

Empirically-driven Analysis for Modeldriven Experimentation: From Lab to Sea and Back Again (Part 1)

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Goals of the Project

- A2C2: 10 years of research in C2
- Abstracted military organizations in our laboratory designs
- Presented with real organization the Expeditionary Strike Group – with real organizational issues
- How can we...
 - Identify the organizational challenges
 - Pull from our previous research to present ideas



Anchor future research based on observations





The A2C2 Project

The General Problem:

→ How would you design a command team organization for this mission?



→ How would you derive human requirements for the organization?
→ How would you evaluate its performance for this mission?
→ How would you design adaptability into this organization?







The A2C2 Project

- Research undertaken by government, academic, and industry groups
 - Naval Postgraduate School
 - Naval War College
 - Carnegie Mellon University
 - George Mason University
 - University of Connecticut
 - Michigan State University
 - Aptima, Inc.
- Iterative model-experiment-model approach
- Issues addressed in recent years
 - Organizational congruence
 - Structural adaptation to change
 - Optimization of resource allocation
 - Coordination among decision makers
 - Implications of Intelligence/Information commander





Model-Based Experimentation Paradigm









Distributed Dynamic Decision-making Environment (DDD)

- Captures essential elements of C2
- Experimentally vary
 - Team structure
 - Access to information
 - Control of resources
 - Mission parameters
- Provides substantial degree of control
- Designed to capture measures









The Lab-Sea Bridge

- What can we take from previous research of use in an operational organization?
- What can we take from a case study of an operational organization and use in our research?









Introducing the Expeditionary Strike Group (ESG)

- Personnel
 - ESG FO/GO with a staff of ~50
 - Amphibious Squadron (PHIBRON) Commodore and staff of ~35
 - Marine Expeditionary Unit (Special Operations Capable) Commander and staff of ~150+ and 2000+ marines
 - Ships company for multiple platforms
- Missions:
 - Expeditionary Warfare, MIO, MSO, SUW, USW, MIW, STRIKE, SOF, Air Defense, Disaster Relief/Humanitarian Ops...
- Platforms:
 - Amphibious Assault Ship (LHA), Dock Landing Ship (LSD), Amphibious Transport Dock (LPD), Cruiser (CG), Destroyer (DDG), Frigate (FFG), Fast Attack Sub (SSN)









Our Approach to ESG Engagement

- A. Begin engagement w/ staff before deployment
- B. Identify organizational challenges of interest
- C. Gain deeper understanding through on-board exposure
 - Interview ESG staff
 - Observe ESG & Ship operations
- D. Compile and distill information
- E. Reassess challenges of interest
- F. Bring challenges to A2C2 experimentation and modeling
- G. Work with ESG staff to ensure operational relevance







A. Begin engagement w/ staff before deployment

- Small meetings with members of the ESG staff and A2C2 research group
- Attended Commander's Conference to be more exposed to larger organization
- Additional meetings with members of ESG staff to assess their goals and interests
- Relationship building to enable access during deployment







B. Identify organizational challenges of interest

- 1. CPR cell: Amphibious Warfare
- 2. CPR cell: Maritime Operations
- 3. ISR Coordinator
- 4. Hybrid Supported-Supporting Structure
- 5. EAG Distributed C2
- 6. C2 of Temporary Assets
- 7. Direct Tasking of MAGTAF Assets (ACE)
- 8. TLAM "Ownership"









C. Gain deeper understanding through on-board exposure

- Two multi-day trips to ESG flagship
- 4-5 scientists per
- Trip 1
 - Pre-theatre
 - During multi-national exercise
- Trip 2
 - Post-theatre
 - During transit back to CONUS









ESG staff members interviewed

ESG	PHIBRON	
Commander, ESG	Commodore	
Chief of Staff	Future Operations	
N2: Intelligence	Current Operations	
N3: Operations	Intelligence	
N5: Future Operations	MEU (SOC)	
N6: C4I	Commander	
Other staff officers, watch standers	Executive Officer	
Ship's Company	Intelligence, Operations, Planning,	
Ship CO	ACE Commander	



Over 40 ESG staff members interviewed





Where we were observing

- Joint Operations Center (JOC)
 - Flag Watch Officer
 - Assistant Flag Watch Officers
 - PHIBRON
- Daily Meetings
 - Admiral's Briefing
 - N-Head (Senior Staff) Meeting
 - Composite Warfare Commander Meetings
 - Future and Current Operations Meetings
- Normal Ship Operations









D. Compile and distill information

- Notes from observations and interviews consolidated
- Comments relevant to top challenges were pulled out
- Reports were written; presentations were presented







