in an incongruent situation **recognize** this fact, and adapt its structure (e.g., who owns what, who does what) in order to become more “congruent” with its environment?
- Evaluate our ability to induce, guide, support and measure strategy and *structural adaptation* via:
 - Training, procedures, triggers, feedback, decision aids, ...
- Affect adaptation during *facilitated off-line planning* sessions, **not** during on-line dynamic play

Pilot 9 Design (1)



Start Org	# of teams	Training (Hashx2)	Play#0 Congruent 1 (no SCUD)	Adapt for SCUD (PS #1)	Play#1 Congruent
F	2 (B,D)	(OrgH)h1 (OrgF)h2	Ff(no SCUD)	F ₁	F ₁ f
D	3 (A,C,E)	(OrgH)h1 (OrgD)h2	Dd(no SCUD)	D ₁	D ₁ d

- H is a hybrid organization, “midway” between D and F
 - Exposes players to elements of Functional & Divisional structures
- First “adaptation” (F ⇒ F₁, etc.) to external SCUD threat
 - Requires players to allocate new assets (TTOM, ABM) and new roles

Pilot 9 Design (2)



Org	Pre-brief & Adapt for Incongruence (PS #2)	Play#2 Incongruent	Post-play Adapt to Incongruence (PS #3)	
... F ₁	F ₂	F _{2d}	F ₃	
... D ₁	D ₂	D _{2f}	D ₃	

- Observational and self-reporting instruments were designed to collect data during planning sessions
- Feedback and aids utilized during planning sessions

Planning Session Protocol

- Planning/adaptation occurs prior to the next play
 - Questions posed to team by facilitator:
 - How are we doing?
 - Should we adapt in some way? If yes, how?
 - Discussions were recorded for analysis
 - Asset changes recorded for immediate implementation
 - Strategic changes and rationale recorded

Congru-o-meter

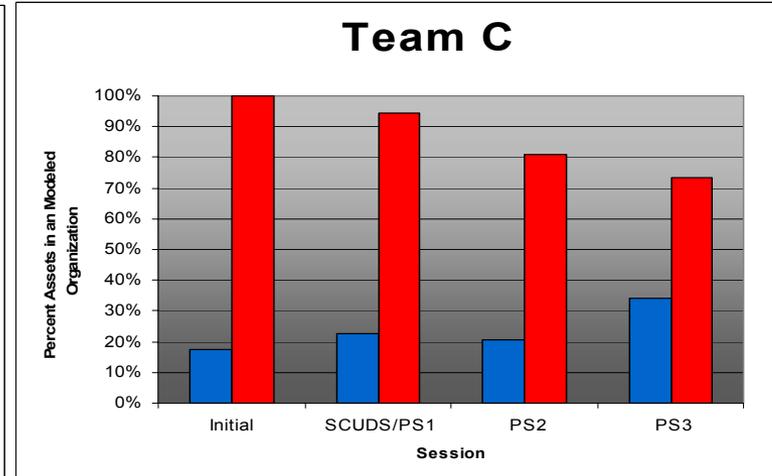
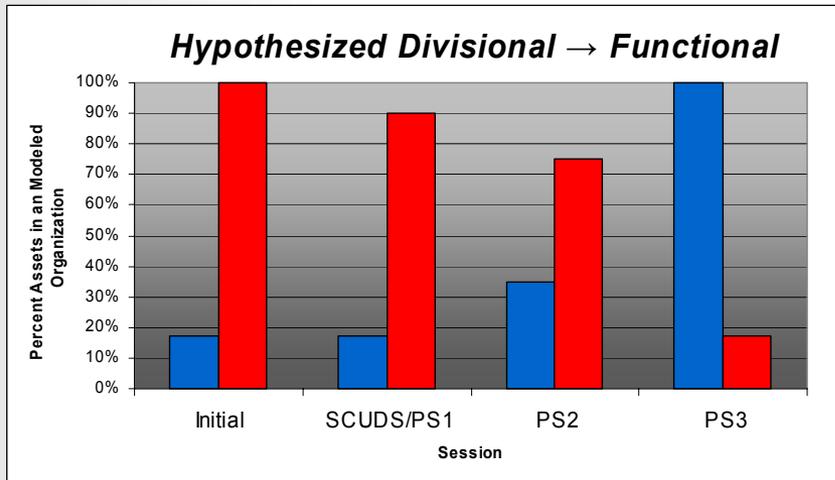
- Provided feedback before each planning session based on team performance to encourage adaptation
 - Model-Based Performance data was available within minutes.

