ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

Agenda Item 1: Introduction and assessment of a global air traffic management (ATM) operational concept
1.2: Enabling concepts in support of the global ATM operational concept

SAFE FLIGHT 21: ALASKA CAPSTONE AND THE OHIO RIVER VALLEY

(Presented by the United States)

SUMMARY

This paper provides a status of the United States (U.S.) Federal Aviation Administration's (FAA) Safe Flight 21 programmes in Alaska and the Ohio River Valley. Emphasis is on the operational aspects and real world applications, as well as accomplishments within the programme to date.

1. INTRODUCTION

1.1 In recent years, the civil aviation community has recognized automatic dependent surveillance — broadcast (ADS-B) as central to the future vision of free flight within a communications, navigation, and surveillance/air traffic management (CNS/ATM) system. ADS-B is the periodic broadcast of aircraft identification, position, velocity and intent information used by ground systems or proximate aircraft that allows both pilots and controllers to have a common situational awareness of all appropriately equipped users. ADS-B applications will enable new procedures (air to air, air to ground, ground to air, and on the airport surface) having the potential to increase safety and efficiency of the airspace system.

1.2 There are current activities ongoing within RTCA and the international community to further the development of technical and operational Standards for ADS-B. Significant progress has been made in the United States to define ADS-B system level requirements and potential applications (RTCA DO-242A ADS-B minimum aviation system performance standards (MASPS) and on operational performance standards (RTCA DO-260A 1 090 MHZ ADS-B minimum operational performance specifications (MOPS), RTCA DO-282 universal access transceiver ADS-B MOPS). Coordination is also underway to harmonize ADS-B applications internationally with EUROCONTROL and the European Organisation for Civil Aviation (EUROCAE) in the form of joint standards documents, and with the International Civil Aviation Organization (ICAO) in the form of Standards of Recommended Practices (SARPs) and manuals.

1.3 The FAA has been developing and conducting technical evaluations of ADS-B technologies since 1992 and has been operationally testing and evaluating related broadcast service applications since 1998. These more recent activities are organized under the Safe Flight 21 (SF-21) programme, formed to evaluate nine operational enhancements in which ADS-B is a key technology. The Alaska Capstone programme is operationally evaluating a subset of the nine enhancements, as well as several other elements, to improve aviation safety in Alaska. To date, several of these enhancements have been fielded in the Alaskan region with full certification and operational approval in commercial revenue service.

2. UNITED STATES STATUS — SF-21 AND CAPSTONE PROGRAMMES

2.1 Ohio River Valley

2.1.1 SF-21 is a cooperative government/industry effort to develop enhanced capabilities for free flight, based on evolving CNS technologies. The SF-21 programme is demonstrating a cockpit display of traffic, weather, and terrain information for pilots, and will provide improved information for controllers, airlines, airport personnel and operations. The new technologies being used include the global positioning system (GPS), ADS-B, flight information services-broadcast (FIS-B), and traffic information service-broadcast (TIS-B), to integrate with enhanced pilot and controller information displays. SF-21 will evaluate the safety, efficiency, capacity, service, and procedure improvements these technologies make possible, and, in certain cases, will facilitate the certification of these technologies.

2.1.2 The primary objective of the SF-21 programme is to enable and expedite implementation of the following nine operational enhancements:

a) weather and other data to the cockpit;

b) affordable reduction of controlled flight into terrain (CFIT);

c) improved low visibility approaches;

d) enhanced capability to see and avoid;

e) enhanced en route air-to-air;

f) improved operations for surface surveillance and navigation for pilots;

g) enhanced controller management of surface traffic;

h) surveillance in non-radar airspace; and

i) improved separation Standards.

2.1.3 SF-21 has conducted several operational evaluations in conjunction with the Cargo Airline Association (CAA). Operational Evaluation-1 was conducted in July 1999 in Wilmington, Ohio. Twenty-four aircraft were fitted with a first generation ADS-B and cockpit display of traffic information (CDTI) suite. The aircraft demonstrated airborne “see and avoid” and “aid to visual acquisition” applications. Operational

Evaluation-2 was conducted in October 2000 in the Louisville airport vicinity. This activity continued the development of ADS-B applications, to include airport surface situational awareness and initiated trials with air traffic call sign procedures to enhance visual acquisition and approaches. In 2002, test and evaluation activities were conducted in May at the Memphis International Airport (MEM). These tests included airport surface moving map and TIS-B trials to enhance ADS-B operations. The current testing emphasis for ADS-B is on evaluating cockpit display of traffic information enhanced flight rules (CEFR) for visual situational awareness and separation applications under reduced visibility conditions. SF-21 is also exploring avionics development under a test and evaluation surveillance information system (TESIS) designed to evaluate alternative air carrier based avionics for ADS-B applications. Four avionics contractors are currently developing prototype units with a set of core capabilities. Each vendor is developing additional ADS-B applications.