E. Reassess challenges of interest

- Each of the "Top Issues" was revisited
- New thoughts based on observations and previous experience in A2C2
- Context within the particular ESG taken into consideration
- Following slides made after first trip to ESG flagship
- Represents interim observations







Issue 1: CPR cell Structure: Amphibious Warfare

- Potential issue (observed or assumed)
 - Overload of CPR and staff
 - Node is operating under two different doctrines
 - Small junior staff
- What do we need to know/measure
 - Situations where overload was observed (when, who, ...)
 - Situations where planning or other functions migrated to ESG staff







Issue 1: CPR cell Structure: Amphibious Warfare

- BLUF:
 - They do not believe it will be an issue during this deployment
 - Some staff changes recommended
- Potential issue (observed or assumed)
 - Overload of CPR and staff
 - MIO has been reduced recently, MSO given to DESRON
 - Node is operating under two different doctrines
 - Issue seems to be two different missions more than two different doctrines
 - Small junior staff
 - Staff changes per Navy report recommended
- What do we need to know/measure
 - Situations where overload was observed (when, who, ...)
 - None since deploy Gulf role for MEU uncertain
 - Situations where planning or other functions migrated to ESG staff
 - None since deploy







Issue 2: CPR Cell Structure: Maritime Operations

- Potential issue (observed or assumed)
 - High expected workload in MIO/MSO
 - MIO differs significantly from other maritime duties
- What do we need to know/measure
 - Frequency, duration and type of maritime tasks
 - Adequacy of intel to support MIO (e.g., results of VBSS activities)
- Comments
 - MIO and MSO may be combinable, both use very similar RMP







Issue 2: CPR Cell Structure: Maritime Operations

- BLUF:
 - They do not believe it will be an issue during this deployment
 - Some staff changes recommended
- Potential issue (observed or assumed)
 - High expected workload in MIO/MSO
 - MIO has been reduced recently, MSO given to DESRON 50
 - MIO differs significantly from other maritime duties
 - Reality: MIO has been reduced recently
- What do we need to know/measure
 - Frequency, duration and type of maritime tasks
 - None since deploy Gulf role uncertain
 - Adequacy of intel to support MIO (e.g., results of VBSS activities)
 - None since deploy Gulf role uncertain
- Comments
 - MIO and MSO may be combinable, both use very similar RMP
 - MIO has been reduced recently







Issue 3: ISR Coordinator or Commander

Recommendations

- Establish role of ISR commander or coordinator to prioritize asset utilization for ISR
- Have tasking authority of ISR-dedicated assets (e.g., UAV)
- Coordinate tasking of other assets for ISR purposes
- ISR-C must be part of ESG planning cells especially current ops

What do we need to know/measure

- What is the evolved ESG N2/S2/JIC organization
- Process for gathering and prioritizing ISR requests and tasking
- External ISR support requested and fulfilled
- ISR tasking of organic ISR assets
- ISR requirements filled by non-ISR dedicated assets (and process for accomplishing)
- Assigned role of ESG-N2 with respect to ISR

Comments

The ISR-C could be an augmented role for the ESG N2







Issue 3: ISR Coordinator or Commander

- BLUF: N2 as ISR Coordinator seems to work, BUT...
- Recommendations
 - Establish role of ISR commander or coordinator to prioritize asset utilization for ISR
 - Partially done
 - Have tasking authority of ISR-dedicated assets (e.g., UAV)
 - Not done explicitly recommends
 - Coordinate tasking of other assets for ISR purposes
 - Only indirectly, if at all (COPS/FOPS)
 - ISR-C must be part of ESG planning cells especially current ops
 - Done, but as N2

What do we need to know/measure

- What is the evolved ESG N2/S2/JIC organization
- Process for gathering and prioritizing ISR requests and tasking
- External ISR support requested and fulfilled tend to use UAV instead
- ISR tasking of organic ISR assets
- ISR requirements filled by non-ISR dedicated assets (and process for accomplishing)
- Assigned role of ESG-N2 with respect to ISR

Comments

- The ISR-C could be an augmented role for the ESG N2.
 - (It is.) Mission uncertainty/disagreement and overall ESG C2 philosophy issues affect
 - Emphasis seems to be more on meeting ISR requirements than exploiting all possible ISR opportunities





Issue 4: Hybrid Supporting-Supported Structure and Internal Control

- Potential issue (observed or assumed)
 - Unknown when S-S breaks down
 - Managing a spectrum of S-S relations: from preset to fully dynamic/contingent.
 - Supported commander needs sufficient staff to plan and guide the mission.

