Effects of Communication Modes and Data Linked Pilot Reply Time on Controller Workload and Communication Tasks in Simulated Terminal Airspace

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How might delays in pilot-to-controller data-link acknowledgments affect approach controller workload and communication? In a mixed-modality (voice radio and data link) simulation environment, eight approach control certified professional controllers completed the same scenario twice, with data link response type (immediate, delayed) counterbalanced during a moderate-traffic density scenario. Although statistically non-significant, NASA TLX ratings showed marginal increases in subjective workload overall and on individual dimensions when the simulation environment involved immediate voice but delayed data link acknowledgments. The main effect noted from the communications data, and the most important finding, was that the mixed-modality environment allowed controllers to multitask and plan more effectively. In particular, transmissions to data link-equipped aircraft took longer to complete and contained longer pauses than transmissions to non-data linked aircraft. When compared with voice messages, data link messages took longer to formulate and transmit, but were more accurate and shorter. Often, the longer pauses resulted from deliberate controller actions that reflected innovations to optimize performance.


A Benefits Assessment of the User Request Evaluation Tool (URET)

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In 1998 the Federal Aviation Administration (FAA) established the Free Flight Phase 1 program to provide new decision-support systems to a limited number of facilities in a relatively short time (by the end of 2002), with the goal to providing increased user benefits and maintaining current levels of safety. The FAA selected systems that were anticipated to meet those goals and had demonstrated support within the Air Traffic community.

The User Request Evaluation Tool (URET) is one of the systems selected for inclusion in the program. URET was an operational prototype that had been deployed at two of the twenty Air Route Traffic Control Centers within the continental United States, Indianapolis and Memphis, in the 1996-97 timeframe. It is a decision-support tool used by the sector team in an Air Route Traffic Control Center. It is implemented at the Radar Associate Position to support the strategic operations of the team in an integrated fashion. With URET, controllers can provide better service by detecting and resolving problems earlier, maneuvering aircraft less off their filed route, and reducing some airspace constraints (such as static altitude restrictions). URET provides an automated conflict probe and trial-planning capability that informs the controller of projected conflicts and assists the controller in evaluating resolutions to determine if they are conflict free before the issuance of a new clearance and amendment. URET also provides flight data management capabilities that reduce controller dependence on paper flight strips.

This paper describes the benefits to users of the National Airspace System attributable to URET. The metrics and measurements described are based on the experience with URET at the Indianapolis and Memphis en route centers. From early May 1999 until the deployment of the production system in January 2002, data was collected on a daily basis in order to assess the operational impact of the system. Analysis of the metrics has demonstrated that savings to airlines and general aviation (GA) attributable to URET derive most directly from savings in nautical miles flown from the issuance of lateral amendments by controllers and reduction in fuel burn from the lifting of static altitude restrictions. The savings in distance flown measured approximately 7,000 nautical miles daily for the two Centers. Reduction in fuel burn from the lifting of static altitude restrictions totaled approximately 950,000 gallons annually. The demonstrated benefits of URET resulted in the recent decision by the FAA to deploy URET at all twenty Air Route Traffic Control Centers within the continental United States.

Concept for Next Generation Air Traffic Control System

Heinz Erzberger and Russell A. Paielli

The next generation air traffic control system must achieve large increase in capacity and throughput while improving efficiency and safety. This paper describes the Automated Airspace concept that has the potential to achieve these objectives. A ground-based component, the Automated Airspace Computer System (AACS), will generate efficient and conflict-free traffic clearances and associated trajectories and send them directly to the aircraft via data link. Another ground-based component, the Tactical Separation Assisted Flight Environment (TSAFE), will provide a safety net to ensure that safe separations are maintained in the event of failures in the AACS or in certain on-board systems. TSAFE will independently monitor the clearances and trajectories sent by the AACS to each equipped aircraft, monitor aircraft conformance to those trajectories, and issue warning and resolution advisories to pilots and controllers when appropriate. Because the Automated Airspace concept will reduce controller workload associated with tactical problem solving, controllers will be able safely to shift their focus to more strategic problems, such as traffic flow management and pilot requests. TSAFE also has application in the current air traffic control system as an improved controller tool for detecting near-term conflicts and reducing the potential for operational errors. Changes in controller and pilot responsibilities for operations in Automated Airspace are outlined.


Sector-Less Air Traffic Management: Initial Investigations

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In the near future, modern communication technologies, together with satellite-based navigation and surveillance technologies, will enable aircraft to be monitored and controlled without necessarily relying on traditional radar-based practices. Based on this assumption, we present a new Air Traffic Management (ATM) concept that dispenses completely with today’s principle of sectorisation. Our work explores the possibility of controlling and monitoring aircraft individually, with no regard to today’s sectors through which aircraft fly. In this paper we discuss the concept referred to as “Sector-less Air Traffic Management.” This concept proposes radical change in the way we traditionally control air traffic: instead of having, say, two controllers controlling a sector containing n aircraft, one controller will be responsible for a limited number of m aircraft, from departure to arrival terminal areas (TMA). It is believed the proposed concept will go a long way towards solving the current conflicting requirements for capacity, safety, and efficiency in the context of today’s continuous growth in air traffic.