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November 2013

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American Business Press
BPA Worldwide

BY EMILY FELIZ

Aviation relies on innovation, and innovation is a dynamic and fluid process. And, in this case at least, politics has severely hindered, if not stopped altogether, innovation.

SHUTDOWN

As I write this column in mid-October from my Maryland office, just a stones-throw from our nation's Capitol, the government is shutdown. Closed. Hundreds of thousands of federal workers around the country were told to stay home; others were deemed "essential" and told to come to work, and no one is getting paid.

Many around the country have expressed frustration and outrage with Congress and the White House for their inability to work together and keep the government funded, and operate it under the debt ceiling for that. Aviation groups have expressed similar anger, saying the shutdown cripples a critical part of our nation's economy and severely undermines our air traffic modernization efforts.

It is my hope that by the time this magazine reaches the desks and inboxes of our readership that the shutdown will be over. But the damage to the aviation industry in the United States will have already been done. It's not as simple as flipping a switch to turn the government back "on." It could take weeks or months to get things running again, and even longer to get processes like aircraft certifications, aircraft deliveries, aircraft registry, title transfers, etc., operating at full capacity. Critical infrastructure projects, not the least of which is the multi-billion-dollar NextGen program, which is already behind and overbudget, have already been hit, and the full extent of the damage is not yet known.

"Imagine if no citizen of the United States could buy or sell a car, purchase or re-finance a home, or if the sale of any other critical goods came to a complete and grinding halt. The impact would be devastating. Well, as of this point in time, general aviation, a crucial part of our econo-

my and manufacturing sector, is basically closed for business," Ed Bolen, president and CEO of the National Business Aviation Association (NBAA), wrote in a letter to President Obama on Oct. 7.

Other aviation groups expressed similar dire predictions as a result of the shutdown. "The lifeblood of general aviation manufacturers is their ability to bring new safety-enhancing products to market. The government shutdown will interrupt the flow of innovation, as the hundreds of FAA engineers who oversee and certify general aviation products will be sent home," General Aviation Manufacturers Association (GAMA) President and CEO Pete Bunce said at the start of the shutdown.

My crystal ball is in the shop these days, so I can't say for certain what the post-shutdown aviation industry will look like in this country. But I think all aviation stakeholders can agree that none of those impacts would be good things. Aviation relies on innovation, and innovation is a dynamic and fluid process, constantly moving forward to produce the best solution. And, in this case at least, politics has severely hindered, if not stopped altogether, innovation.

"The longer this shutdown goes on, the greater the long-term damage will be," National Air Traffic Controllers Association (NATCA) said in a statement at the start of the second week of the shutdown. "This has gone on long enough. NATCA joins the millions of Americans who are calling for an end to the shutdown now."

No one benefits from this shutdown, from Congress to the White House to the government workers forced to stay at home to the American (flying) public. It's all bad news. And that holds true for the aviation community as well. That could mean further delays in the already delayed NextGen program, deepening backlogs of avionics and aircraft certifications, more backlogs in aircraft deliveries, and more. The shutdown comes as aviation continues to struggle to recover from economic downturns, fuel price surges and other roadblocks.

I, for one, am hoping that business as usual returns for the aviation industry sooner rather than later. We, as aviation industry stakeholders, can't control what goes on in Washington, of course, but we can do our best to operate within the situation (read: mess) lawmakers have created. avs

FAA CONSIDERS RELAXING PED RULES

FAA's rules regulating the use of personal electronic devices (PED) on commercial aircraft are expected to change by 2014, as a federal advisory panel is expected to release recommendations for easing the regulations.

An Aviation Rulemaking Committee (ARC) consisting of PED manufacturers and trade associations, pilot and flight attendant groups, airline operators and associations and aircraft manufacturers met in late September to complete recommendations to submit to FAA to alter its rules regulating the in-flight use of PEDs. Currently the agency requires passengers to turn off all devices during takeoffs and landings; that rule is likely to be changed to allow the use of Wi-Fi, while still prohibiting sending or receiving emails and text messages below 10,000 feet to prevent interference with critical aircraft systems.

The ARC's recommendations are due later this year for changes that will likely go into effect in 2014. FAA has come under scrutiny over the last year from lawmakers and trade associations that have said its ban on PEDs below 10,000 feet is unjustified, especially with pilots increasingly using tablet devices in the cockpit, and the fact that many passengers never turn off their devices at any time during the flight which has not produced reports of interference. In 2012, FAA updated its guidance for approving airlines to allow pilots to use electronic flight bags (EFB) in the cockpit, requiring that they demonstrate that the device does not interfere with an aircraft's electronic systems.

A study released this year by the Airline Passenger Experience Association and the Consumer Electronics Association found about 30 percent of passengers said they had left a device on during takeoff or landing.

"The FAA recognizes consumers are intensely interested in the use of personal electronics aboard aircraft, and that is why we tasked a government-industry group to examine the safety issues and the feasibility of changing the current restrictions. ... We will wait for the group to finish its work before we determine next steps," FAA said in a statement to Avionics Magazine.

Sen. Claire McCaskill (D-Mo.), who has been critical of FAA's PED policy, in August wrote a letter to FAA Administrator Michael Huerta urging the ARC to finish its recommendations as quickly as possible. The ARC was originally supposed to submit its recommendations in July, but requested more time to further consider technological standards

associated with the use of PEDs during any phase of flight.

"Given the technological advancement of both PEDs and critical air navigation and flight control systems since the rules were put in place, updated protocols for safe use of PEDs on board commercial flights are long overdue," said McCaskill.

Another factor that further complicates the ARC's rulemaking process is airline's mixed fleet of older and new aircraft; older airplanes are more susceptible to interference. Modern passenger aircraft feature digital cockpit displays, fly-by-wire controls and flight management systems that are certified to withstand interference. However, even those aircraft use systems, such as global positioning, traffic collision avoidance and weather tracking that rely on ground or satellite signals that are susceptible to interference from PEDs. When installing Wi-Fi routers for in-cabin use, FAA requires a Supplemental Type Certification (STC) specific to an aircraft's make and model to ensure onboard avionics systems are shielded from potential interference.

Not up for consideration is the use of cell phones during flight because Federal Communications Commissions (FCC) regulations prohibit airborne calls using cell phones.
—Woodrow Bellamy III

COMMERCIAL

Astronics Buys AeroSat

Avionics manufacturer Astronics Corp., in an effort to increase its aircraft electronics business, in October announced its $12 million acquisition of aircraft antenna systems provider AeroSat.

The acquisition will help expand Astronics into the production of fuselage and tail-mounted antenna systems that enable satellite and ground-based communication for commercial and military aircraft. Nashua, N.H.-based AeroSat is currently working on getting several antenna systems certified by FAA for use with Gogo's in-flight connectivity platform.

AeroSat President Dennis Ferguson will continue to run operations for the company.

"We have long been involved in helping aircraft passengers remain productive by powering their electronics devices. Now, with AeroSat, we also provide antenna systems that enable broadband connectivity. We believe AeroSat's capabilities fit in well with our vision for the future," said Peter J. Gunderman, CEO of Astronics.

UNMANNED SYSTEMS

SUAS Standards

FAA has selected Kansas State University Salina to test certification standards for small unmanned aircraft systems (UAS), part of an effort to begin creating industry standards for certifying unmanned systems for commercial applications within the National Airspace System (NAS).

The university signed a memorandum of agreement with FAA on Aug. 29, under which K-State Salina will use its own unmanned aircraft to begin validating

industry standards for small UAS, which are those unmanned aircraft that weigh 55 pounds or less. The standards will help the agency determine the airworthiness of small UAS.

Current unmanned systems industry standards for small UAS were created by ATSM International, formerly known as the American Society for Testing and Materials, a group known for developing international voluntary consensus standards.

"This project is of national importance in that this could well be the first small UAS to obtain an FAA airworthiness certificate for routine operations in our national airspace system here in the lower 48," said Kurt Barnhart, professor and head of the department of aviation and executive director of the university's Applied Aviation Research Center at K-State Salina.

Barnhart said the airworthiness certificate will likely be developed as a "restricted" certification similar to those issued for agricultural aircraft, "meaning that these vehicles would be restricted from operating above certain locations."

The agreement is the first of its kind between FAA and a university, and should help both FAA and the unmanned systems industry to determine how standards for small UAS need to be further developed.

"Successful certification of a small unmanned aircraft system using the F38 standards as a certification basis would be a giant step toward commercial use of unmanned aircraft in the national airspace system," said Mark Blanks, unmanned aircraft systems program manager at K-State Salina.

—Woodrow Bellamy III

CONTRACTS

➤ FAA has placed its first production order for new air traffic control (ATC) radios that feature Voice over Internet Protocol (VoIP), as the agency prepares to replace its legacy analog radios.

The $25 million order was placed with **General Dynamics C4 Systems**, the company which produces the CM-300/350 UHF and VHF air traffic radios and training materials. This is the first production order for the radios following a $10 million initial award issued to General Dynamics in April 2012 as part of the FAA's Next Generation Air-Ground Communications Segment 2 program.

The NEXCOM program is the agency's initiative to replace its analog air traffic communications system with a Very High Frequency (VHF) Digital Link Mode 3 (VDL3) system that provides increased channel capacity with the capability to transmit both voice and data communications.

In September, FAA completed the first phase of testing for the new ATC radios, and began the second phase of testing, placing 90 of the CM 300/350 radios in air traffic facilities located in New Jersey, Florida and Oklahoma to evaluate the performance of the radios within live operational environments.

