

# AVIATION WEEK

## & SPACE TECHNOLOGY

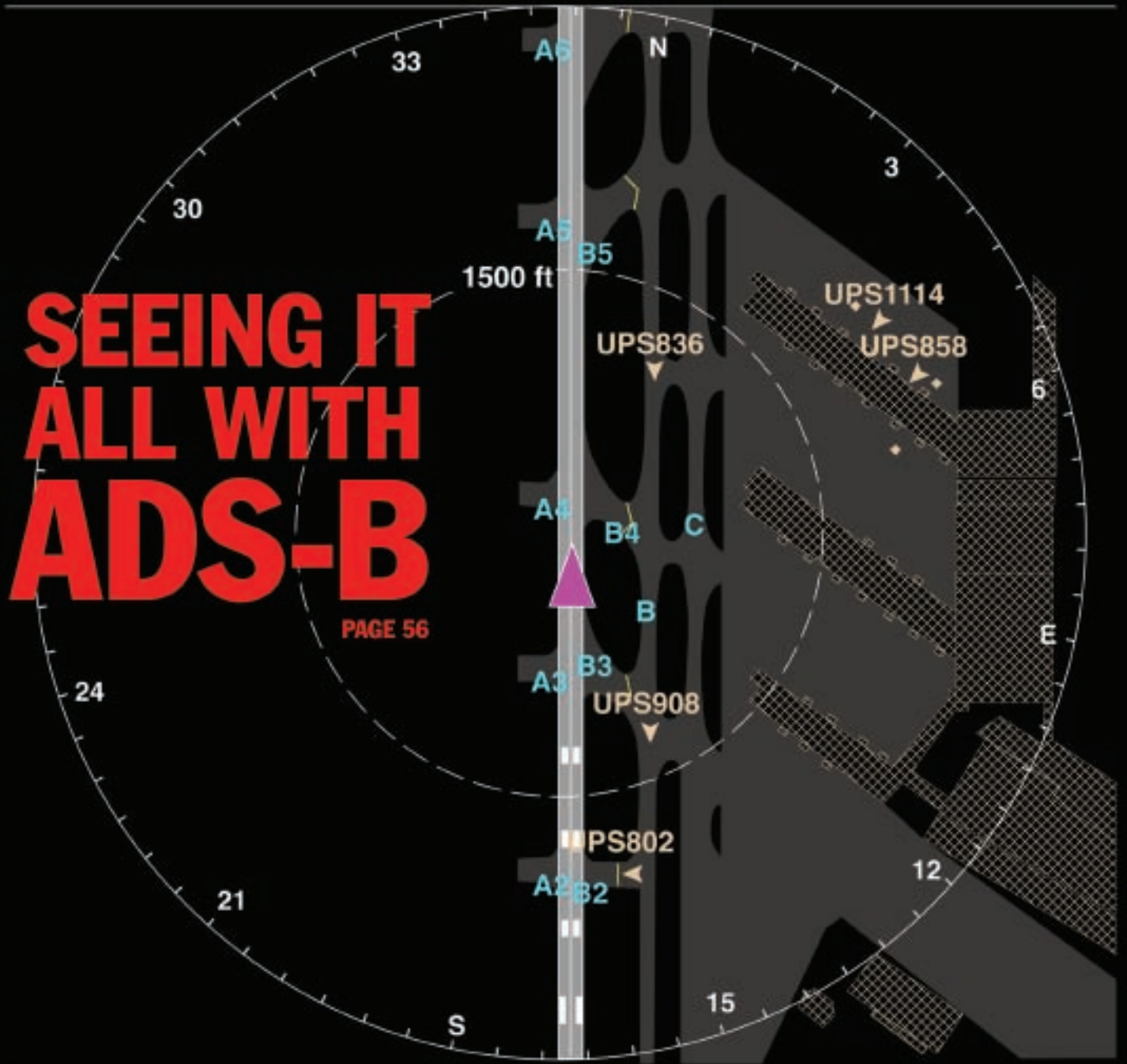
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# SEEING IT ALL WITH ADS-B

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# ACSS Readies ADS-B Software

An L-3/Thales company is helping UPS with merging and spacing, as well as runway safety

DAVID HUGHES/PHOENIX

**A**vionics engineers here are perfecting software that UPS will need to become the first U.S. airline to use ADS-B to streamline arrivals and surface operations at a hub airport.

