Aeronautical-Satellite-Assisted Process Being Developed for Information Exchange Through Network Technologies (Aero-SAPIENT)

Communications technologies are being developed to address safety issues during aviation travel. Some of these technologies enable the aircraft to be in constant bidirectional communications with necessary systems, people, and other aircraft that are not currently in place today. Networking technologies, wireless datalinks, and advanced avionics techniques are areas of particular importance that the NASA Glenn Research Center has contributed.

Glenn, in conjunction with the NASA Ames Research Center, NASA Dryden Flight Research Center, and NASA Langley Research Center, is investigating methods and applications that would utilize these communications technologies. In mid-June 2000, the flight readiness of the network and communications technologies were demonstrated via a simulated aircraft. A van simulating an aircraft was equipped with advanced phased-array antennas (Advanced Communications/Air Traffic Management (AC/ATM) Advanced Air Transportation Technologies (AATT) project) that used commercial Ku-band satellite communications to connect Glenn, Dryden, and Ames in a combined system ground test. This test simulated air-ground bidirectional transport of real-time digital audio, text, and video data via a hybrid network configuration that demonstrated the flight readiness of the network and communications technologies. Specifically, a Controller Pilot Data Link Communications application was used with other applications to demonstrate a multiprotocol capability via Internet-protocol encapsulated ATN (Aeronautical Telecommunications Network) data packets.

The significance of this combined ground test is its contribution to the Aero Information Technology Base Program Level I milestone (Software Technology investment area) of a real-time data link for the National Airspace System. The objective of this milestone was to address multiprotocol technology applicable for real-time data links between aircraft, a satellite, and the ground as well as the ability to distribute flight data with multilevel priorities among several sites.

Glenn van simulating an aircraft in ground tests.

The impact of this achievement contributes to the maturation of airborne networking for safety-critical and noncritical data, the reduction in redundant data links, and enhanced information integrity for safety.

Also, with the support of the Glenn Director's Discretionary Fund program and continued collaboration with the Army Research Lab and Embry Riddle University, progress was made in the applicability of silicon carbide to avionics. During fiscal year 2000, optimized silicon carbide mixer diodes were fabricated and packaged in preparation for benchmark testing. Also, a patent was issued for Wide Dynamic Range RF (radiofrequency) Mixers Using Wide Band-Gap Semiconductors (U.S. patent 6,111,452).

The significance of this material and design is the reduction of the RF receiver circuits' susceptibility to undesired interference. This interference reduction increases the communication link performance and the ability of pilots to navigate in poor weather. Furthermore, the rejection of intermodulation distortion products enables a wider dynamic range, more efficient performance of very high frequency (VHF) data links, and more efficient spectrum utilization.

The impact of its applicability to avionics will improve aviation safety by decreasing navigation instrument malfunctions and communication dropouts. Also, it may improve electronic device electromagnetic compatibility (e.g., the use of personal portable electronics during air travel).

Plans are in place to perform an initial flight test in fiscal year 2001 of the communication and network technologies used in the June 2000 ground test. The air-craft to be used is Dryden's DC-8, which routinely conducts airborne science missions. Therefore, this progress to enable bidirectional transport of real-time digital audio, text, and video data will not only benefit improvements within the National Airspace System but NASA science missions as well.

Glenn contact: Michael J. Zernic, 216-433-5286, Michael.J.Zernic@grc.nasa.gov
Author: Michael J. Zernic
Headquarters program office: OAT

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