➤ The Brazilian Air Force fleet of in-service A1M fighter jets and E-99 AEW surveillance aircraft will be retrofitted with new Identification Friend or Foe (IFF) transponder upgrades from Thales.

Embraer selected **Thales** to supply its TSC 2030 and TSC 2050 transponders to

a total of 48 aircraft operated by the Brazilian Air Force.

IFF transponders provide an identification capability compliant with secure identification modes used by NATO forces, including Modes 4 and 5.

➤ The U.S. Army is upgrading its fleet of RQ-11B Raven unmanned aircraft systems (UAS) through a new $20 million order for Mantis i23 gimbaled sensor payloads from **AeroVironment**.

The Mantis i23 upgrade will allow the Army's Raven operators to pan, tilt and zoom with uninterrupted video imagery for reconnaissance, surveillance and target acquisition missions. Delivery of the new payload enhanced Ravens aircraft is scheduled within 12 months, according to AeroVironment.

Most Raven systems used by the Army consist of three aircraft, two ground control stations and spares, which are typically used to provide "over the hill" reconnaissance for tactical units.

➤ **General Dynamics** (GD) has received a $12 million task order from FAA to provide support to the agency's NextGen Integration and Evaluation Capability (NIEC) under the System Engineering 2020 program.

The System Engineering 2020 program is a 10-year contract award issued to GD in 2010 for NextGen research, with a potential value of $1.2 billion if all options are exercised. Funding is provided through individual task orders, such as the $12 million award issued to GD, to provide engineering, operations, software design and development, infrastructure and administrative support to NIEC's laboratory located at the William J. Hughes Technical Center at the Atlantic City (N.J.) International Airport.

The General Dynamics team for the System Engineering 2020 program includes Gulfstream and Jet Aviation.

In addition to the latest task order, the General Dynamics team has been tasked with performing mission-analysis for air traffic management automation, avionics systems operations and maintenance and cost-benefit analysis.

➤ **CAE** announced new orders for its full-flight simulators and flight training devices, totaling $48 million, from operators and airlines in Africa and China.

The Canadian manufacturer will provide a Boeing 787 simulator for Ethiopian Airlines, a Sikorsky S-92 simulator for the Zhuhai Flight Training Center in China and and two other simulators to an undisclosed African operators.

➤ **Lockheed Martin** secured Department of Defense (DoD) contracts totaling $165.7 million to provide radar systems and mission avionics for a fleet of U.S. and foreign military MH-60R Sikorsky Seahawk helicopters.

Lockheed Martin won a $98.4 million firm-fixed-price indefinite-delivery contract to supply up to 50 AN/APS-153(V)1 automatic radar periscope multimode radar kits for the U.S. Navy's fleet of MH-60Rs. Delivery is expected in 2016.

Separately, Lockheed was awarded a $67.3 million contract to supply common cockpits and mission avionics for the Danish military fleet of nine MH-60Rs. The contract was distributed under the foreign military sales program, with delivery by 2018. avs

Human in Avi

Photo courtesy Thales

Photo courtesy Honeywell

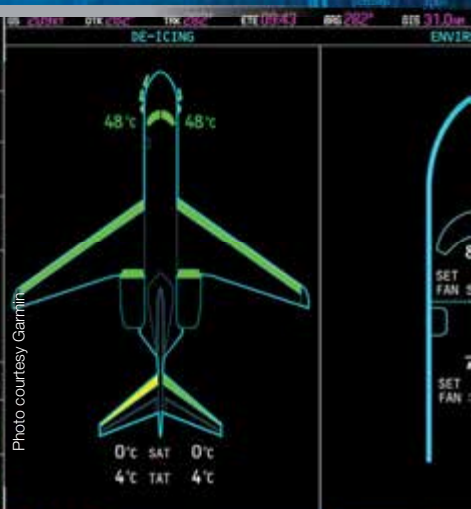

Photo courtesy Garmin

Factors onics Design

Analyzing the interaction of the operators with the avionics systems is increasingly becoming a part of cockpit system design and development

By Charlotte Adams

Human factors engineering applies our understanding of the abilities and limitations of the human mind to the design of aircraft cockpits by studying the interaction of the pilot's mind with proposed avionics systems rather than focusing on the avionics alone.

Human factors engineering teaches that human machine interfaces (HMI) should be as intuitive and natural, as simple and direct as possible. And human factors considerations are becoming more and more central to the overall design process. "The only way forward is by re-centering the [cockpit] design around the pilot's need, using cognitive engineering," says Sylvain Hourlier, Thales' human factors senior expert and design authority.

Basic tenets of human factors, from an avionics perspective, include being intuitive in order to simplify tasks and reduce pilot workload, says Bill Stone, Garmin's senior business development manager. "The ultimate goal would be to eliminate the reliance upon memory and memorization," he says.

Thus, despite all the magic of computers, a simple button or knob is sometimes the best solution. For setting barometric pressure or adjusting the heading, "there's really no better human factors than the rotational knob," Stone says.

Rockwell Collins stresses the understanding of the pilot's "mental model" of the system — his understanding of how the system is organized, how it works. This view may be complete or incomplete — a pilot may not need to know all the engineering details of a system in order to fly the plane. But in designing avionics, it's important to understand cognitive limitations because these impact attention, workload and decision making on the flight deck, says Debbie Richardson, principal systems engineer, commercial systems avionics, at Rockwell Collins.

Two of the criteria Honeywell uses to evaluate proposed innovations are operational

benefit and usability, says Ken Snodgrass, Honeywell's vice president of integrated cockpits. Why (unless a change is mandated) should you add something new to the cockpit unless it buys the user tangible benefits such as lower minimums or entry into new airports? And even if it's beneficial, why add something that isn't usable?

A Little History

Before the human factors vogue cockpits had many dials, each with a single piece of information. The Concorde took this trend to an extreme, requiring four pairs of eyes to monitor all the gauges, Hourlier recalls.

However, there were six main dials in most older aircraft — the "six pack" of so-called steam gauges by which the pilot flew the airplane. When the industry first went to glass cockpits, all it really did was put the same steam gauges on glass, Snodgrass says. But it was still natural to the pilots because that's exactly how they had been trained.

One breakthrough spearheaded by Honeywell was the development of "windows" in the cockpit, Snodgrass says. By this he explains that, instead of having one big display like a television, you could split it up and present different things at the same time, such as the map function and a checklist. The pilot and the copilot could have different presentations.

Another Honeywell breakthrough with Primus Epic was graphical flight planning, Snodgrass says. The company added a mouse — a cursor control device — so that instead of punching a lot of buttons on the multifunction control display unit (MCDU) and trying to put different position information on the display, you could click on a spot and insert a waypoint or a holding pattern. You can click on an airport and get the frequencies and runway information, he says.

Growing Complexity

As avionics evolved, more information became available and was consolidated, which increased complexity, Richardson says. Thus some information is less visible, so that pilots have to dig for it, she explains. "Depending on [the nature of] the function, we'll try not to bury things. Anything we can put on the top level, we will put on the top level." Controls are prioritized, so that the most critical or most frequently used ones are put at a higher level, she adds. And no more than three menu steps or layers are required, adds Derek Jensen, senior engineering manager, Pro Line Fusion human factors, at Rockwell Collins.

Honeywell asks the question in a different way. How many button pushes away is a function? Honeywell

Rockwell Collins is developing is a touch-sensitive primary flight display (PFD) for Pro Line Fusion.

Photo courtesy Rockwell Collins

design teams use a structured evaluation process called the functional allocation matrix. Engineers and designers consider how information should be presented to the pilot in the event of hydraulic failure, for example. They look at what needs to be up in front of the pilot, what needs to be one button push away, or what could be five button pushes away, Snodgrass explains.

At the higher reaches of complexity is the ubiquitous MCDU. This important device, which interfaces the pilot to the flight management system (FMS) and other systems, requires typing a lot of data on a small keyboard and viewing data on a relatively small screen. But that's not the biggest challenge, according to an industry paper on the device. The researchers pointed to pilots' need to reformulate certain tasks before keying them into the device — increasing workload — and pilots' overreliance on memory to operate the MCDU.

Introduced as the CDU, it started life performing a single function—as the interface to the FMS. But as more functions were added to the flight deck, there wasn't room for more controllers so the CDU became the MCDU. That's where the problem of "mode confusion" comes in, Stone says.

The complexity of inputting information through the MCDU prompted a search for a more intuitive interface. The next step appears to be touch-sensitive displays.

Touchscreens

In its new G5000 cockpit, Garmin solves the problem of the difficult MCDU interface with touch screens. The company is the first to use this type of interface on the flight deck, Stone says. Not only has it added touch screens, it has taken off the MCDUs. And the touch screen is used not only to interface with the FMS but also to manipulate and control other systems such as environmental, fuel, ice protection, hydraulics and brakes, Stone says. The first aircraft had not yet been certified at the time of this writing but was expected in the near future.

The touch-sensitivity feature was located on pedestal displays rather than on the main displays. This was a matter of deliberate choice involving human factors. It would be difficult for a pilot to stretch out his arm to a multifunction display (MFD) and perform precise muscle movements with his finger to operate a touchscreen, especially in turbulence. "We believe that's actually poor human factors," Stone says. The pedestal is closer to the pilot's body, so the touchscreen is less challenging to operate. And it's easy to brace one's hand against the pedestal if there's turbulence.

Touch control plays to human strengths, as "we're optically centered beings," Stone says. "If I have to abstract and try to remember that I have to go to page 4 and menu item 7, it requires memorization, and that increases workload."