2.2 **Alaska Capstone**

2.2.1 Current Capstone planning has focused on two regions of Alaska: Phase I addresses the Bethel/Yukon-Kuskokwim (Y-K) delta area and Phase II addresses the Juneau/Southeast (SE) Alaska area. Phase I planning in the Bethel area includes the installation of government furnished global positioning system (GPS) driven avionics suites in up to 200 commercial aircraft serving this area, along with a supporting ground based infrastructure. Compatible data link transceivers installed at strategically located ground sites were designed to facilitate air traffic and flight monitoring/weather information services. January 2000, Capstone began operational use of ADS-B to provide visual flight rules (VFR) and instrument flight rules (IFR) surveillance services in non-radar airspace in southwest Alaska. This event marked the beginning of air traffic control (ATC) use of ADS-B for separation, vectoring, and sequencing aircraft. This ADS-B surveillance information is also being routed to airline operators for flight following and to assist in search and rescue.

2.2.2 Phase II of the Alaska Capstone Programme will transition and begin in the Juneau area. The goal of this phase will be to incorporate technologies matured in the Phase I area, while building on lessons learned to provide a more useable IFR infrastructure. This will focus on navigational capabilities for lower en route altitudes, improved communications, weather information, surveillance, CFIT protection, and traffic awareness. On March 31, 2003, Capstone initiated enroute navigation using the world's first GPS/WAAS receiver certified for aviation use. Special Federal Aviation Regulation 97 provided authorization for trained pilots to use the GPS/WAAS receivers as the sole means for enroute navigation in Alaska. Already, this has produced an additional 41 000 ft of usable airspace along 1 521 NM of the existing route structure in southeast Alaska. Approximately 200 aircraft (fix-wing and helicopter) will be fitted with upgraded and certified avionics. This next generation of avionics will include ADS-B and explore new capabilities, including WAAS capable GPS, see and avoid/traffic warning system, and enhanced awareness and avoidance. These avionics will be compatible with the ADS-B ground and airborne infrastructure. Both the ground and airborne segments will be upgraded to meet the RTCA universal access transceiver MOPS.

2.2.3 Promising aviation safety improvement trends are documented in the Alaska Capstone region report "The Safety Impact of Capstone Phase I: An Interim Assessment of 2000-2001" (MP 02W0000150, MITRE Center for Advanced Aviation System Development, August 2002). Capstone equipped aircraft have had 40 per cent fewer accidents than those not equipped. To determine whether this is a long-term trend, further data must be collected.

2.2.4 With the advent of ADS-B surveillance services in and around Bethel, Alaska there has been significant advancement of ADS-B implementation. All required operational evaluation and implementation activities were achieved and documented in the "Capstone Test and Evaluation Master Plan for Radar-Like

Services" (Capstone Programme Office, 30 January 2001). Although FAA Alaska Region implementation and refinements are still being made, this same process can be followed for both national and international ADS-B surveillance services.

3. SAFE FLIGHT 21 DEMONSTRATION AND EVALUATION ACTIVITIES

3.1 In 2001, the Safe Flight 21 programme conducted an air traffic modernization forum in Memphis, Tennessee to demonstrate newly installed multilateration surveillance capabilities and on-board moving map displays for monitoring surface aircraft and vehicle movement. A multilateration infrastructure was also ordered for the Louisville, Kentucky test site. Other efforts included the award of four contracts for avionics development and evaluation, the development of a visual concept of use for surface moving map displays, and initial development of a surface moving map database to support this effort.

3.2 In 2002, the multilateration system was installed at Louisville, Kentucky, and a new automation platform for that facility to support ongoing ADS-B test and evaluation efforts is being procured. Development and evaluation is continuing on avionics and the procedural modifications needed to improve surface situational awareness and enhance existing surface surveillance using ADS-B. Interoperability and shakedown testing of avionics capable of transmitting and receiving ADS-B messages, receiving TIS-B messages, and displaying the combined ADS-B and TIS-B information to flight crews was conducted in April and May at Memphis International Airport. This data collection effort was designed to demonstrate the end-to-end functionality of the TIS-B infrastructure installed at Memphis, and provided data to assist in the validation of the avionics. Additionally, it provided an opportunity to document the air-to-air and air-to-ground surveillance performance of ADS-B in a light-to-moderate interference environment.

3.3 In 2003, demonstrations and evaluations include call sign procedure evaluation in Louisville and ADS-B/automation system integration and vehicle surface moving map testing at both Louisville and Memphis. In addition, east and west coast areas in the lower 48 States are being evaluated for potential use of ADS-B as a surveillance tool; these areas could offer opportunities for initial pockets of implementation.

4. CONCLUSION

4.1 Safe Flight developmental efforts are focused on the application of technology to meet user identified improvements that will provide significant safety, efficiency, and capacity benefits. Several of these are "near term" benefits that will be achievable in a relatively short time period with little or no changes to current ATC procedures. Equipment is provided as avionics in the aircraft and as infrastructure improvements (i.e., automation system upgrades, ground-based transceivers, etc.) on the ground. Test flight activities are prioritized to focus on the near term benefits, and are designed to focus on crew performance, operational procedures and benefits, and data link technical performance.

4.2 Demonstrations will be used to determine if these applications should be made operational on a national basis.

4.3 The Eleventh Air Navigation Conference participants are requested to consider the information presented in this paper and the applicability of our efforts to improve safety and efficiency for civil aviation operations in other regions of the world, particularly the Asia-Pacific Region. Members are also invited to visit the programme Web sites at http://www.faa.gov/safeflight2l and http://www.alaska.faa.gov/capstone.

— END —