- Measures displayed were suggested by previous study as leading indicators and/or model based
 - Performance (Percent Tasks Completed)
 - Perceived Workload
 - Communications Distribution
 - Gain (UCONN)
 - Cognitive Demand (CMU)

Adaptation Analysis

- To assess how adaptive changes made by the teams were, we:
 - Broke asset allocation into the smallest meaningful elements
 - Measure percent overlap between team asset allocation for each mission with the modeled organization
- The result is: overall similarity between the team-generated allocations and the modeled class of organizations

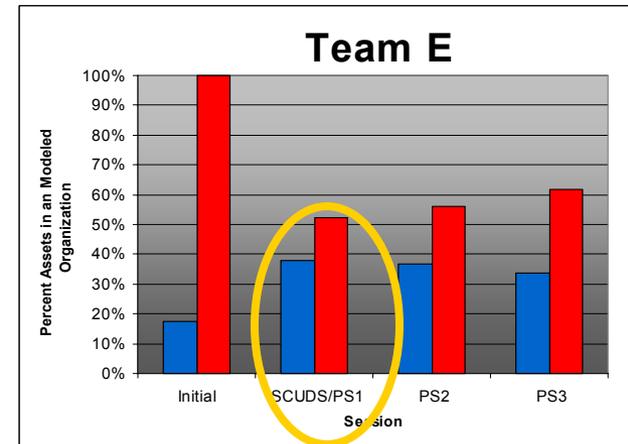
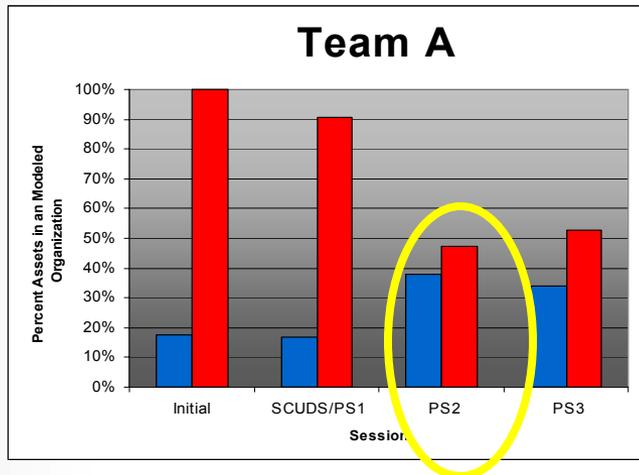
Divisional Results



Team A adapted in anticipation of incongruence

Team C made few, minor changes.

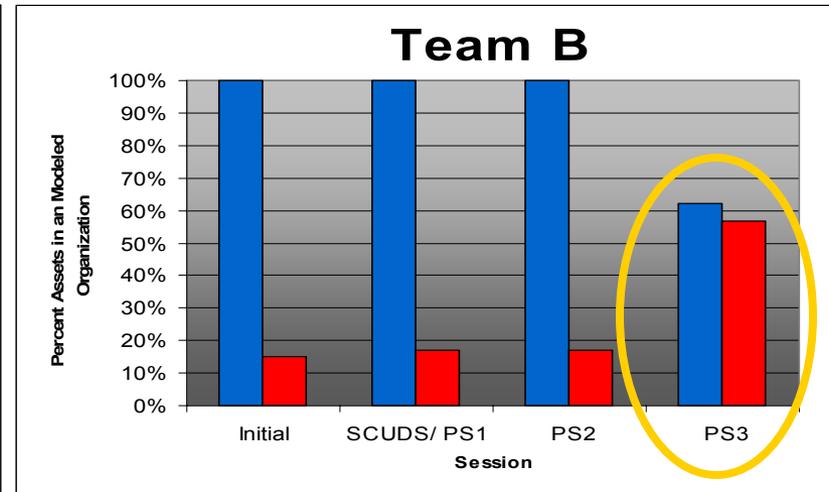
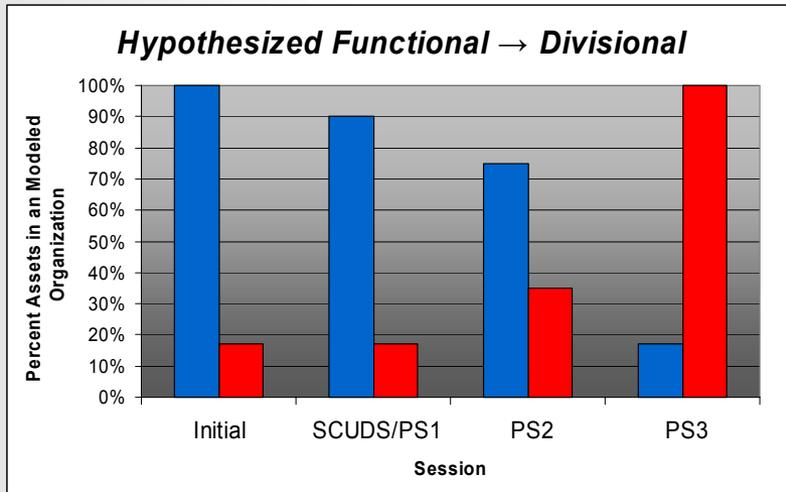
Team E changed in a maladaptive fashion.