The SafeRoute software is being developed by Aviation Communication & Surveillance Systems (ACSS), which is designing it to display data on Astronautics Corp. Class 3 electronic flight bag systems. The EFBs will be installed on more than 100 UPS 757s and 767s. These displays will then be used to show pilots the two new ADS-B applications of SafeRoute—merging and spacing procedures for arrivals into the terminal area, and surface area movement management (SAMM) for more efficient and safer ground operations at UPS's WorldPort hub at Louisville (Ky.) International Airport.

ACSS is a joint venture of Thales Avionics, which has a 30% stake, and L-3 Communications, which owns the majority share. Thales of France and its business unit in Australia developed ground-based ADS-B receivers, which will start providing surveillance for all of Australia's upper airspace early next year—including over the outback, where there's no radar coverage. This will be the first nationwide ADS-B system operating in the world.

UPS is poised to start ADS-B merging and spacing as well as SAMM operations at Louisville late next year. An ACSS King Air C90 recently flew a series of test flights at the FAA's William J. Hughes Technical Center in Atlantic City, N.J. An FAA turboprop also was equipped to fly merging and spacing maneuvers with the King Air. ACSS plans to apply for a Supplemental Type Certificate for SafeRoute by next August and hopes to win operational approval for its customer UPS before the end of 2007.

ACSS President Kris Ganase notes that with widespread implementation of ADS-B in the U.S. still a decade away, the UPS initiative is way out in front.

**THE SAFEROUTE SOFTWARE BEING** developed by ACSS (with some of the algorithms originally developed by NASA) will run on the ACSS surveillance processor on each aircraft. This will provide two functions. The merging and spacing display on the EFB and related commands will allow UPS freighters to work in concert to coordinate arrivals at Louisville. More than 100 UPS aircraft congregate each night so packages can be sorted and dispatched all over the U.S. when the same airplanes depart. SAMM will then help freighters on the ground taxi to their assigned gate in the most efficient manner by showing pilots a moving map with all the aircraft and vehicles moving on the airport surface.

SAMM's safety benefit comes from the fact that it works on the ground much as a traffic-alert and collision avoidance sys-



ACSS merging and spacing software commands the pilot (see "own-ship" position at blue triangle) to merge behind UPS 2 at PRINC waypoint (indicated by outline around UPS 2's green icon). However, the aircraft is flying at 272 kt., faster than the 257 kt. commanded by software (note fast-slow indicator lower left).

tem (TCAS) works in the air. Not only will it show "own-ship" position based on GPS, but the location and identification of other aircraft on runways, taxiways and ramps are shown on a moving map based on ADS-B surveillance (see cover). SAMM will also display visual alerts and sound audio alerts to hazardous situations that result from a conflict with another aircraft, according to Cyro A. Stone, chief technologist at ACSS. And SAMM will also be able to show the location of vehicles on the airport surface that are transmitting GPS-derived position fixes.

The God's-eye view of the entire airport gives pilots "eyes in the back of their head." Their aircraft could be lined up on a runway and the pilots glance at the SAMM display to see an aircraft on short final approaching them from behind. UPS pilots note that ADS-B has much better lateral accuracy than TCAS. In fact, TCAS might mistakenly show that an aircraft landing on a parallel runway is a threat when it is not.

UPS's idea is to manage the incoming stream of freighter aircraft from gate to gate. So even before a freighter leaves Los Angeles, for example, software will predict when pushback and takeoff will occur. In addition to the SAMM appli-



SafeRoute software was evaluated at the FAA's Technical Center in Atlantic City, N.J., last month. ACSS pilots Tom Clements (left seat) and Jeff Quackenbush (right seat) fly as flight test engineer Tom Eich adjusts electronic flight bag showing merging and spacing situation in King Air C90.

cation running on the aircraft, the UPS airline operations center (AOC) in Louisville will be running its surface management system (SMS) software to monitor the situation. SMS is based on algorithms developed by NASA and Mitre Corp. Data such as whether the aircraft is in commission (according to maintenance), whether the crew is on board, and how close the aircraft is to being fully loaded will be assessed by SMS.