When things become busy and the pilot needs to focus on high-priority tasks, the ability to think through and remember things becomes diminished, Stone explains. But "optical cognition still remains razor-focused," he says. "When you look at an icon, you are able to cognitively understand [it]; you don't have to do translation." That's why

Garmin thinks the touch screen is a pretty superior user interface, he says. It's an array of virtual buttons.

Honeywell, Rockwell Collins and Thales are also looking at touchscreens. Honeywell expects to have a touch-sensitive general aviation navcom system, the KSN770, out in a couple months, Snodgrass says. It will be a pedestal-mounted system with both hard buttons and touch sensitivity.

Rockwell Collins is developing is a touch-sensitive primary flight display (PFD) for Pro Line Fusion, another first. As part of its research on the project, the company measured the time pilots took to do some simple procedures, such as changing a heading or selecting something on the PFD, Jensen says. It found that it was almost 50 percent faster to perform these operations by touch than by the normal way of entering data into a control panel. The reason is that you're entering data directly on the display rather than indirectly through another device, Richardson says.

Rockwell Collins is still developing the touchscreen feature, but a company presentation on YouTube shows how a pilot could change altitude, speed and heading settings at the touch of a finger. Such a feature also promises to reduce avionics size, weight, power and cost. The company expects the touch-sensitive PFD to appear first as a retrofit on King Air.

Nevertheless, touch is not it the only way of manipulating information on the avionics, Richardson says. "We still have traditional knobs, cursor control and button presses."

There are many things to consider with touch screens, Snodgrass says. Uncommanded operation is a key concern. It is possible that touch screens could increase confusion because they are software-driven and easier to activate than fixed and rigid knobs and buttons.

Synthetic Vision

Synthetic vision is another example of human factors that make sense from both operational benefit and usability perspectives. Honeywell has been doing a lot of flight testing and data collection to try to prove to FAA that synthetic vision can provide better accuracy in landing that a head-up display (HUD) would give you.

The company has done some 350 approaches and landings in a real airplane, alternating the use of the HUD and the synthetic vision display. The HUD is limited in that it gives you information that is right in front of the nose of the aircraft, Snodgrass explains. If you're heading for the airport but you're in a crosswind, the HUD may be looking off to the side — not at the runway. If you can get equivalent safety without another large and expensive addition to the airplane and can get operational benefit similar or better than a HUD, why not go with synthetic vision? Also the synthetic vision display is so realistic that the heads-down and heads-up views are almost identical, Snodgrass says, so that the transition is rapid. Honeywell is also engaged with FAA to obtain lower minimums for aircraft equipped with synthetic vision. avs

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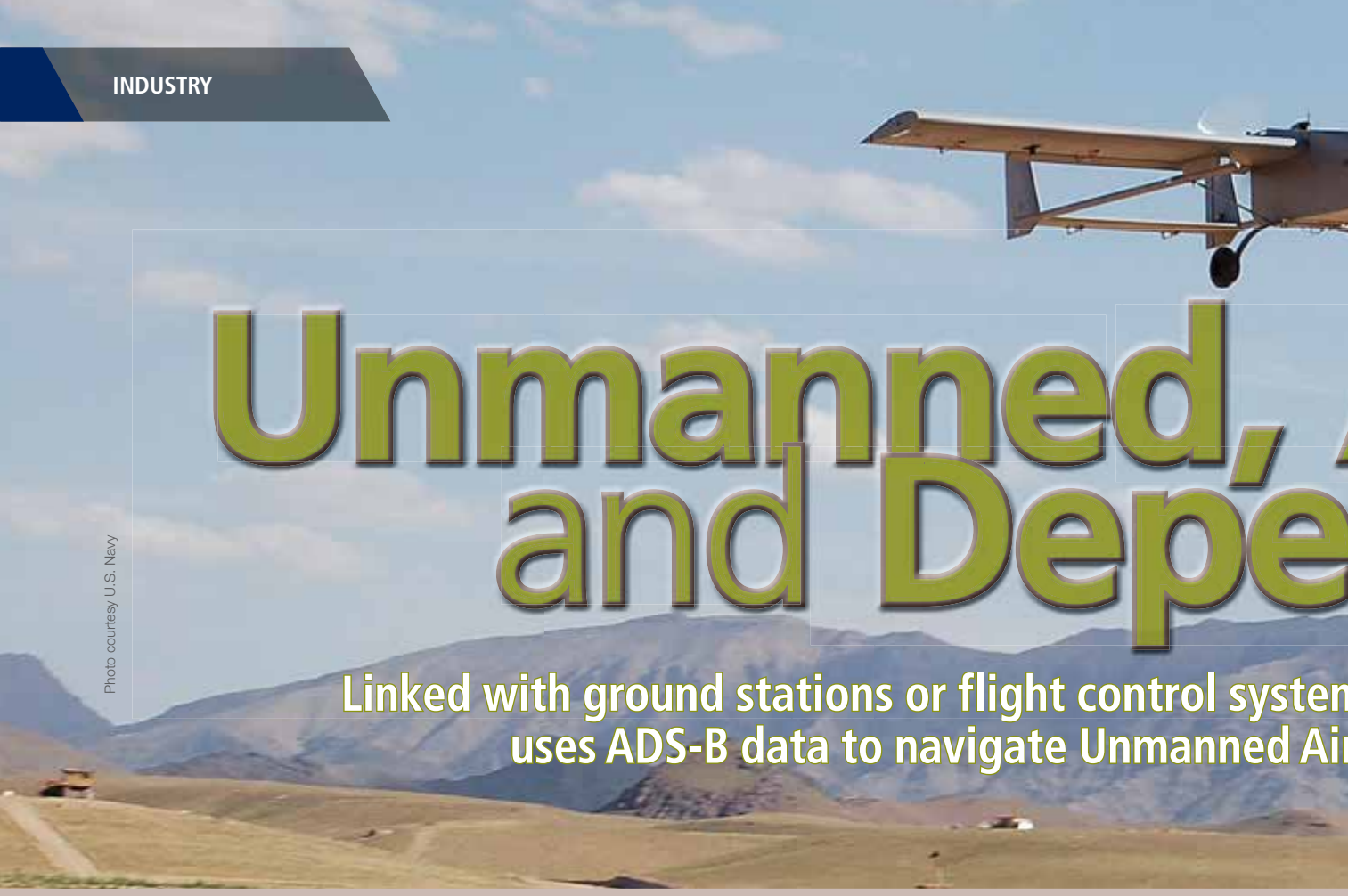


Unmanned, A and Depe

Photo courtesy U.S. Navy

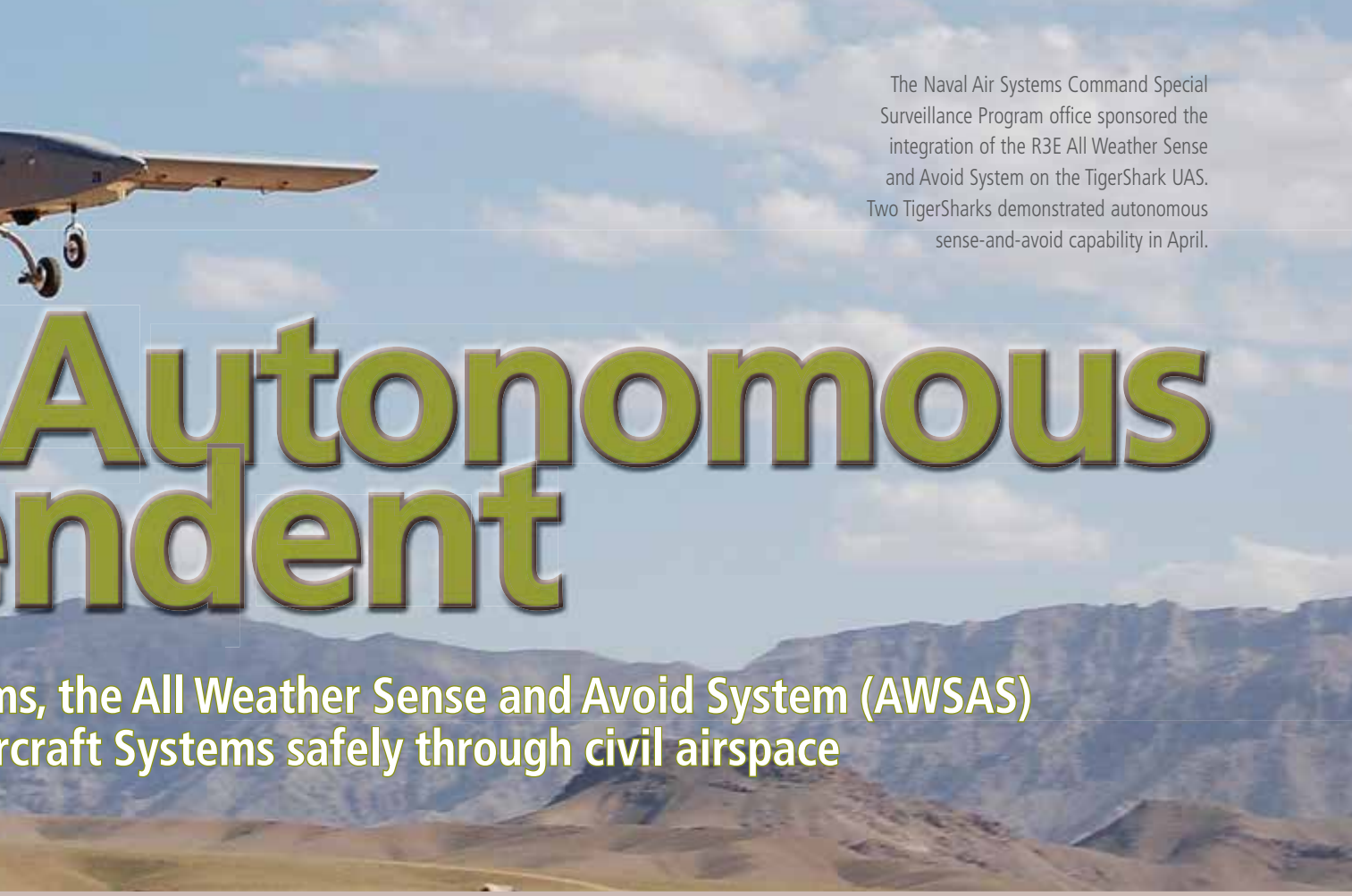
Linked with ground stations or flight control systen uses ADS-B data to navigate Unmanned Ai