Blue: Percentage of Assets that are *Functional*

Red: Percentage of Assets that are *Divisional*

Functional Results

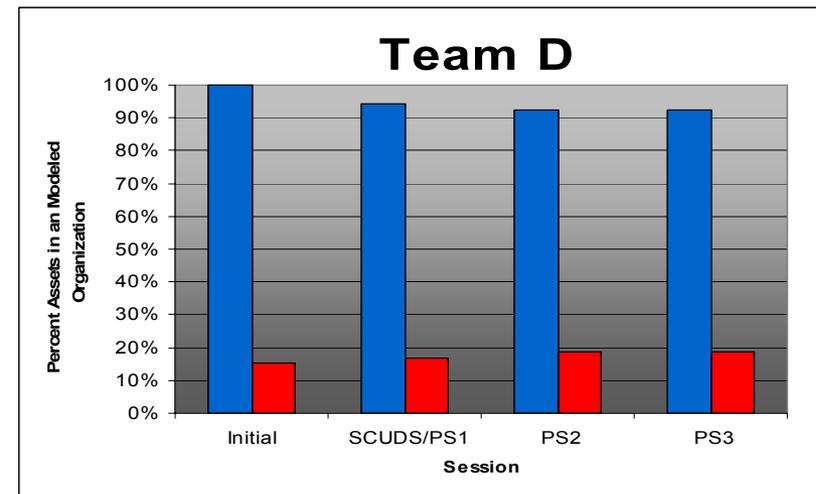


Team B made adaptive changes in reaction to incongruence.

Team D made few, minor changes.

Blue: Percentage of Assets that are *Functional*

Red: Percentage of Assets that are *Divisional*



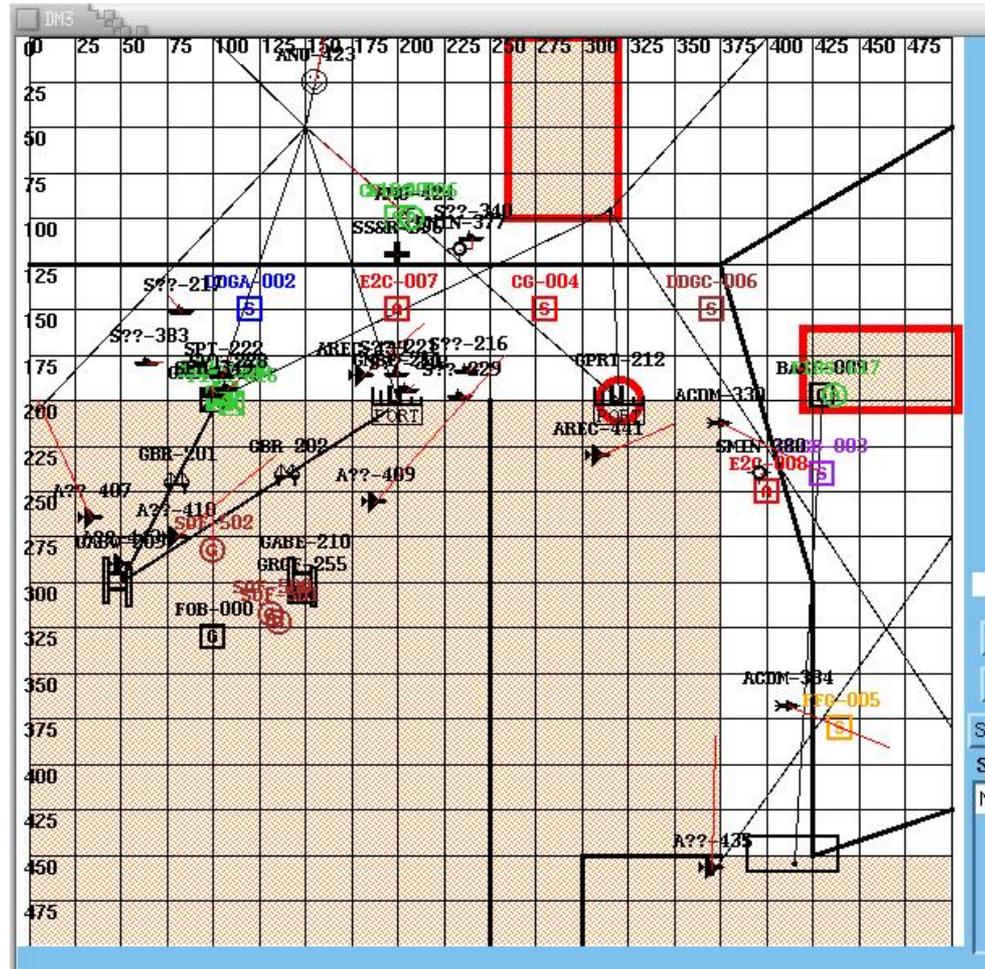
Manipulating Congruence (2)

