Air Ground Integration Study

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A simulation was conducted to examine the impact of shared air/ground authority when each is equipped with enhanced traffic and conflict alerting systems. The potential benefits of advanced an Air Traffic Management (ATM) concepts referred to as “free flight” include improved safety through enhanced conflict detection and resolution capabilities, increased flight-operations management, and better decision-making tools for air traffic controllers and flight crews. One element of the free flight concept suggests shifting aircraft separation responsibility from air traffic controllers to flight crews creating an environment with ‘*shared-separation*’ authority. During FY00, NASA, FAA, and Volpe National Transportation Systems Center completed the first integrated, high fidelity, real-time, human-in-the-loop simulation . A number of related accomplishments contributed to the successful completion of this effort: (1) Linking Ames simulation facilities on the west coast with those of the FAA William J. Hughes Technical Center (WJHTC) on the east coast; (2) Developing a prototype Cockpit Display of Traffic Information with Alerting Logic (CDTI-AL) which served as a flight crew decision support tool (Figures 1, 2); and (3) Incorporating the User Request Evaluation Tool (URET) developed by MITRE Corporation for the air traffic controllers

The simulation, conducted over a four-week period, involved six line pilots, 12 certified professional controllers, four operations supervisors who served as participants and subject matter experts who served as observers. Two Memphis Air Route Traffic Control Centers (ARTCC) were emulated in the experiment. Four test conditions were defined by level of controller and flight crew shared-separation responsibilities and associated procedures. Standard separation rules of five nautical miles horizontal or 1000/2000 ft vertical (as appropriate) were observed throughout. All flight crews and controllers experienced all four conditions. Objective ground-side data included communications, separation errors, URET alerts and trial plans, closest point of approach, traffic density, and number of free flight cancellations. Objective air-side data consisted of communications, separation errors, CDTI-AL alerts, closest point of approach, and number of free flight cancellations. Subjective ground-side and air-side data consisted of workload and situation awareness ratings and comments about shared-separation experiences, traffic realism and other details. Expert observers recorded critical observations.

The controllers expressed concern about the feasibility of shared-separation as simulated in this study and its potential impact on flight safety. They reported higher workload, preferred to resolve conflicts earlier than pilots did, and tended to cancel free flight when they perceived pilots were delaying the conflict resolution. However, their level of situation awareness was high across all conditions. Pilots preferred shared-separation conditions, particularly the one affording them the highest level of separation responsibility (SS:L2). They rated both shared-separation conditions as being relatively safer than current operations, and providing more situation awareness.

This research helped to facilitate the technical connection and collaboration between multiple organizations. It also demonstrated some of the advantages of exploring free flight and separation authority in a full-mission study environment.