by Frank Colucci

Automatic Dependent Surveillance–Broadcast (ADS-B) technology central to NextGen airspace management can enable Unmanned Aircraft Systems (UAS) to cue their ground operators or alter their own flight paths to avoid collisions. In April, the All Weather Sense and Avoid System (AWSAS) developed by R3 Engineering (R3E), of Lusby, Md., used ADS-B data to steer one Navy TigerShark UAS away from another over the Yuma Proving Ground in Arizona without operator intervention. The Naval Air Weapons Center Aircraft Division at Patuxent River, Md., plans a follow-on Cooperative Research and Engineering Development Agreement (CRADA) with R3E to further explore the benefits of AWSAS and re-broadcasting fused information via ADS-B links.

"The going-forward plan is to integrate radar target data into the computer that is in the box so that we can have non-cooperative or non-participating target data and avoid them the same as an ADS-B target," said R3E Chief Technology Officer Richard Healing.

FAA will mandate ADS-B Out on most aircraft by 2020 to broadcast on-board information every second including altitude, aircraft number, and vertical air speed, and horizontal and vertical velocity relative to the ground. The GPS-accurate data will be used by ground controllers, and by other aircraft with ADS-B In capability — either through 978 MHz Universal Access Transceivers (UAT) on aircraft below



The Naval Air Systems Command Special Surveillance Program office sponsored the integration of the R3E All Weather Sense and Avoid System on the TigerShark UAS. Two TigerSharks demonstrated autonomous sense-and-avoid capability in April.

Autonomous endent

ms, the All Weather Sense and Avoid System (AWSAS) rcraft Systems safely through civil airspace

18,000 ft or 1090ES MHz transponders above. On an unmanned platform, AWSAS collects three incoming ADS-B messages from the other aircraft to determine target track and define a protected zone shaped like a hockey puck. "The protected zone around that aircraft is determined by what it's doing," said Healing. "The zone around our aircraft is determined by what our aircraft is doing. The idea is not to let those two hockey pucks touch each other."

The AWSAS demonstration computer tracks 24 simultaneous contacts. Avoidance algorithms divide each calculated conflict into two sequences. The first early-detection sequence tells a Ground Control Station (GCS) pilot what he needs to do to avoid the traffic. If the pilot commands the wrong maneuver or ignores the guidance, the second sequence commands the UAS autopilot directly to fly its own avoidance maneuver. In the Yuma demonstration, AWSAS waited 70 seconds to initiate the autonomous maneuver. "Up until that point, the system would tell the pilot on the ground to turn left or right," says Healing. "The pilots never really give up control ... The pilot can always override a maneuver initiated by the system."

The AWSAS computer chooses from a library of separation maneuvers to avoid conflicting traffic without steering into new conflicts. R3 engineers programmed maneuvers tailored to different UAS missions. A 360-degree turn, for example, resolves the calculated conflict and returns a notional surveillance aircraft to its ground track. "You still need to come back and do 100 percent coverage," said

GA-ASI demonstrated ADS-B on a U.S. Customs and Border Protection Guardian UAS in 2012. A follow-on demonstration with FAA will integrate ADS-B with Due Regard Radar and TCAS.

Healing. "You pick up the trail where you left it."

Depending on programmed preferences, AWSAS could alternatively slow the unmanned aircraft down or speed it up, or turn left or right and later rejoin the flight path to its destination. Unlike the climb-or-descend advisories generated by the Traffic Alert and Collision Avoidance System (TCAS II), AWAS maneuvers avoid altitude changes. "They involve using gas," notes Healing. "In addition to the separation of two aircraft, we want to keep the cost to a minimum."

With Due Regard

The ability to navigate unmanned aircraft through civil airspace shared with manned traffic has powerful implications for current government and potential commercial UAS users. Last year, General Atomics Aeronautical Systems Inc. (GA-ASI) and U.S. Customs and Border Protection flew a Guardian UAS with a BAE AN/DPX-7 IFF transponder including ADS-B In/Out capability plus standard transponder modes. ADS-B-Out performance was verified by the FAA Technical Center in Atlantic City, N.J. The same test demonstrated ADS-B In capability when 1090ES data was received by the transponder and re-sent to the ground station. The test did not include any encounters with cooperating ADS-B aircraft.

Since the 2012 flight tests, GA-ASI has made ADS-B

capability part of the Guardian's operational flight code. GA-ASI and FAA plan to fly a proof-of-concept Sense And Avoid (SAA) system next year on a Predator B integrating ADS-B 1090ES In/Out, a Due Regard Radar, and TCAS to verify ADS-B targets. "There is still a lot of work to do in order to say for sure what will be required for SAA, but I believe everyone in the community agrees that ADS-B will play a major role," GA-ASI engineer Brandon Suarez acknowledges. "Even after 2020 when ADS-B-Out will be mandated in certain classes of airspace, there will be many airspace users that will not be equipped, and if a UAS wants to fly in those areas, it will need a way to detect those non-ADS-B aircraft."

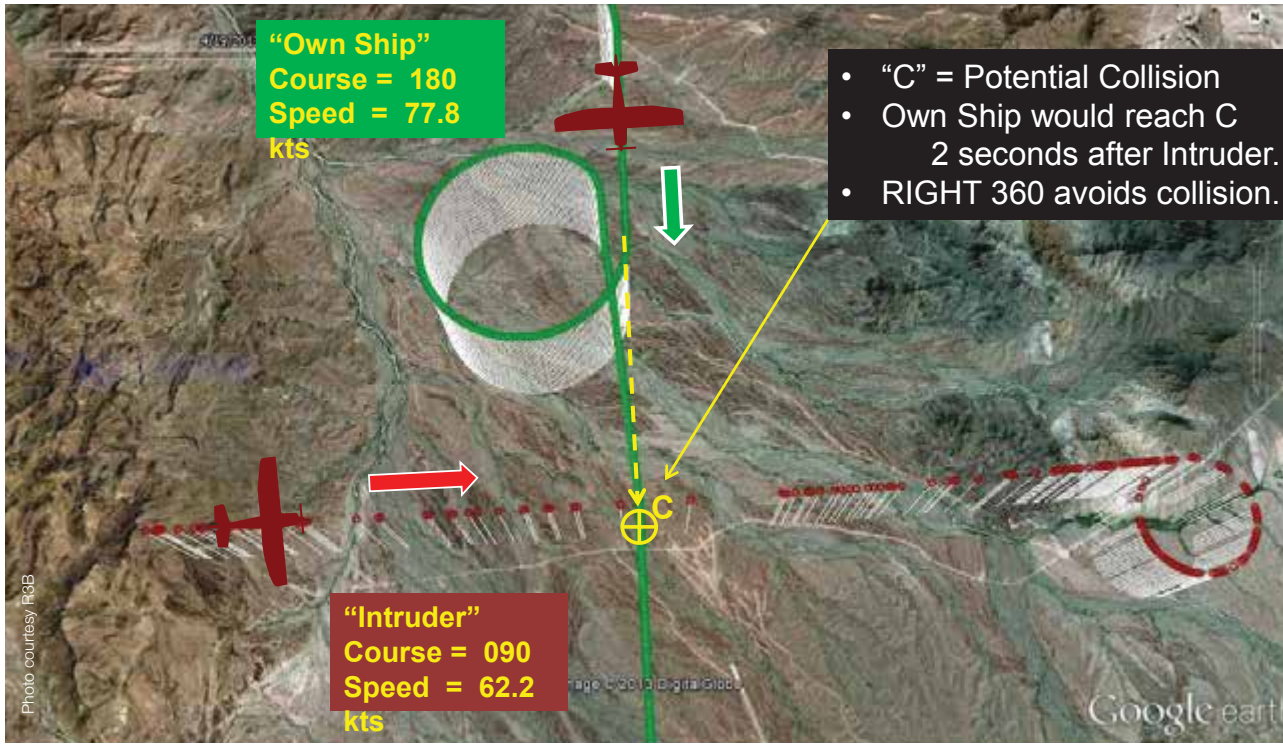
FAA acknowledges ADS-B may be useful to send and receive some of the surveillance information that a UAS could use to avoid collisions with other aircraft. However, FAA also cautions ADS-B alone is not likely to be sufficient. RTCA Special Committee 228 is developing minimum performance standards for Detect and Avoid systems and will consider the use of ADS-B. Separate from ADS-B functionality is the need to develop airworthiness standards that will allow Unmanned Aircraft Systems to earn standard Type Certificates and airworthiness certificates. In addition, FAA says current operating rules must be analyzed and updated to ensure UAS operations are predictable for air traffic controllers and other operators in U.S. National

Airspace. Once updated, ADS-B rules and certification requirements will apply equally to manned and unmanned aircraft. Integration of the optional ADS-B In technology on the UAS would also give GCS operators the same weather and traffic information available to pilots of manned aircraft.