After pushback, SMS monitors aircraft at the departure

ning will start to pay off. With proper spacing already arranged, it should be possible for UPS pilots at Louisville to fly continuous-descent approaches (CDAs) routinely with power near idle almost all of the way to touchdown. Since most UPS arrivals at Louisville occur between midnight and 2 a.m., this should help local residents get a good night's sleep. Bob Hill, advanced flight systems manager for UPS, notes that a CDA is just a "specialized area navigation [RNAV] arrival" procedure. "We want to stay at cruise altitude longer to burn less fuel and reduce emissions."

CDA tests conducted by UPS at Louisville demonstrated that noise can be cut 30% and engine-exhaust emissions below 3,000 ft. by 34%. The CDAs also saved UPS up to 500 lb. of fuel per approach. That's because the aircraft involved were able to avoid most low-altitude vectoring. Minimizing these maneuvers will also reduce air traffic controller workload, ACSS points out. And there's every expectation that a UPS freighter will reach its gate faster.

In addition, UPS is seeking FAA approval to use the CDTI (cockpit display of traffic information) on the EFB to continue with visual separation rules as visibility deteriorates due to haze, Sun glare or background lights.

The UPS-ACSS project is important to the FAA because it envisions nationwide use of ADS-B for surveillance one day. So the agency has assigned a "tiger team" to meet regularly to make sure all safety and regulatory issues related to the use of ADS-B are addressed. The team is handling preparation of an ADS-B advisory circular, for example. The FAA's



This scenario shows proper in-trail spacing with "own-ship" aircraft (blue triangle) flying behind UPS 2 at 236 kt. compared with commanded IAS of 234 kt. on fast-slow indicator (lower left).

airport and notes which runway is active. SMS will track West Coast departures and start the process of lining up the incoming freighters for arrival at Louisville. The SMS software will issue commands over Acars (aircraft communication addressing and reporting system) for minor speed adjustments as aircraft exit the terminal area, taking into account the arrival fix at Louisville, park-

ing spot, wake category and other expected traffic at the Kentucky airport. The aim is to have the freighters spaced about 15 mi. in trail when they start their descent to Louisville. UPS will begin to phase in ADS-B arrivals by focusing first on the stream of West Coast aircraft arriving late at night. Eventually, airplanes arriving at Louisville from all points of the compass will be involved.

Once the SMS software has handled the strategic positioning of aircraft, the aircraft's SafeRoute merging and spacing software will calculate the tactical navigation solution. The software selects an aircraft to follow and commands a speed change, if necessary. A fast/slow indicator will show whether the pilot should speed up or slow down to achieve the correct spacing.

As the descent begins, the real benefit of all this pre-plan-

aircraft certification office in Los Angeles is monitoring the development of ADS-B avionics to ensure the system complies with all regulations, is properly integrated on the flight deck, and is designed with the correct human-factors considerations. Meanwhile, the FAA's Flight Standards Service is developing operational guidance for new procedures and software, and the Air Traffic Organization is working on procedures for new airspace uses.

These FAA efforts should pave the way for certification guidelines and industry standards that will steer similar airline initiatives in the future. The agency will also make sure that U.S. efforts are harmonized with ADS-B implementation in Europe and Australia. One beneficiary may be ACSS, which is already working with a European airline on the use of SafeRoute software.

While UPS will be the first airline to use SafeRoute at Louisville, the airborne application could be used by other carriers. For example, an airline that dominates one airport could equip all of its aircraft with ADS-B without having to worry about many other carriers. However, at airports with numerous airlines or significant business and general aviation traffic, convincing other operators to install ADS-B avionics could be a challenge. The FAA plans to mandate that all aircraft have ADS-B, but the deadline won't be until about 2018.

Ganase says SafeRoute can be delivered for \$50,000 or less per aircraft. The software is being designed so it can also run on surveillance equipment made by ACSS's competitors. ACSS may offer SAMM-only software or a merging-and-spacing-only package, but pricing has not yet been established.