

PERSUADE*: Modeling Framework for the Design of Modular Army Organizations

Georgiy Levchuk, Aptima Inc. Yuri Levchuk, Aptima Inc. Shawn Weil, Aptima Inc. Krishna Pattipati, University of Connecticut

*PERSUADE: PERSonnel-based Unit of Action Design Environment

CCRTS, 2006



The research reported in this paper was performed in connection with contract/instrument W911QX-06-C-0045 with the U.S. Army Research Laboratory. The views and conclusions contained in this document/presentation are those of the authors and should not be interpreted as presenting the official policies or position, either expressed or implied, of the U.S. Army Research Laboratory or the U.S. Government unless so designated by other authorized documents. Citation of manufacturer's or trade names does not constitute an official endorsement or approval of the use thereof. The U.S. Government is authorized to reproduce and distribute reprints for Government purposes notwithstanding any copyright notation hereon.





- Trends in current Army operations & PERSUADE challenge
- PERSUADE method and tool concept
- PERSUADE conceptual model
- PERSUADE example of analysis
- Conclusions







- Trends in current Army operations & PERSUADE challenge
- PERSUADE method and tool concept
- PERSUADE conceptual model
- PERSUADE example of analysis
- Conclusions





Trends in Army Tactical Operations

Conflicts Trends



Past

- Slow-time large-scale conflict
- Numbered engagements
- Enemy is well known

Current

- Asymmetric threats and changing missions
- Moderate to small-size forces
- Enemy may take different forms

Future: Increased # & change in type of Ops

- Fast-paced engagements
- Larger number of and higher time criticality
- Enemy is adapting

US Army Response: Force Transformation

Major variables to consider

- Speed of deployment/attack/response
- Accuracy/precision/firepower
- Action effects
- Understanding/predicting the situation; proactive COAs

Transformation focus on

- Novel C2 organizational forms tailored for new & diverse environments/missions and technologies
 - Modular force units

Novel processes/TTPs

- Rules of engagements
- Adaptation (reactive and proactive)





Addressable Problems

Army's Force Tailoring Problem:

- Find the right mix and sequence of units to accomplish a mission:
 - Force Allocation select main force unit
 - Force Augmentation add-on force components
 - Force Refinement
 - METT-TC adjustments
 - Force deployment sequencing
 - Staff tailoring & Task organizing

PERSUADE's questions:

- Question 1: How to compose the forces mix?
 - Select the units, resources & staff
- Question 2: How to organize units?
 - Define command, control, and communication relationships/structures/roles
- Question 3: How to employ the force?
 - Design mission execution strategy and courses of action
 - Reconfigure/adapt the force dynamically based on mission changes





PERSUADE Challenge

PERSUADE Design Space

Technologies enable new C2 organization forms

Technologies

FCS
UxVs
Network Centric C2

Environment is changing Current organizations are stove-piped Missions

Organization

•Work Process/TTPs

Design

•C2 Structure

•Responsibilities

•Environment

•Tasks •Threat



Can have leaner, faster forces Save cost + improve performance

Human Element

CapabilitiesCompetencies

Ŕ

New mission rehearsal capabilities allow attaining broader skills



PERSUADE Challenge

How do we <u>optimize</u> the *modularity* afforded by Future Combat Systems (FCS) and the Future Brigade Combat Team (FBCT) to adapt to mission changes?



sal

lls

es





- Trends in current Army operations & PERSUADE challenge
- PERSUADE method and tool concept
- PERSUADE conceptual model
- PERSUADE example of analysis
- Conclusions





PERSUADE Tool Objectives

- What:
 - Develop model-based decision support system focused on design and evaluation of organizational structures and processes for Army teams
- How:
 - Interactive environment
 - User in full control
 - Develop and compare design alternatives
 - Present the **reasoning** behind each alternative developed using estimization engine

Allow the user to

- Visualize the environment
- Develop mission plans
- Design organizations
 - Unit and staff selection
 - Command, control, communication structures
 - Roles definition
 - Mission execution strategy
 - Adaptive reconfiguration of the organization
- Simulate the organization in virtual environment

In PERSUADE, C2 organization can be designed •Manually

- •Using optimization for whole C2 structure
- •Using optimization for parts of C2 structure

re performance



PERSUADE Workflow





PERSUADE and Other Design & Simulation Tools







- Trends in current Army operations & PERSUADE challenge
- PERSUADE method and tool concept
- PERSUADE conceptual model
- PERSUADE example of analysis
- Conclusions





PERSUADE **Conceptual Model**

Integrated Dynamic Management of Physical, **Communication, and Human Resources**



Information flow

Human Operators, Commanders, and Staff Modeling

- Monitoring
- Decision-making
- Communication
- Command
- Synchronization

Challenges:

- Expertise/skills/load constraints
- Coordination overhead
- Situation awareness
- Switching costs & task complexity
- •Learning, fatigue

PERSUADE benefits:

- A-priori optimized C2 organization design
- **Dynamic re-organization**
- Integrated man-machine dynamic re-tasking

•Delays

- Quality of decisions
- Quality of actions



PERSUADE Optimization Steps







- Trends in current Army operations & PERSUADE challenge
- PERSUADE method and tool concept
- PERSUADE conceptual model
- PERSUADE example of analysis
- Conclusions





PERSUADE Analysis Example: **Use-case Scenario Development**

Supported by our partners from L-3COM, we developed mission scenario for brigadesize forces

of the tool

Route

Recon

IEDs

Advance

Recon

Inspect

Disarm

Launch

Secure

- Test PERSUADE concepts
- Understand uses and users



© 2006. Aptima. Inc.



PERSUADE Analysis Example: Structure Design & Assessment

- Baseline organization: traditional HBCT
- Created alternatives and compared using several different scenario classes
 - Varying Engineer, fire, civilians, attacks
- Alternative organizations
 - Add resources
 - HBCT + 6 Rec Co
 - HBCT + 6 Rec Co + 4 MP + 3 Engr Co
 - HBCT + 6 Rec Co + 4 MP + 2 Fire Co
 - Change C2 structure
 - Alternative-1 with control of engineers, infantry, tanks, and reconnaissance by single commander
 - Alternative-2 with TUAV and attack Helicopters distributed among commanders









- Trends in current Army operations & PERSUADE challenge
- PERSUADE method and tool concept
- PERSUADE conceptual model
- PERSUADE example of analysis
- Conclusions





Conclusions

- Mission performance is influenced by number and types of tasks and dependencies (structure) between them
- Different trade-offs can be achieved by changing organizational resources composition and C2 structure
- The design of mission-tailored C2 organizations can be extended for robust design (over multiple mission classes) and adaptive design (adaptive proactive/reactive reorganization)
- PERSUADE tool is currently in the planning and early development stage