ADS-B and TCAS already provide Due Regard layers of protection on the big Navy MQ-4C Triton UAS, cuing the Air Vehicle Operator to maintain safe separation from civil aircraft. According to the Naval Air Systems Command, the current Triton does not include automated avoidance capability, but the system architecture is designed for growth. The Navy canceled the planned Triton Due Regard radar and is talking to Northrop Grumman about alternative SAA solutions. In contrast to the 32,000-pound MQ-4C, most Unmanned Air Vehicles impose tighter space, weight and power constraints than manned aircraft. The miniaturized AWSAS is designed for Department of Defense Group 2 and larger Unmanned Aircraft Systems. NAVAIR reports there are currently no funded plans to integrate ADS-B in the Navy's Small Tactical UAS or the FireScout unmanned helicopter.

In 2009, the Office of Naval Research and the Defense Safety Oversight Council awarded an AWSAS development contract to R3 Engineering. R3E is a technology development company and called upon Appareo Systems in Fargo, N. D., to build AWSAS hardware.

"It was our design team that put the design together," recalls Healing. "We put



The AWSAS Collision Avoidance Maneuver puts the "avoider" in a 360-degree level turn to interrupt the timing of an calculated collision and return the aircraft to its original flight path.

'There is still a lot of work to do in order to say for sure what will be required for SAA, but I believe everyone in the community agrees that ADS-B will play a major role.'

Brandon Suarez, GA-ASI engineer

some software in and began downloading data." In 2011, R3E began AWSAS tests in Florence, Ariz., on a large radio-controlled aircraft without an autopilot. "What we were doing their was testing our ability to send and receive a correct ADS-B signal from other aircraft."

Follow-on AWSAS tests on a Piper Seminole from the University of North Dakota showed the dual-band AWSAS could identify 15 to 20 aircraft in the area.

"The ADS-B message is very robust; it has lots of information on it," notes Healing. The AWSAS box weighs less than 1 pound but records its own position, altitude, and courses, and data from other contacts. All information can be downloaded for analysis. AWSAS also stores terrain data; locations of wires, towers and tall buildings; and virtual obstacles including no-fly zones. Initial avoidance maneuver tests with AWSAS in Newfoundland on a research UAS in 2012 showed the system could command an autopilot to change flight path.

Shark Repellent

The Naval Air Systems Command (NAVAIR) tasked R3E to integrate the system on the Group 3 TigerShark UAS made by Navmar Applied Sciences Corp. in Warminster, Pa. The NAVAIR Special Surveillance Program office rushed the 400-pound Tiger Shark to combat theaters in 2006, and later versions continue to fly in Afghanistan. Initial AWSAS tests on the TigerShark in 2012 confirmed the sense-and-avoid box could command avoidance maneuvers through the Piccolo autopilot. The Piccolo from Cloud Cap Technology in Hood River, Ore., (now part of UTC Aerospace Systems) is used on a range of unmanned aircraft and designed to interface with UAS payloads and other external devices.

Tests with two TigerSharks at Yuma Proving Ground in December 2012 began with the AWSAS "avoider" aircraft on the ground towed up and down the runway while the ADS-B-Out "intruder" flew overhead at various intersecting angles transmitting on 978 MHz. The Piccolo autopilot in the ground aircraft deflected control surfaces to show how it would respond to an ADS-B participating target on a collision course.

TigerShark GCS operators quickly learned to fly intercept profiles in simulations, but real collision courses posed unacceptable risks to the expensive unmanned aircraft. "Pilots normally fly them like Golden Eggs," said Healing. "We were asking these guys to put these two different aircraft into a deliberate intersection point

at same time." He explains, "Tests in the air were very effective, but for safety and sanity, we maintained 1,000 feet vertical separation."

The two UAS pilots programmed courses, speeds and altitudes, then hand-flew their TigerSharks to starting point tracks. Once the test pilots initiated their programs, the TigerShark autopilots flew the programmed paths. With the altitude component of the track disabled, the AWSAS "avoider" calculated an impending collision and warned the operator 70 seconds from intersection. Without pilot intervention, AWSAS triggered a 2- or 3-minute circular turn left or right to let the conflict traffic pass and returned the "avoider" to the turn starting point. Five days of successful tests included 140 intersections, including one instance where the "avoider" pilot, doubting the autopilot, seized control of the maneuvering aircraft and proved GCS operators still had complete authority over their UAS.

Subject to Navy approval, NAVAIR reports the follow-on CRADA will integrate AWSAS into the NAWCAD AIR-5.4 Unmanned Aircraft System Integration Lab (UASIL) at Patuxent River. The UASIL simulator environment can be stimulated by either live or recorded flight tracks supplied by the Atlantic Test Range. The Range Data Distribution System will tap highly accurate radars and other sensors to provide virtual non-cooperative targets in simulated airspace.

Ground-Based Sense And Avoid (GBSAA) simulations would lead to test flights with AWSAS on a piloted aircraft likely in 2014. The test system fusing ADS-B and GBSAA data would generate avoidance recommendations to be followed or disregarded by the pilot. Manned test flights could lead to an SAA sensor integrated with AWSAS on an unmanned aircraft. Radar is a more appealing ADS-B adjunct than infrared or electro-optical sensors. "This is basically good in almost all weather conditions that are flyable," said Healing. "We are ordering a small radar to be installed on a TigerShark UAV. Actually, it's a real, cool idea because the radar is quite small and lightweight — the whole weight of the system is about 10 pounds. If we can successfully detect and track non-cooperative targets, whatever they may be, we can translate the radar output into ADS-B format." He adds, "ADS-B is going to make a difference. There are efforts underway to make sure that we are not vulnerable to spoofing the GPS."

R3E designed AWSAS with an open architecture and can provide Interface Control Documents to tie the system to different unmanned platforms, autopilots, and avoidance software. Around 30 systems are being tested by NAVAIR, the ONR, and Memorial University of Newfoundland. "The idea is if this becomes a certified design or capability, we'd license it to others to use it," says Healing. avs

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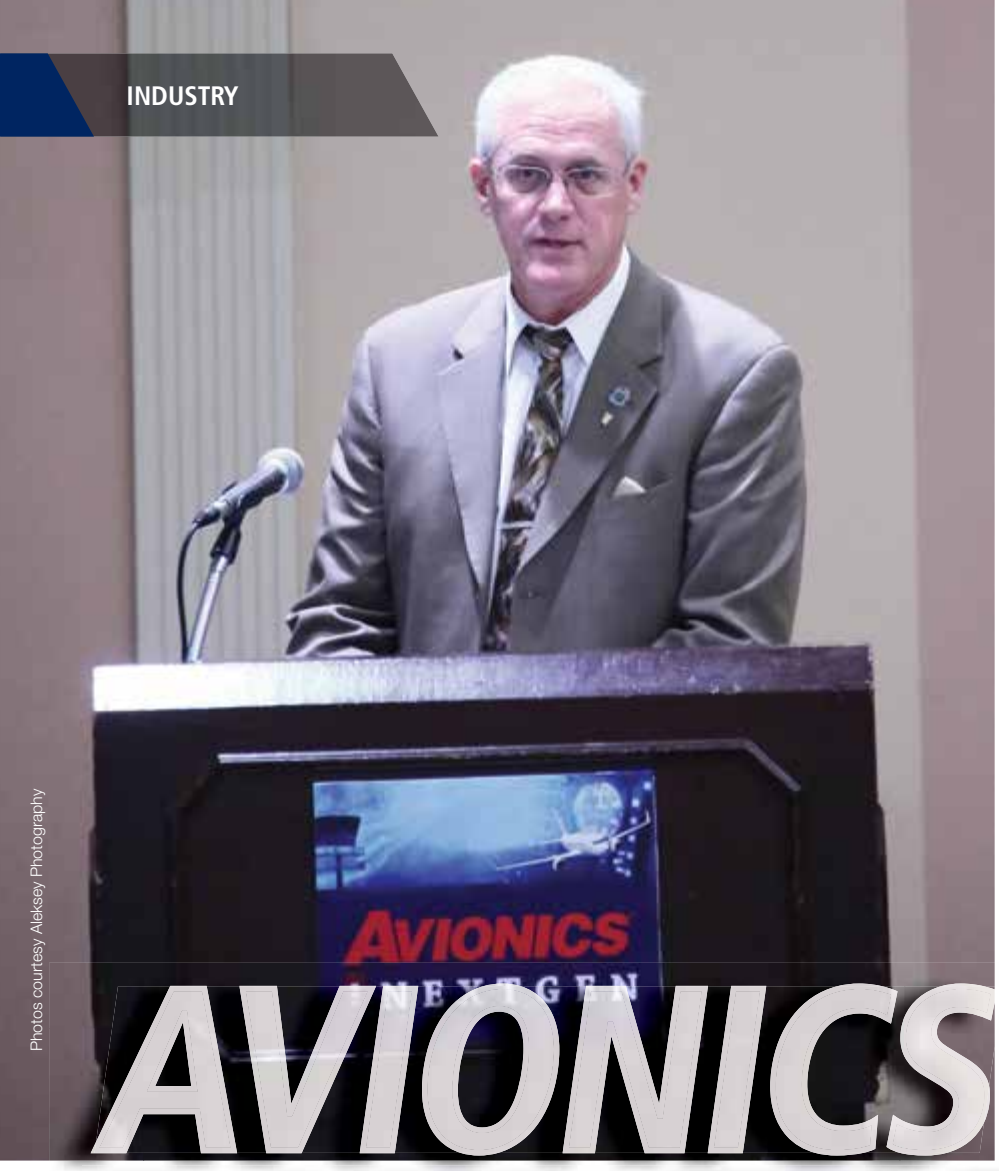
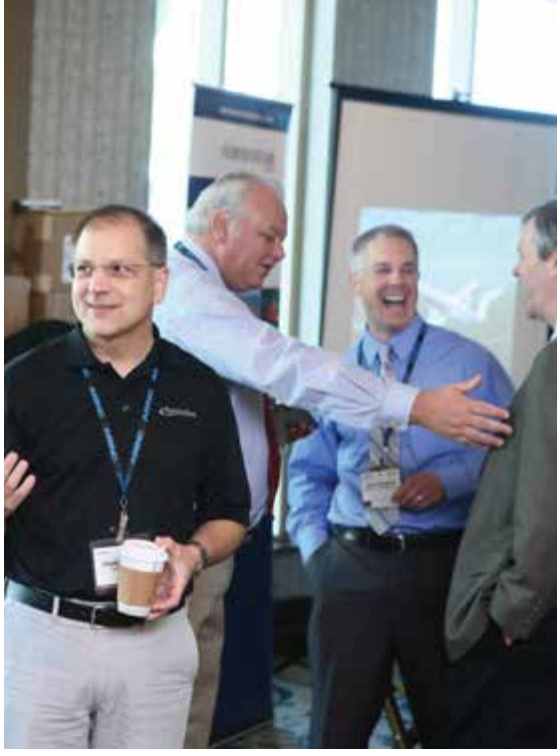


