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## PROJECT SUMMARIES CC

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### HUMAN CENTERED DESIGN TOOLS

**Susan G. Hutchins, Research Assistant Professor**  
**Command, Control, and Communications Academic Group**  
**Sponsor: Naval Submarine Medical Research Laboratory**

**OBJECTIVE:** The objectives of this project are: (a) to define the behavioral components of the command, information, and control (CIC) suite (e.g., cognitive tasks and decision making); (b) review, refine, or develop effective assessment instruments of human system performance in the CIC; (c) apply existing and new models of the CIC with the purpose of enhancing efficiency and reliability while reducing manning through automation; (d) review existing system design processes with respect to determining the utilization of humans and human systems interfaces; and (e) define a human-centered design tool interface that incorporates the results of (a) through (c) to improve the process of designing complex systems.

**SUMMARY:** Conducted a literature review of the effects of automation on humans, and reported preliminary results for a report to be issued in the first year report. Developed a database as results from various studies were collected to perform a meta analysis. In this technique, the data from different studies of the same or similar effects of automation on humans were analyzed together to obtain further insight on the given effects.

**DoD KEY TECHNOLOGY AREAS:** Human Systems Interfaces, Command, Control, and Communications

**KEYWORDS:** Human Factors, Decision Theory, Command, Control, and Communications, Decision Support System, Human Systems Interfaces

### CULTURAL ASPECTS OF DECISION MAKING (CADM)

**Susan G. Hutchins, Research Assistant Professor**  
**Command, Control, and Communications Academic Group**  
**Sponsor: Space and Naval Warfare Systems Center-San Diego**

**OBJECTIVE:** The goal of the CADM program is to develop a decision support system (DSS), to support coalition operations, based on an understanding of current models of decision making and any differences in decision making styles between cultures. Data collection has involved administration of the survey on decision biases and conducting a computer-based experiment on information loss and information ambiguity, and its effects on decision making.

**SUMMARY:** To date 35 questionnaires have been administered to U.S. military students and 20 to foreign students. Thirty U.S. students have participated in the experiment. Fifty-three foreign students have participated in the experiment. Current plans are for ongoing data collection for FY99.

#### PUBLICATIONS:

Morrison, J., Kelly, R., Moore, R., and Hutchins, S., "Implications of Decision-Making Research for Decision Support and Displays," *Decision Making Under Stress: Implications for Training and Simulation*, J. Cannon-Bowers and E. Salas, (eds.), Washington, DC, American Psychological Association Books, 1998.

Hutchins, S., Morrison, J., Kelly, R., and Hutchins, R., "Implications of Decision-Making Research for Command and Control," *Naval War College Review*, 1998, in revision.

Hutchins, S. and Hutchins, R., "User-Centered Interface Design of Tactical Aircraft Display," *Proceedings of the 36th Aerospace Sciences Meeting and Exhibit*, American Institute of Aeronautics and Astronautics Paper #98-1036, Reno, NV, 12-15 January 1998.

#### CONFERENCE PRESENTATIONS:

Hutchins, S. and Hutchins, R., "User-Centered Interface Design of Tactical Aircraft Displays," 36<sup>th</sup> Aerospace Sciences Meeting and Exhibit, Reno, NV, 12-15 January 1998.

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### **ADAPTIVE ARCHITECTURES FOR COMMAND AND CONTROL (A2C2)**

**William G. Kemple, Associate Professor**

**Command, Control, and Communications Academic Group**

**Sponsors: Office of Naval Research and Naval Postgraduate School-Institute for Joint Warfare Analysis**

**OBJECTIVE:** This is part of a continuing project to conduct field, theoretical, and experimental research to establish a body of knowledge in current and future joint command and control and to develop and test theories of adaptive architectures.

