8.0 SUBCOMMITTEE C – AVIONICS AND SYSTEM INTEGRATION

8.1 Metrics Based Approach for Evaluating Air Traffic Control Automation of the Future – Mike Paglione, presented by Stan Pszczolkowski, FAA Technical Center

The Federal Aviation Administration (FAA) is in the process of replacing the current enroute air traffic control automation system. This system, the heart of the National Airspace System (NAS), was installed in approximately 1970 and has been modified, enhanced and upgraded since. The replacement – Enroute Automation Modernization (ERAM) – will be the largest and most complex system in the NAS. There are 1,298 requirements in the System Level Specification that will translate into an estimated 1,200,000 source lines of code. Due to this size, complexity and schedule constraints the execution of an effective test program is a challenge. A Metrics Based approach has been undertaken with a cross functional team of subject matter experts. Metrics have been sorted by High Priority (i.e. direct link to external requirements, significance of effect, directly observable by the controller, etc.) and Low Priority (i.e. contribute to a high priority metric, not directly observable, etc.). These metrics include both the accuracy of calculations and computer-human interface functions. The Metrics Based approach not only provides benefits to the ERAM efforts but also will serve as a basis of future Next Generation Air Transportation System evaluations.

An initial task determined the accuracy of the current aircraft tracker in order to establish a baseline for ERAM performance assessments. Post-processed GPS data from the Reduced Vertical Separation Minimum (RVSM) certification efforts was compared to data extracted from the current enroute automation system. This included 265 flights in January and February 2005 with data from all 20 Enroute Air Traffic Control Centers. There was a significant effort in the synchronization and the translation to a common coordinate system of the independently collected RVSM data and the data extracted from the current center automation systems. The results indicate a normal distribution of cross-track errors but a negatively skewed “half-normal” distribution of along track errors.

8.2 An Automated Airspace Concept for the Next-Generation Air Traffic Control System – Todd Farley NASA Ames Research Center

The economic health and competitiveness of nations is dependent on the safe and efficient movement of people and goods, and a safe and efficient air traffic system is a critical part of this economic engine. To accommodate anticipated growth in demand for air transportation—and growth in the economy overall—aviation planners have called for increasing the capacity of our air transportation system by factors of two or three over the next 20 years. While the spatial capacity of our skies appears ample, the practical capacity of the en-route and transition (arrival/departure) airspace as presently operated is already near its operational limit and is routinely oversubscribed. The principal constraint on airspace capacity is the air-traffic-controller workload associated with monitoring and controlling the separation of aircraft from one another. Therefore, the key to increasing the capacity of this airspace is reducing controller workload. We propose to do so by automating the separation-assurance function currently performed
by sector controllers and by using an air-ground data link to transmit necessary trajectory adjustments directly between ground-based and airborne computers. We call this concept the Advanced Airspace Concept.

The Advanced Airspace Concept is presented from a system-safety perspective, focusing on the system architecture, its functional elements, and the operational concept. Results from a safety analysis and fast-time simulations are presented. Implications for pilots, controllers, and the traveling public are discussed.

8.3 Unmanned Aircraft Systems in the National Airspace System – Doug Davis, Federal Aviation Administration

Unmanned Aircraft Systems (UAS) are here. They have traditionally been known as Unmanned Aerial Vehicles (UAVs), Remotely Operated Aircraft (ROAs), drones, etc and have actually been around in one form or another for decades. The events following September 11, 2001 have brought the use of these aircraft to the forefront. The Department of Defense has made significant investments in this technology for use on the Global War on Terror. Using this application stateside, however, has presented different and more complex challenges.

The FAA does not issue airworthiness certificates to Public organizations like DoD, DHS, etc. But these Public Organizations must show compliance with 14 CFR Part 91, General Operating Rules, to the FAA. This is the area where UAS fall short. Detect, Sense, and Avoid (DSA), and the Command, Control, and Communications (C3) standards for UAS to “file and fly” in the NAS are still undefined, but are being worked hard by RTCA SC-203, at the request of Nick Sabatini, the FAA Associate Administrator for Aviation Safety. Currently, Minimum Operational Performance Standards (MOPS) for DSA and C3 are projected to be completed and submitted to FAA for approval in FY2011.

The FAA has established an Unmanned Aircraft Program Office which is responsible for developing the policies needed for the safe integration of UAS into the NAS. Some of the challenges facing the integration are things that differ from traditional manned aircraft like wake vortex issues, significant speed differences, climb and turn characteristics. In addition, UAS must integrate with the current NAS infrastructure.


Landing unmanned helicopters presents itself with unique challenges and opportunities. This presentation will focus on (i) the need for innovative, low-cost positioning systems, (ii) control issues specific to the operations of vehicles in the vicinity of obstacles and (iii) vehicle landing in off-nominal conditions. A compact, vision-based monocular positioning system will be presented that offers 6 DOF, accurate position information. Recent progress in gain-scheduled control laws that handle the proximity of obstacles will follow. Finally, we will present Georgia Tech’s flight testing environment for all-attitude VTOL vehicle landing.