Photos courtesy Aleksey Photography

AVIONICS for NEXTGEN

Avionics OEMs, regulators and international operators discuss equipment mandates, business cases and benefits at annual event

By Emily Feliz



Hundreds of aviation professionals gathered in Atlantic City, N.J., in September to hear about NextGen technologies, implementation and challenges at Avionics Magazine's third annual Avionics for NextGen conference.

Congressman Frank LoBiondo (R-N.J.), chairman of the House subcommittee on aviation, kicked off the conference, saying the industry has made a lot of progress on NextGen, but faces many challenges ahead, not the least of which is sequestration and other budgetary challenges, and bipartisanship in the Congress. "We're not building runways. We have to find a way to be more efficient. NextGen is essential, and it's critical that we find a way to move forward," he said.

In the United States, with the 2020 automatic dependent surveillance-broadcast (ADS-B) Out mandate looming, avionics manufacturers, installers and operators are working to get systems developed, certified and installed, which is an enormous challenge, conference panelists said. International mandates, including one in Australia at the end of 2013 and in Europe in 2015, further complicate the equipage picture for operators.

Other challenges faced by operators include mixed fleet equipage, training, varying

technical specifications and mandate timeline slips.

Capt. Brian Will, director of airspace modernization and advanced technologies at American Airlines, said return on the investment of the equipment and training is a key piece of the NextGen puzzle. And the delayed use of purchased capabilities is expensive.

"When you put all this stuff on the airplane and you don't get to use it, and see the benefits we're hearing about, then it is costing us something. … The longer it takes to get these things accomplished, it is costing us up here real money, every day," said Will.

United Airlines, JetBlue, American Airlines and Delta Air Lines, who were represented on the Airline Roundtable panel at the conference, have all participated in various NextGen trials, and reiterated their commitment to this multi-billion project. JetBlue, for example, said in 2012 it installed ADS-B Out on 35 of its A320s; and in April 2013, completed its first installation of ADS-B In. Additionaly, Delta Airlines launched a program to upgrade its MD80s with NextGen-capable avionics. American Airlines has earmarked about $3 billion, not counting new aircraft purchases, for NextGen fleet renewal.

"It's not just about JetBlue; it's about the airspace itself. If we can move more aircraft through the airspace that benefits everyone," said Capt. Bill Allen, director of operations at JetBlue Airways.

But all the panelists agreed it is now time to move beyond the trial phase of programs and enter the deployment and implementation phase.

"Delta is committed to NextGen. We've committed vast amounts of resources to it. We believe in it," said Chip Beall, technical pilot at Delta Airlines. He further suggested changing the idea of "best equipped, best served" to "best operationally capable, best served."

NextGen for GA

The business case for operators is still a tenuous one; airlines face stringent return-on-investment scenarios from their chief financial officers, and general aviation operators still see 2020 as a long way off and are putting off their equipage plans. However, in both the air transport and general aviation cases, the industry needs do a better job of more clearly outlining the business case and the equipment standards needed for operators, according to conference panelists.

"Equipment and equipage and taking advantage of the capabilities that that equipment offers is certainly at the forefront of the operating community's mind, especially the general aviation community," said Heidi Williams, vice president of Air Traffic Services and Modernization, Aircraft Owners and Pilots Association (AOPA).

General aviation operators are approaching NextGen equipage with a different focus than their air transport counterparts. Specific components of NextGen, namely ADS-B, wide area augmentation system (WAAS) GPS and weather in the cockpit, are particularly applicable to general aviation operators, according to speakers on the panel, NextGen for General Aviation: What Equipage Looks like for the Private Operator. In fact, NextGen is not

the impetus for many equipment upgrades in this space, according to John Uczekaj, president and CEO of Aspen Avionics — it's cost and safety.

"What's interesting about our end of the market is that it's not really about return on investment; it's not about anything other than what is it going to do for my airplane. The big thing for the people in our market is what do I need as the bare minimum, and that's ADS-B Out and that you can get with a transponder upgrade in many cases," said Uczekaj.

There are still many questions about what exact equipment is required, what mandates are applicable, and what benefits will that equipment yield, specifically in the GA community.

"We have a lot of challenges ahead of us, but certainly the NextGen environment has created a lot of demand for avionics, and as an avionics manufacturer, we like that quite a bit," Uczekaj added.

The fourth annual Avionics for NextGen conference will be held Sept. 23, 2014, at the Sheraton in Atlantic City, N.J. Visit www.avionicsfornextgen.com for more information. avs

Simulati

Flight Simulation Training Devices (FTSD) replicating complicated avionics systems

By Scott Smith

The engineering required to design, build, operate and maintain modern aircraft is no less than a monumental feat. Hardware, software and integration challenges have been solved by many hours of effort from countless engineers. For example, modular racking circuit card assemblies now comprise the majority of the hardware architecture, moving away from traditional line replaceable electronic or mechanical units. And compared to just 20 years ago, the level of integration between systems is immense and inseparable.

Now imagine building a replica of an aircraft with additional systems, hardware, software, inputs and outputs. These also require seamless integration into your replication. Also, you must add much more specialized functionality. And as an engineer, you realize that much of this additional work could have, and should have, been designed into the architecture in the first place. Congratulations, you have just built a flight simulator.

Flight Simulation Training Devices (FSTD) are complex systems that require unique capabilities to provide efficient training to aircrews. These capabilities allow the FSTD to be rapidly configured to maximize the available training time. These capabilities and functionalities are defined by ARINC Report 610: Guidance for Design of Aircraft Equipment and Software for Use in Training Devices, which outlines the specific needs of the flight simulation industry, including guidance for implementation, description of functions, documentation requirements and case examples of proper and poor implementation in civil aviation FSTDs.

The Flight Simulator Engineering and Maintenance Conference (FSEMC) delegates consistently rank the lack of ARINC 610 functionality in their top five engineering challenges. In response, the FSEMC chartered a working group to create ARINC Report 610 (currently at Revision C). The working group consisted of subject matter experts from airframe manufacturers, training device manufacturers, avionics suppliers and airlines.

Because of increasing air travel, fuel costs, as well as the continuing need for trained pilots, the flight simulation training industry is a vital part of the aviation industry. Flight training is expensive, and using a flying aircraft in a non-revenue

ng Flight

offer real-world scenarios for pilots, but presents challenges to system developers

Delegates at the annual Flight Simulator Engineering and Maintenance Conference (FSEMC) consistently rank the lack of ARINC 610 functionality in their top five engineering challenges.

training scenario is, in most cases, simply not an option.

FSTDs are a less-expensive option than operating aircraft and are the next best thing for aircrew to either learn new flight procedures or practice emergency and abnormal procedures. Simulators are often in use training aircrews 20 hours out of a 24-hour day. In a four-hour training session, every minute counts.

Consider when a crew first gets into a Full Flight Simulator (FFS) for a training session. Before they take off, they must enter a flight plan in the Flight Management System (FMS). Often, this can be a quite lengthy procedure. During this time, the aircrew is heads down, using the keyboards and not using any other parts of this very expensive FFS. The rest of the simulator is idle. This uses 20-30 minutes of expensive simulator time.

There is a solution to this, and it involves the avionics found on the vast majority of airframes flying today. Aircraft equipment and software developers provide functionality in their products specifically for flight simulators. Although not all inclusive, a short list of these capabilities includes flight freeze; reposition; weight change; wind change; fuel freeze; snapshot upload; and snapshot download.

Photo courtesy ARINC

Full flight simulator

ARINC Report 610 uses analogies to explain the defined functions. For example, a Fuel Freeze for an automobile would result in the car being able to travel any distance without affecting the level of fuel in the tank (nice feature if you can find it). Similarly, an analogy of Snapshot Upload is already a reality in some automobiles. By recognizing a unique key device, the car will move the seat, the steering wheel, and set the environmental system

to the saved settings by that user of the key.

