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ASSESSING THE FEASIBILITY, COST, AND UTILITY OF DEVELOPING MODELS OF HUMAN PERFORMANCE IN AVIATION

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ABSTRACT

Substantial change is expected in aviation in the United States, both commercial and private, over the next decade and beyond. New aviation tools (TCAS, innovative CDTI display concepts, and "cockpit weather management") are now being developed that will change the essential nature of aviation. There is also the expectation that the system itself will change; load will increase; more "high flight" will occur, and more capable and efficient aircraft will become available, along with many other fundamental changes. Changes will also occur in areas separate from, but that will impact on aviation. For example, new methods will be developed for selection and training of pilot and ground personnel, and flight procedures will continue to evolve.

Decisions regarding the development of new technologies, such as those mentioned above, or related implementation issues (training requirements of new technologies) are usually difficult to make prior to the testing and/or fielding phase of a system development effort. A primary reason for the difficulty is the unavailability of data useful for evaluating the system's effectiveness. In some situations, models of various types (simulation, statistical, or mathematical) provide data that can be used for such evaluation.

The purpose of the effort outlined in this briefing will be to determine whether models exist or can be developed that can be used to address aviation automation issues. A multidisciplinary team has been assembled to undertake this effort, including experts in human performance, team/crew, and aviation system modeling, and aviation data used as input to such models. The project consists of two phases, a requirements assessment phase that is designed to determine the feasibility and utility of alternative modeling efforts, and a model development and evaluation phase that will seek to implement the plan (if a feasible cost effective development effort is found) that results from the first phase.

HUMAN PERFORMANCE MODELS TO ASSESS AUTOMATION IMPACTS IN AVIATION

GOAL:
- Determine impacts of automation on Aviation performance

OBJECTIVES:
- Assess feasibility of modeling key aspects of the Aviation System
- Determine value and cost of adding human performance to existing aviation system models
- Develop a research plan
- Implement developmental efforts

Interdisciplinary Team

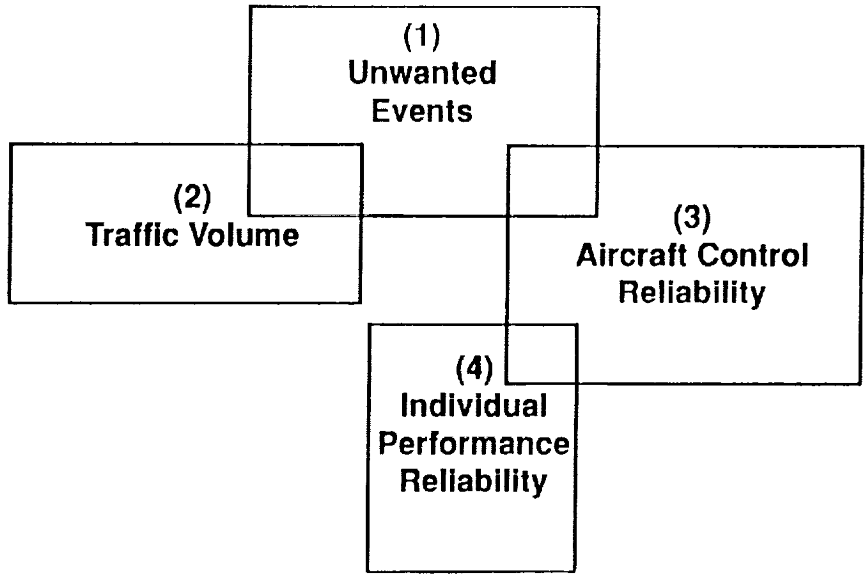
- Human Performance
- Team/Crew Performance
- Large Scale System Modeling
- Aviation Information

Project Phases

- Phase I - Requirements Assessment
- Phase II - Model Development and Evaluation

Phase I

- Determine Needs/Requirements
- Inventory and Evaluate Existing Models
- Detail Additional Modeling Requirements
- Determine Feasibility and Cost of Developmental Efforts
- Develop Model Portfolios
- Assess NASA Tradeoffs
- Establish Modeling Plan



INPUTS

- ❑ Intelligent Actors
  - ✔ Pilots
  - ✔ Aircraft Computers
- ❑ Individual Task Loadings
- ❑ Performance Shapers
  - ✔ Training
  - ✔ Experience
  - ✔ Duty Cycles
  - ✔ Work Loads
  - ✔ Noise
  - ✔ Discomfort
  - ✔ Fatigue
  - ✔ Etc.

(4)
Individual
Reliability

OUTPUTS

- ❑ Individual Performance Reliabilities
  - ✔ Expected Error Rates

Models of Individual Performance

- THERP (Technique for Human Error Rate Prediction)
- OAT (Operator Action Tree)
- HCR (Human Cognitive Reliability)
- SLIM-MAUD (Success Likelihood Index Methodology--MultiAttribute Utility Decomposition)
- STAHR (Socio-Technical Assessment of Human Reliability)
- CES (Cognitive Environmental Simulation)
- HOS (Human Operator Simulation)
- Norman's Model of Action Slips
- Reason's Model of Action Lapses
- Rasmussen's Model of Skill, Knowledge and Rule-Based Behavior

Phase II

- Development Efforts
- Kludge
- Nothing

PROGRAM ELEMENT II

INTELLIGENT ERROR-TOLERANT SYSTEMS