**SUMMARY:** The A2C2 research project includes an ongoing series of model-based, team-in-the-loop experiments at NPS. Two major experimental activities took place during the reporting year. First, data generated by the third experiment (conducted at NPS in November 1997) was used to examine hypotheses concerning the propensity of organizations, required by an unanticipated event to change their architecture, to select an architecture “close” to the one they are familiar with rather than one “far away,” even though the distant one should be superior for the task at hand. Second, the fourth A2C2 experiment was conducted at NPS in August 1998. The third experiment tentatively confirmed the propensity of organizations to select an architecture “close” to the one they are familiar with, but the anticipated superior performance of the distant architecture failed to materialize. Following the model-experiment-model paradigm, the questions examined in the third experiment arose in part from results of the first and second experiments. Similarly, the fourth experiment was designed, among other things, to resolve questions that arose from the third. Analysis conducted so far indicates that the architectures designed to “match” the task do in fact yield superior performance, if the decision-making teams are adequately trained. In addition to A2C2 researchers from NPS and several other sites, over 50 NPS officer-students were involved in experiment four. As with all A2C2 experiments, experiment four provided data to: answer the overall project’s research hypotheses, answer research questions at each of the sites involved in the project, support model-data comparisons, and help formulate the research questions to be examined in subsequent experiments. Data generated by the fourth experiment will continue to be analyzed at NPS and the other sites in 1999.

Long range plans for the A2C2 project include transition of research findings to the operating forces. One step toward that goal is the use of a more realistic simulator (e.g., computer-based war game) for selected experiments. The NPS Systems Technology Battle Laboratory and ONR have already combined to procure and install the Marines MTWS war game to support these experiments, among other uses. In 1998, the A2C2 team initiated investigation into the unique requirements of using MTWS for A2C2 experiments. This will include at least one MTWS experiment in 1999.

### **PUBLICATIONS:**

Benson, R., Kemple, W., Kleinman, D., Porter, G., and Serfaty, D., “An Example of Model-Based Empirical Research: A Soup-to-Nuts Evaluation of Alternative C2 Architectures,” *Proceedings of the 1998 Command and Control Research and Technology Symposium*, Monterey, CA, June-July 1998.

Hutchins, S.G., Kemple, W.G., Entin, E.E., and Serfaty, D., “Innovative Measures for the Evaluation of Command and Control Architectures,” *Proceedings of the 1998 Command and Control Research and Technology Symposium*, Monterey, CA, June-July 1998.

Kemple, W.G., Porter, G.R., Benson, R., Hutchins, S.G., and Hocesvar, S.P., “Research in the Classroom and Simulation Laboratory: Combining C2 Research and Education,” *Proceedings of the 1998 Command and Control Research and Technology Symposium*, Monterey, CA, June-July 1998.

Hocesvar, S.P., “Deciding to Adapt Organizational Architecture: Facilitators and Inhibitors to Change,” *Proceedings of the 1998 Command and Control Research and Technology Symposium*, Monterey, CA, June-July 1998.

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Hocevar, S.P., Kemple, W.G., and Benson, R., "Translating Model-Based Findings to an Operational Arena: Data Interpretations from Research Participant/Experts," *Proceedings of the 1998 Command and Control Research and Technology Symposium*, Monterey, CA, June-July 1998.

### CONFERENCE PRESENTATIONS:

Benson, R., Kemple, W., Kleinman, D., Porter, G., and Serfaty, D., "An Example of Model-Based Empirical Research: A Soup-to-Nuts Evaluation of Alternative C2 Architectures," 1998 Command and Control Research and Technology Symposium, Monterey, CA, June-July 1998.

Hocevar, S.P., Kemple, W.G., Benson, R., and Hutchins, S.G., "Determinants of Organizational Structure From a Military Operations Perspective," 66<sup>th</sup> Military Operations Research Society Symposium, Monterey, CA, June 1998.

Hutchins, S.G., Kemple, W.G., Benson, R., and Hocevar, S.P., "Drivers of Adaptation Within Military Architectures: An Empirical Evaluation," 66<sup>th</sup> Military Operations Research Society Symposium, Monterey, CA, June 1998.

Kemple, W.G., Kleinman, D.L., Benson, R., Serfaty, D., and Porter, G.R., "Adaptive Architectures for Command and Control (A2C2): The Third Experiment," 66<sup>th</sup> Military Operations Research Society Symposium, Monterey, CA, June 1998.