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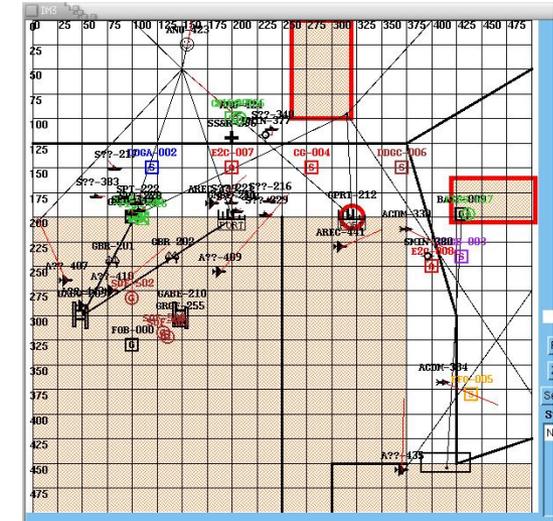


Previous Experiments

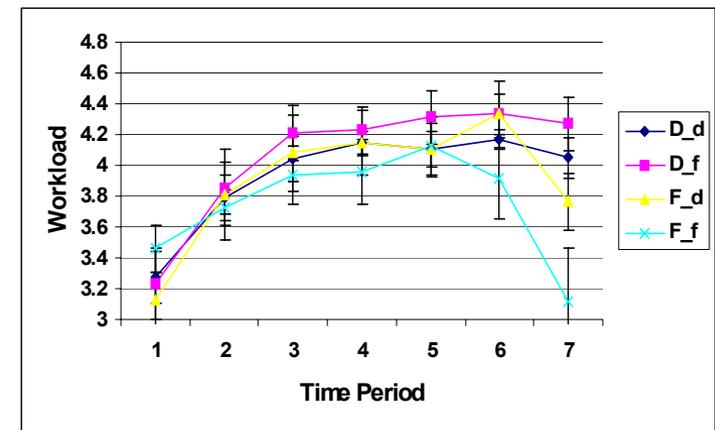


Realization of Model-based Experimentation

- Model-based Organizations (F, D)
- Scenarios (f,d)
- Successful Manipulation of Congruence
 - Congruent out-performed Incongruent
 - Differences in communications & workload – leading indicators of incongruence
- New Model-Based Measures



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6	DDGC	8TLAM	3ABM, 4TTOM	1UAV	6SM2	1FAB, 2HARP	1HH60, 1SOF



- Demonstration of structural adaptation in some teams based on model-based congruence manipulation
 - Open-ended adaptation
 - Adaptations observed were modest and variable
 - Most changes were small, some not adaptive
 - Participants often recognized the need for organizational change, but were reluctant to do so

- Implementation of initial version of congru-o-meter
 - Model-based measures available for planning
 - Near real-time information available
 - Observations indicated that more detailed performance feedback would be beneficial