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Papers

In general, much of the human factors research was new compared to previous ATM Seminars in terms of the types of applied problems addressed and the sophistication of applied methods that together highlight the human factors challenges and opportunities associated with SESAR and NextGen.

There were seven Human Factors Papers:

Paper 21, Developing a Safety Culture Measurement Tool kit (SCMT) for European ANSPs, presented by Richard J. Kennedy, Boeing.

The paper describes development and validation of a safety culture questionnaire that was subsequently deployed to eight ANSPs across Europe to raise the level of safety culture prior to SESAR implementation. Audience discussion included the relationship of safety culture with resilience engineering and safety metrics such as incidents.

Paper 126, Bet on both sides of the coin to improve the organizational climate: The impact of congruent task and role clarity between leaders and staff, presented by Johan Jonsson, Lund University.

The paper presented a baseline on organizational climate for four organizations at Stockholm-Arlanda airport in relation to new technology implementation and other capacity improvements. Audience discussion noted that congruent behavior between leaders and staff can be a mediating factor between leadership effectiveness and organizational climate.

Paper 28, Methodology for Estimation of Benefits of Human Factors Engineering in NextGen/SESAR Development, presented by Lance Sherry, George Mason University.

Analysis of annual cost savings from redesign of Flight Management System error messages estimated to amount to \$45M demonstrates value of human factors contributions to NextGen/SESAR. Audience discussion noted that training and practice can reduce error rates, which justifies investment in specialized computer based training.

Paper 114, Human Factors Assessment of Runway Status Lights and Final Approach Runway Occupancy Signal FAA Operational Evaluations at Dallas Ft. Worth and San Diego International Airports, presented by Maria P. Kuffner, MIT.

The paper described new lighting systems for improving runway safety during approach and taxi phases, and field demonstrations using pilot ratings showed excellent operational suitability. Audience discussion noted status lights pose a new pilot responsibility to follow red lights and stop if able. Controllers are accepting of status lights for its contribution to safety.

Paper 27, Carbon Copy: The Benefits of Autonomous Cognitive Models of Air Traffic Controllers in Large-Scale Simulations, presented by Steven Estes, Mitre/CAASD.

The paper describes construction and use of a cognitive model to assess human performance effects for estimating NextGen benefits and closely reflects communication and other task times. Discussion noted common modeling considerations, e.g., handling off-normal situations, brittleness of rule-based models, modeling new procedures, addressing variability in controller performance, levels of model fidelity, and validation of modeling results with operational data.

Paper 16, Impact of future time-based operations on Situation Awareness of air traffic controllers, presented by Koen van de Merwe, NLR.

The paper reports a simulation with the Speed and Route Advisor (SARA) that showed reduced arrival times using time based separation, and assessed automation effects on controller planning and situation awareness. Discussion noted the challenge when new automation may reduce situation awareness and this may be reasonable to the extent the tool is highly reliable.

Paper 41, Evaluation of ATC working practice from a safety and human factor perspective, presented by Karim Mehadhebi, DSNA.

A methodology is presented that combines safety and human factors expertise allowing a high level of assessment of ATC working practices and controller performance. Audience discussion recognized its applicability to safety spanning proximate events, ATC instruction errors, lengthy or late handoffs, and failure in conflict resolution. Situation awareness ensures the controller can distinguish independent components of “the picture” to formulate actions.

Analysis

The maturity level of research elements ranged from applied research addressing concerns involving safety culture and organization climate, to field and analytic methods for assessing and validating benefits of new or improved capabilities, and on to modeling and simulation methods applied to concepts and capabilities. The variance of this maturity was broad in relation to the operational and conceptual challenges and issues addressed across these seven papers.

The Human Factors theme showed advancement compared to the ATM 2007 Seminar in terms of broader scope and clearer path for transition of research to implementation. These papers reported advancement of human factors in system safety and safety climate, in methods for assessing human factors benefits including use of operational demonstrations, and effective use of methods for cognitive modeling and human-in-the-loop simulation.