Kemple, W.G., Porter, G.R., Hutchins, S.G., and Hocevar, S.P., "Research in the Classroom and Simulation Laboratory: Combining C2 Research and Education," 1998 Command and Control Research and Technology Symposium, Monterey, CA, June 1998.

Kleinman, D.L. and Serfaty, D., "The DDD - A Team-in-the-Loop Software Tool for Performance Evaluation of Distributed Organizations," 66<sup>th</sup> Military Operations Research Society Symposium, Monterey, CA, June 1998.

Hocevar, S.P., "Deciding to Adapt Organizational Architecture: Facilitators and Inhibitors to Change," 1998 Command and Control Research and Technology Symposium, Monterey, CA, June-July 1998.

Hocevar, S.P., Kemple, W.G., and Benson, R., "Translating Model-Based Findings to an Operational Arena: Data Interpretations from Research Participant/Experts," 1998 Command and Control Research and Technology Symposium, Monterey, CA, June-July 1998.

Hutchins, S.G., Kemple, W.G., Entin, E.E., and Serfaty, D., "Innovative Measures for the Evaluation of Command and Control Architectures," 1998 Command and Control Research and Technology Symposium, Monterey, CA, June-July 1998.

### CONTRIBUTION TO BOOKS:

Hutchins, S.G., Kemple, W.G., and Porter, G.R., "Evaluating Human Performance in Command and Control Environments," *Model Driven Experimentation for Command and Control*, Alexander H. Levis, and W.S. Vaughan, (eds.), accepted, in progress.

Kemple, W.G., Hocevar, S.P., Sovereign, M.G., Porter, G.R., and Kleinman, D., "The Experimental Concept," *Model Driven Experimentation for Command and Control*, Alexander H. Levis and W.S. Vaughan, (eds.), accepted, in progress.

### THESES DIRECTED:

Benson, R.E.L., "Conduct and Assessment of A2C2 Experiment 3 and Guidelines for Future Experimentation," Master's Thesis, Naval Postgraduate School, June 1998.

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Greenwood, D.F., "Adapting the A2C2 Experiment for Use With MTWS," Master's Thesis, Naval Postgraduate School, June 1998.

**DoD KEY TECHNOLOGY AREAS:** Command, Control and Communications, Human Systems Interface

**KEYWORDS:** Command and Control, Joint Operations, Organizational Experiments

### **NEW COMMAND, CONTROL AND COMMUNICATION (C3) ANALYSIS TECHNIQUES APPLICABLE TO PROJECT ALBERT MODELING METHODOLOGIES AND MODELS**

**William G. Kemple, Associate Professor**

**Command, Control and Communications Academic Group**

**Sponsor: United States Marine Corps Combat Development Command**

**OBJECTIVE:** To conduct an evaluation of C3 aspects of the Project Albert related modeling methodologies and models, and build upon previous research to develop a set of spatio-temporal measures of combat potentials appropriate to the MAGTF Commander in Operational Maneuver From the Sea (OMFTS) environment that may have applicability to Project Albert modeling methodologies and models.

**SUMMARY:** This is anticipated to be a continuing project, and it builds upon work done under a previous USMC project. Initial funding was not received until August 1998, but significant progress has been made. Evaluation of modeling methodologies relating to the implementation and integration of spatio-temporal measures of combat potential in existing combat simulators has been conducted and the JANUS model has been selected for initial implementation. Combat potential algorithms have been identified and a code implementation plan prepared. The high resolution PVNT Battlefield Display system has been identified as the most cost-effective platform for demonstrating dynamic spatio-temporal (S-T) displays. Combat scenarios, terrain database, and a presentation development plan have been completed. An engineering report outlining the proposed software modification and demonstration work has been prepared and delivered. Multi-color LOS, range and local topographic information is now available as input to Combat potential calculations. A demonstration CD of combat potential displays on high-resolution 3D terrain is in preparation.

**DoD KEY TECHNOLOGY AREA:** Command, Control, and Communications

**KEYWORDS:** C2 Measures of Effectiveness, C2 Technology, C2 Evaluation, Command, Control and Communications Analysis Techniques