Moving from cars to planes, let's return to our example above. The training instructor could use the Snapshot Upload/Snapshot Download functions to record the flight plans that are being used in this (and other) training sessions ahead of time. When it is time to enter the flight plan, it is simply copied into the simulator's Flight Management Computer (FMC) using the ARINC 610 function. You have just saved 12 to 15 percent of very expensive simulator time (time equals money, especially in the aviation industry). That saved time can then be used for other valuable training maneuvers that make more use of the full FFS capability.

Another time saving example involves the use of the Reposition and/or Flight Freeze functions. An aircrew training on missed approaches benefit greatly by being able to quickly slew the aircraft position to 10 miles on final, flying the approach, and having the instructor freeze the simulation to immediately provide feedback to the aircrew.

Without these features, the aircrew must fly time-wasting circles around the subject airfield and then wait to receive feedback in the classroom debrief.

In addition to the aircrew time and workload, instructor workload is a concern. Without simulator-specific features, the instructor may spend an exorbitant amount of time managing the device and not the training session.

The design of avionics equipment and software is a long and arduous process. The added time for integration and certification of adding ARINC 610 functions is sometimes sacrificed at the altar of saving time/money. However, a direct effect of excluding ARINC 610 functions is the cost of developing workaround solutions for multiple simulators, and continuing the maintenance of flight simulators using workarounds. Keep in mind that these flight training devices, similar to flying airframes, are used for 25+ years.

From a training device manufacturer's point of view, integrating existing aircraft equipment with ARINC 610 functions results in less expensive development costs, which in turn allow airlines and operators to acquire simulators at a lower initial cost. After purchase, the maintenance of the devices is also lower because there are fewer engineering changes to provide simulator-specific capabilities. As any engineer knows, it is easier and cheaper to design for success than to design to correct failures.

Similarly, from an airline's point of view, airplane purchasing decisions necessarily include consideration of training of the aircrew on the new type. While acquisition cost of the airframe and avionics equipment could be initially lower if the unseen ARINC 610 capabilities are not incorporated, the cost of flight simulation device acquisitions would be higher for all of the airlines establishing simulator capabilities. The airlines will then also incur the cost of additional engineering and maintenance over the lifetime of the training device.

There are regulatory requirements that apply to simulators as well. ICAO 9625, Manual of Criteria for the Qualification of Flight Simulators, requires the FSTD be assessed

to ensure that repositions, resets and freezes support efficient and effective training. Similarly, FAA regulations require that the simulator should be capable of operating reliably after the use of training device functions such as repositions or malfunctions.

Consider the maintenance efforts to keep the device at the required fidelity, as well as supporting the training capabilities required by regulatory authorities, over a 25-year timeframe. System upgrades generally require new software, or even hardware interfaces, to be integrated into the device. This invariably results in a considerable amount of time for testing the systems and testing the device as a whole. Including the time required to re-qualify the simulator, the device could be unavailable for aircrew training for a significant amount of time while upgrades are installed and tested. If all of that isn't enough, when another upgrade is required, the work to enable simulator-specific functions will begin again. More training availability time will be lost.

A majority of this work could be avoided if the newly acquired airframe avionics systems incorporated ARINC 610 functionality. The training device manufacturer could build and integrate more efficient devices, and the airline would see better efficiency in the use of the device in training. Over the 25+-year life of the training device, less engineering and maintenance resources will potentially return savings (and possibly revenue if training time is sold to outside organizations) to the airline. avs

Scott Smith is a staff principal engineer at ARINC Industry Activities, and is the assistant secretary for the FSEMC. He can be reached at 410-266-2805, or at slsmith@arinc.com. The next FSEMC conference will take place Sept. 15-18, 2014, in Tulsa, Okla. For more information, visit www.aviation-ia.com.

NextGen SwiftBroadband Safety Services

Satellite-based communications is a vital part of airspace modernization initiatives around the world, notably NextGen in the United States and SESAR in Europe. Satellite service provider Inmarsat recently was granted approval for safety services over its SwiftBroadband network, which the company says will pave the way for a new generation of smaller, lighter and less expensive avionics that will provide safety voice and data functionality while simultaneously offering high quality voice and IP data connectivity for non-safety applications.

In a recent Avionics Magazine Webcast, NextGen for Swiftbroadband Services, Inmarsat and satcom equipment provider Cobham discussed the challenges and opportunities these next-generation satcom systems and services can provide to aircraft oeprators.

Dale Irish, head of aviation product management, Inmarsat:
Inmarsat Aviation, or Aero Services, has roughly 15,000 aircraft that currently rely on global in-flight connectivity from Inmarsat. Very widely used within the industry, we're a standard fit on nearly all widebody aircraft delivered by Airbus and Boeing. And, there's also quite a healthy retrofit market with Inmarsat satcom systems being installed. We currently operate on 10 geostationary satellites, which Inmarsat owns and operates from our headquarters in London. We also own and operate a ground network, with earth stations around the world.

The approved safety services are operated on Classic Aero, which has been in operation since the early '90s. Inmarsat has just finished a major renewal of the ground stations around the world. This concludes a major investment in the 2012-2013 timeframe to ensure that these stations operate well into the future. In addition,

'The use of FANS is driven by the efficiency gains. ... As we look forward, we envisage a world where soon only a small minority of long-range aircraft will fall outside FANS control.'

we are currently engaged in a program to take those safety services and put it on our new high-speed SwiftBroadband digital product.

2013 was a big year for us. I mentioned the new Inmarsat grounder stations for Classic Aero. Those are now up in operation, and we've transitioned aircraft onto those stations. We launched a new satellite called AlphaSat. It's also termed our fourth, Inmarsat-4. So that provides us an in-orbit spare satellite, and we're currently going through in-orbit tests of that new satellite. And everything's gone very well.

And finally, we've received confirmation of a major European Space Agency program, which is going to help us take our safety services from our current oceanic domain into something we call continental. So much more performance, much higher availability requirements, and lower latency, to enable techniques such as I4-D trajectory management.

Future Air Navigation System (FANS), which is widely used, is essentially being driven by efficiency and modernization within the oceanic domains. What it really enables is more and more aircraft are flying what we call Great Circle routes. By having this communication media, aircraft are allowed to be flown closer, reduce separation. It also enables what we call dynamic rerouting of tracks, depending on weather changes. The bottom line is that the efficiency benefits justify the install and operating costs. We're seeing a high degree of aircraft utilizing FANS in both the North Atlantic, and especially in the Pacific, where the benefits are so great.

The current need within the oceanic domain is what we call 30-by-30 separations to enable the aircraft to fly on these ideal tracks. That's our current target, which we are working to achieve. But in the future, with the additional investment that we're putting into what we call our continental services, we'll be working to 5 to 3 nautical-mile operations in the future. So again, this is an area of investment for us and investment with the European Space Agency and the national administrations behind that.

The use of FANS is driven by the efficiency gains. There are also mandates that are driving the FANS equipage. As we look forward, we envision a world where soon only a small minority of long-range aircraft will fall outside FANS control. This is really the direction that air navigation service providers (ANSP) are going. The ANSPs have continually been looking to initiatives to improve flight efficiency, and there have been a number of trials that have been done by individual ANSPs or groupings. And they show that increased ADS-C reporting rates have demonstrated various benefits to both the separation, also for vertical separation improvements, and to enable a variety of techniques, all that are designed to improve airspace efficiency and fuel benefits to the airlines.

Andy Beers, director, aeronautical sales for the Americas region, Cobham: I think the word of the day is efficiencies. Everybody's looking to, especially on the air transport side, modernize. But again, there's always the cost involved. What can I do on the return on the investment? They're certainly setting a situation up where, in order to leverage all these things, that there's got to be a way to do that without expending a lot of money and being able to make a return on the investment. And I think that's just driving the opportunity to find smaller, lighter and faster at a lower cost. …

'I think the word of the day is efficiencies. Everybody's looking to, especially on the air transport side, modernize.'

I think the first wave of connectivity for air transport has kind of happened. And I think that there are, naturally, for the cabin, if we're speaking about the cabin right now, that need for a very large data connectivity pipe is evident. You've got a lot of passengers that want to have a lot of access. They want to have a lot of bandwidth to do a lot of things.

But I think beyond that first wave of connectivity, there's a second and possibly third wave of some very segment-driven needs for connectivity. Maybe regional airlines or other airlines that don't need that or want to have both a large pipe for the cabin but also want to have connectivity that's separated from the cabin for the flight crew. I think there's a lot of opportunities for L-band and others to coexist, especially when we're talking about the safety services aspect, which we know those large pipes will not serve.

Additionally, I think there's a tremendous amount of opportunities there for segmentization. We actually did a project for an airline that put a current SwiftBroadband satcom system on to do one specific task, and that's all that system does. So I think that's an indication for me, and for all of us, I think, to see that if there's a need to do something and it needs to be done over beyond line of sight data link, that if the price is right, the avionics is small enough, that there's certainly a potential to meet something as niche as just one single function.

I think there's a much broader opportunity spectrum out there for connectivity to meet all those different domains, and it won't always be just as simple as for the cabin. It's going to be the large pipe, and for the cockpit, it's going to be L-band.

