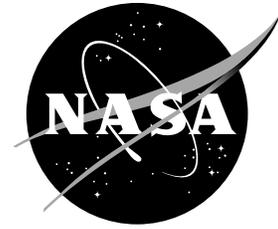


NASA Facts

National Aeronautics and
Space Administration

Langley Research Center
Hampton, Virginia 23681-2199



FS-1999-12-42-LaRC

Airport Surface Capacity and Safety Enhancement Technologies

The Problem

The U. S. aviation industry is investing \$6 billion over 20 years to increase airport capacity; however, a gap exists between the industry's desired capacity and the National Airspace System's ability to handle the increased air traffic. The FAA reported that by the year 2000, 40 major airports will be experiencing more than 20,000 hours of delays. Between 1990 and 1993, the number of flights delayed greater than 15 minutes averaged 312,000, with an average of 64 percent of these caused by poor weather.

Also, hazardous runway incursions have increased by more than 50 percent over the past four years and five fatal airport surface accidents have occurred since 1990. In 1996, 287 surface incidents were reported — a 10-year high. Reduced visibility was a contributing factor in many of these accidents and incidents.

NASA's Approach to the Problem

To operate safely on the airport surface during poor weather at rates equal (or better) to those in clear weather, pilots and controllers need supplemental information about the airport and relevant traffic. This information should "fill the gaps" created by the visual cues that may be missing during poor weather conditions.

The pilot requires three types of information to control the movement of the aircraft while avoiding an accident/incident on the airport surface. These are (1) continuous awareness of position, (2) continuous awareness of traffic or obstacles that may impede progress to the destination and (3) an understanding of the route to follow from current position to the desired destination. Ground controllers need similar information for all vehicles moving on the surface.

NASA's Aviation Systems Capacity Program addressed these issues through the Low Visibility Landing and

Surface Operations (LVLASO) research. LVLASO has shown, through simulation and flight test activities, how new technologies can be used to reduce the uncertainties in poor weather conditions by providing controllers and pilots with supplemental guidance and situational awareness information.

Figures 1 to 3 depict the current LVLASO flight display concepts resulting from this research.



Figure 1. HUD Taxi Symbology

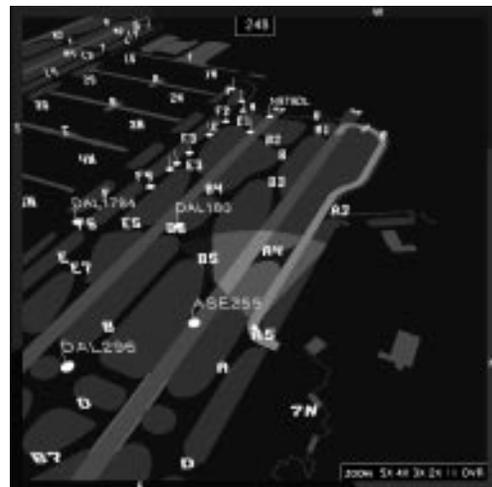


Figure 2. Electronic Map Display

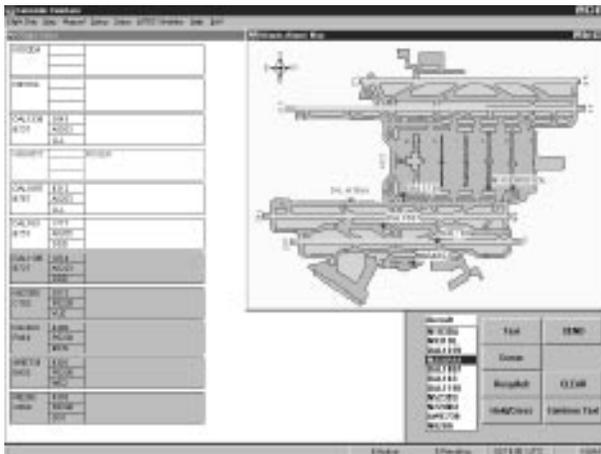


Figure 3. Controller Interface Display

Initial Demonstration System

A major milestone of the LVLASO research program was a demonstration at the Hartsfield Atlanta International Airport in August 1997. This activity was a cooperative effort with the FAA's Runway Incursion Reduction Program (RIRP). The prototype system consisted of several advanced technologies that made up an integrated communication, navigation and surveillance (CNS) system. This specific implementation was designed to show whether the concept was feasible both operationally and technically. In developing this prototype system, every attempt was made to use certified avionics and systems envisioned by the FAA for use in the National Airspace System. Technologies demonstrated included:

Airborne

- Electronic moving map liquid-crystal display (figure 2)
- Head-Up Display depicted roll-out, turn-off, and taxi guidance (figure 1)
- Differential Global Positioning System (DGPS) as the position sensor
- Data links transmitted data to/from the airborne and ground systems

Ground-based

- Surface surveillance radar provided traffic position reports
- Airport Traffic Identification System provided traffic position reports with identification
- Surveillance data fusion system fused all sources of position data. Fused data were provided to both a controller display and the test aircraft.
- Controller interface (figure 3) supported controller-pilot datalink communications in parallel with the normal voice communications.

The system was tested using NASA's B-757-200 aircraft, NASA test pilots and commercial 757 captains. Data resulting from 53 tests are being used to enhance the system's capabilities for future implementations and to develop and validate requirements for using these technologies in the future.

Potential Benefits

The LVLASO technology has the potential to significantly increase the safety and efficiency of aircraft movements on the airport surface through the following:

- Supplemental guidance cues and increased situational awareness
- Runway incursion avoidance
- Low visibility surface navigation
- Reduced navigation errors
- Reduced runway occupancy time and improved braking efficiency
- Reduced taxi time
- Reduced controller/pilot miscommunications
- Operational capability in any visibility on the surface

Status

Because of the potential to eliminate runway incursions and increase safety, the LVLASO research has been transitioned to the NASA Aviation Safety Program.

NASA Langley researchers have performed simulations of expanded LVLASO capabilities and plan to demonstrate these capabilities in-flight at Dallas-Ft. Worth in the summer of 2000 in conjunction with the FAA's Runway Incursion Reduction Program.

ATL Flight Team Test Members

NASA Langley Research Center, NASA Ames Research Center, Federal Aviation Administration, Volpe National Transportation Systems Center, Rockwell International, Cardion, Inc., Jeppesen-Sanderson, St. Cloud State University, QuesTech Project Management Enterprises, CNS Systems, Rannoch Corporation, Trios Associates, Research Triangle Institute

For More Information

Contact the NASA Langley Office of Public Affairs at (757) 864-6124 or Visit the LVLASO web site at: <http://tnasa.larc.nasa.gov/lvlaso>

