Flight Deck Tools for distributed air ground decision making in future ATM systems.

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Cockpit Situation Display (CSD) tools designed to maintain pilots' awareness of surrounding aircraft, alert them of impending conflicts, and aid them in developing de-conflicted flight plans were evaluated in an air/ground simulation. The aviation community is exploring new concepts of operations to address saturation of the air traffic management (ATM) system. "Free Flight" concepts decentralize and distribute flight-path management control and responsibility and information unique to the flight deck and flight dispatchers is included in the ATM decision-making process. All participants must have access to needed information in real time to generate the anticipated benefits. However, a shift away from the current centralized system must not occur at the cost of safe separation between aircraft and acceptable workload levels. To address these issues, the Advanced Air Transportation Technologies Program is demonstrating new distributed air-ground (DAG) conceptsin a series of full-mission, distributed air-ground simulations.

The DAG concept underlying the current effort was based on three principles: (1) Current flight plan information on all aircraft will be updated and broadcasted in real-time; (2) All aircraft will de-conflict their flight path to the maximum extent possible (within the current 120 nautical mile range limit of ADS-B); and (3) Flight-deck display tools will reduce crew workload and head-down time through the use of natural graphical display interfaces. Airline and general aviation pilots utilized an Advanced CSD system to remain clear of conflicting traffic and submit flight plan revisions to air traffic controllers (ATC). These flight-plan revisions allowed ATC to accommodate airline preferences while managing and de-conflicting arrival traffic in a simulation of Dallas- Fort Worth Airport. The CSD depicted the location, heading, and flight plans of surrounding traffic; dynamic 4-D predictors; and alerted crews to impending losses of separation (Figure 1). A graphical route assessment tool (RAT) was used to develop alternative de-conflicted flight plans and to submit them to ATC for approval while automatically uploading approved plans into the flight management system and data-linking them to surrounding aircraft. An advanced spacing tool was used to maintain ATC-assigned intervals behind a leading aircraft after arriving at the final approach fix (Figure 2). The autopilot system maintained the specified interval with only minor energy management input from the flight crew.

Flight crews reported that the CSD tools were excellent aids for conflict detection and resolution during the free flight (en route) phase as well as the controlled (approach) phase. Further, they agreed that the tools were excellent for self-spacing and maintaining situation awareness. Based on this preliminary demonstration, both controller and pilot comments indicate the DAG concepts evaluated are feasible and viable.