Significant achievements were shown in furthering attention to safety culture and organization climate. Techniques for the analysis of human factors benefits have been advanced involving assessing costs from human error in automation interface design, human performance improvements from new runway safety lighting systems, and workload benefits from new conflict detection automation.

An issue shared by European and U.S. human factors communities involves building the human factors business case to justify investment in human factors research and system development. Papers showed human factors impacts from effective and improved design approaches, as well as workload reduction from design of a conflict detection decision aid.

General Aspects

- There was one joint European/U.S. paper, four papers authored by Europeans, and two papers by U.S. authors. Best paper was paper 16, authored by Europeans.
- Approximately 40 Seminar participants attended the two sessions on Monday afternoon and Tuesday morning.
- Overall quality of papers was high. Many papers and presentations emphasized how data were collected and showed insightful interpretation of results and findings.
- A difference in scientific culture was reflected with two papers addressing safety culture and organization climate addressed by European authors. These papers showed an excellent foundation for ensuring safety is integrated, maintained and improved with transitions of future capabilities.
- A general correlation is that better integration of human factors in the implementation of safety improvements leads to increased validity of results. This is exemplified through the application of pragmatic human factors to support safety improvement in the paper on airport operational evaluations improving runway safety.
- Safety Culture can be seen as a recognized and established area within R&D and operational implementation. Change management and organizational factors are well on their way to being recognized as important R&D issues. Drivers are to support industry transformation and improve overall performance of Air Transport stakeholders. It should be noted that R&D and implementation within Safety Culture are well coordinated between FAA and Europe and aligned to the global efforts promoted by CANSO.

- As the proposed future operational concept outlined by the SESAR and NextGen programs matures, there is an increasing need to coordinate integrated air and ground research in order to “get it right” between controllers and pilots such as in terms of changes in roles and responsibilities, shared situation awareness, expectations of automation, and handling off-normal events.
- Human factors expertise is needed to ensure that the evaluation methodologies applied to HF problem areas are carefully selected including applying increasingly complex statistical tests.
- Integration of human factors with NextGen/SESAR operational improvements necessitates “cross disciplinary actors” who can cross over with a set of aviation actors to ensure integrated efforts, such as in relation to system level considerations (CDM, change management) as well as future concepts (design and validation, and air ground interactions)
- Human factors assessments in NextGen/SESAR require the use of both fast-time and real-time simulation methods.
- Future efforts to address air/ground aspects like human-computer interaction and situation awareness should include representation from the involved future users. Maximum understanding about the operational concept and associated design and performance requirements must be carefully analyzed.
- The application of field trials ensures maximum validity to transition new capabilities into operations.
- Integration of human factors principles, methods, and evaluations early in the ATM development process ensures a higher level of safety in tool implementation or development process.
- Involving users early in design and applying standards in following integrated design processes can avoid the appearance that human factors pours cold water on concepts.

High-level Recommendations

- Papers reported scientific progress addressing near term safety needs providing a baseline enabling transition of future NextGen and SESAR technologies, concepts and procedures. Papers provided improved approaches for addressing the human factors benefits case, and methods for modeling and simulation.
- Essential finding from the Human Factors Theme is the shared emphasis in Europe and U.S. on the role of human factors contributions to NextGen and SESAR. Human factors is shown to successfully ensure the safety case by addressing culture and climate, ensure the business case by showing that human performance enables accrual of intended NextGen/SESAR capacity and safety benefits, and ensure having the right methods and techniques to model cognitive performance and assess performance in human-in-the-loop simulations.
- Issues to address for future seminars
 - Air-ground integration of SESAR/NextGen capabilities and concepts including field trials and operational demonstrations
 - Innovations in measuring safety in ATM
 - Methods for making a strong benefits case for human factors
- Research gaps, divergences and needs
 - Challenges in training strategies to transition future capabilities
 - How to integrate and transition human factors as part of system development