Recommendations

- Be prepared to augment planning capability/staff of a supported Cdr.
- Current ops must be ready to resolve conflicts that may arise
- Supported/supporting assignments should consider other factors
- What do we need to know/measure
 - ESG's guidelines and implementation for S-S relationships
 - Situations single Cdr simultaneously supported multiple Cdrs (who, what, how,...)
 - Situations single Cdr simultaneously supported and supporting (who, what, how,...)
 - Conflicts and how they were resolved







Issue 4: Hybrid Supporting-Supported Structure and Internal Control

- BLUF: Not an issue so far, but not stressed yet
- Potential issue (observed or assumed)
 - Unknown when S-S breaks down
 - Little stress so far
 - Managing a spectrum of S-S relations: from preset to fully dynamic/contingent.
 - Little stress so far
 - Supported commander needs sufficient staff to plan and guide the mission.
 - Can request and get specific skills from N5

Recommendations

- Be prepared to augment planning capability/staff of a supported Cdr.
 - Done somewhat (N5-see above)
- Current ops must be ready to resolve conflicts that may arise
- Supported/supporting assignments should consider other factors
- What do we need to know/measure
 - ESG's guidelines and implementation for S-S relationships
 - Situations single Cdr simultaneously supported multiple Cdrs (who, what, how,...)
 - None since deploy
 - Situations single Cdr simultaneously supported and supporting (who, what, how,...)
 - None since deploy
 - Conflicts and how they were resolved



None since deploy





F. Bring challenges to A2C2 experimentation and modeling

- Need to bring these back to the laboratory
- Motivated by but not fully constrained by current and planned ESG
- Inspired by original "Top Issues"
 - ISR Coordinator
 - Supporting/Supported
 - Phibron Composition
- Must retain operational relevance and still generalize
- One chosen Independent Variable...so far
 - 1. Information Commander/Coordinator







Independent Variable Information Commander

Clence & Tec

- Related to ISR Coordinator Issue
- Motivated in part by ESG experience with N2 (Intelligence)
- Connected to previous A2C2 research
 - NWC & SSG work
- Multiple levels of Information Commander authority and responsibility
- Two or three levels of this variable
- Simplified continuum compressed to one dimension
- We need to be cognizant of but not constrained by the political implications of our design choices

None	Coordination	Control
No Info Coordinator	Info Commander w/ control over some assets and some information	Info Commander w/ control over all assets and information
NEW CONTRACTOR	07	DEARTMENT OF THE MAIN



Possible ESG Experimental Positions

- Simplification of ESG for DDD simulation
- No FO/GO
- Commodore and MEU
 Commander
 Responsibilities distributed in subordinates









Possible Dependent Variables

- Resource allocation
 - ISR
 - Non-ISR
- DDD Performance
- Information access
 - Time
 - # Number of hits
- Communications Patterns
 - Within vs Between groups communications
- Coordination Efficiency
- Subjective Workload/Attitudes



- Pupil dilation
- Gaze
- Information presentation
 - Use of collaborative tools
 - Page Views
 - Time/info match
- Planning inquiries
 - Process tracing
 - Collaboration Assessment via Probes
- Post-hoc Computational Measures







G. Work with ESG staff to ensure operational relevance

- Presented expanded experimental design ideas
- Operational perspective on experimentation is very informative
 - Issues of interest in the literature may not be most critical to the warfighter
- Need to balance specificity and generality
- Interaction with ESG staff is ongoing
- Interaction with other ESGs TBD









- Experimental variables to be settled based on recent feedback from ESG staff
- Scenario being designed at the Naval Postgraduate School
- Inclusion of collaboration tools, intelligent agents, and complementary modeling being assessed
- Pilot scheduled for Fall 06
- Full experiment scheduled for Winter 2007







Some lessons learned

- Goal is to bridge the gap between research and operational concerns
- Difficult to compare apples with apples
 - Is SA in DDD study the same as SA in an ESG?
- Issues that are fair game in the laboratory can be insulting or politically sensitive in the operational org
 - How would I study "Unity of Command" without implying that it was a problem?*
- Some issues dependent on organization size and pace
- Going back to the modeled organizations, need to decide which aspects of the real ESGs to emulate







Thank You





EXPEDITIONARY STRIKE GROUP

22d Marine Expeditionary Unit



Command Element



Battalion Landing Team 1st Battalion, 2d Marines



Marine Medium Helicopter Squadron 162 (Reinforced)



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USS Saipan (LHA-2)



USS Ponce (LPD-15)



USS Philippine Sea (CG-58)



USS Gonzalez (DDG-66)



USS Gunston Hall (LSD-44)



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USS Nicholas (FFG-47)



USS Miami (SSN-775)