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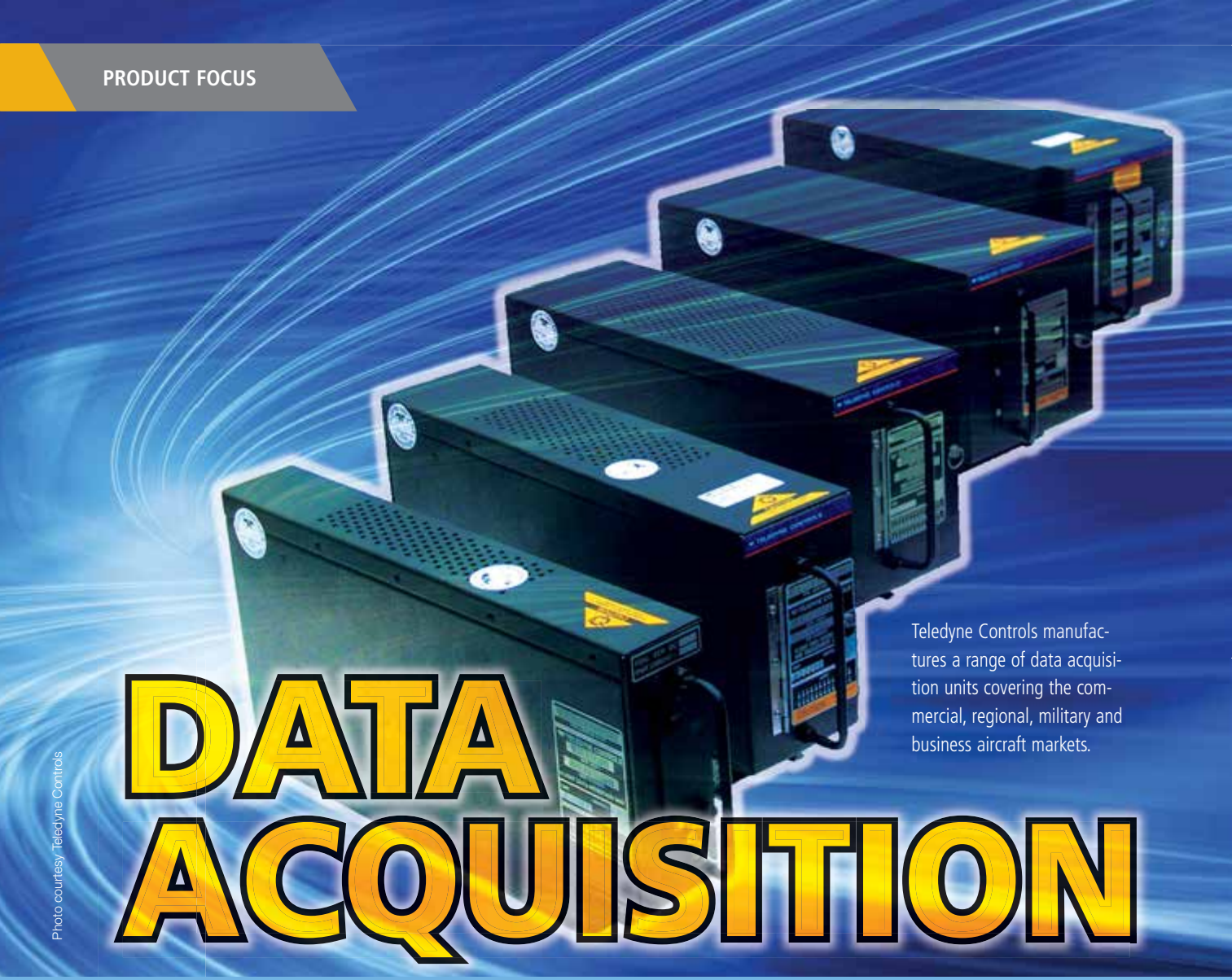

Photo courtesy Teledyne Controls

Teledyne Controls manufactures a range of data acquisition units covering the commercial, regional, military and business aircraft markets.

DATA ACQUISITION

There are mountains of data on the aircraft, but the challenge for avionics manufacturers is acquiring and transforming that data into usable information

By Ed McKenna

Like it has in many other industries, "big data" has taken hold in aviation. Boeing engineers report that on the 787 flight data can be collected from about 146,000 parameters; for operating efficiency experts this cache of data is a potential gold mine. It can be used by operators to boost fuel efficiency, maintenance and even scheduling, along with safety and many other applications. This surge in available data has helped spark greater use of an array of technologies designed to collect, analyze and extract value from the data for current operations and predict future hiccups in the system.

Systems that manage or monitor and analyze operating data for other than pure safety reasons are not new. Boeing rolled out its Aircraft Health Maintenance (AHM)

system more than 10 years ago. GE Aviation's Integrated Vehicle Health Management system (IVHM), now deployed on the Gulfstream G650, grew out the company's helicopter HUMS program begun in the early 1990s and its "flight recording skill sets," said Mark Thomson, the program manager for IVHM. In general, these systems collect data from systems already resident on the aircraft, such as central computers and databuses that link together the various systems.

One source of information on many aircraft is a data acquisition unit, such as Teledyne Controls' Digital Flight Data Acquisition Unit (DFDAU), which offers a processor for mandatory data acquisition for safety and the aircraft condition monitoring system (ACMS), which can be programmed by operators to work on the operating data during all phases of flight, said Mark Collishaw, director, business development, Flight Data Analysis & Investigation Solutions at Teledyne Controls. It can "cause (that data) to be transmitted or recorded or be downloaded by data loader after flight."

Over the years, there has been hesitance to use these systems for other than the mandatory data collection role, but that tendency is changing, said Collishaw.

In fact, over the past two years, there "has been accelerating interest in health monitoring technology," said Rajit Jain, engineering manager for Boeing's AHM product. From a single launch customer a decade ago, AHM now has 58 customers, and is on more than 2,000 airplanes.

Meanwhile, while the role of flight data analysis in supporting flight safety has remained significant for nearly two decades, "we have not seen any major or significant changes in that in the past few years," said Bruno Cacciola, director, product strategy and marketing – Civil Products and managing director, CAE Flightscape. However, the company, which provides flight data analysis software and services, has been seeing more interest in finding ways to "improve the production of actionable safety information from that data." To this end, CAE has "added broader airline operational relevance," including maintenance and engineering, to its criteria for analyzing the data. It is also working with industry experts to merge key aircraft data with "other operational databases, such as route planning, dynamic flight plans and other data related to fuel, noise and drag reduction initiatives."

A significant developer of training and simulator tools, CAE also has been able to use the data it has collected and analyzed to boost its integrated training offering or the Simulator Operations Quality Assurance (SOQA) program. For example, data from its user base has contributed to the greater "understanding of unstabilized approaches, (including) the key characteristics of those approaches and how to train better in that area," said Cacciola.

In practical terms, the sales of next generation aircraft, such as the 787s, which have AHM designed into them, have spurred the increased use of the health maintenance systems. Boeing also uses the AHM on 777s, 747s, MD-10s and 11s and Boeing Business Jet as well; "we are (also) implementing a solution for 757s and 767s

Photo courtesy Curtiss-Wright Controls

Curtiss-Wright Controls Avionics & Electronics' CVR-E Encrypted Cockpit Voice and Flight Data Recorder can be configured to encrypt up to three intercom channels, one high-quality area microphone channel and one flight data channel (ARINC 573/717).

and 737NGs," said Jain. Unlike the 777 and 787, which have central maintenance computers to collect data, the older aircraft rely on "the digital flight data units to do some of that data collection," said Jain, noting that Boeing works a number of data acquisition system providers including Honeywell, Sagem and Teledyne. The latter has been signed up to be the sole provider of the digital flight unit for the Boeing 327 MAX, said William Cecil, director, business development, Airline eOperations at Teledyne.

This transition is also being fueled by "big data," which demands complex data management tools. "The 787s and the newer Airbus' can generate terabytes of data per flight — a far cry from the 125-some parameters that, even today, we still deal with on some of the older legacy aircraft types, said Cacciola. "Our concern is more to do with having the right amount of good data to work with."

It is important to "whittle down" the mass of information and identify the relevant data to address specific issues, added Jain. "It would be really nice to be able to capture all those data all the time but it is not really economical."

In addition to "big data," the demand in the consumer market for "real-time information, (such as) real time tracking of information for our packages … (is now) translating into the aviation industry as well," said Jain. To manage their operations, airlines need real time data about their aircraft to make sure they can achieve their tight turnaround schedules.

"The aircraft is becoming a node on a network," said Thomson. There is "lots of the data being sent off via systems on the airplane, such as satcom … and ACARS,

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and … on the ground … the transfers occur either via Wi-Fi or GSM cellular technology." However, the main barriers to it becoming that node are chiefly economics and security related. "The cost for bandwidth while in air is the biggest thing." In terms of security, "a big concern … (keeping) somebody from getting a hold of an airplane and being able to do things with it that weren't intended," he said. "A lot of work is going into making sure that systems … have the right security tied around them and that the avionics are constructed such that the different domains don't cross."

Even as those critical efforts proceed, operators are using systems, such as IVHM, to address key flight issues, such as "intermittent concerns," said Thomson. It could be an overlooked event — a flicker of a control light that the pilot doesn't catch — that is not an issue on that flight but can eventually, if it happens routinely and is finally seen by the pilot, take that aircraft out of service. Working with Gulfstream, "we found some intermittent issues and were able … to tell customers what we were seeing," Thomson said. "We were able to do this without being anywhere near the aircraft; that is like being a node on the network."

The IVHM also has functioned in other ways providing proof to the operators "that the aircraft is actually working as designed," and delivering to the OEM, Gulfstream, an overall view of entry into service of the aircraft. "With a brand-new airplane, there will be things that go wrong; you don't know what they will be, but having this data picture helps you assess how big an issue you've got initially," said Thomson.

The IVHM is up and flying on all Gulfstream G650s that have been delivered since beginning of the year, he said. The system has been rebranded by Gulfstream as PlaneConnectHTM, and "we are working as a back office to Gulfstream … it is a relationship that works well with the business jet market," where operators don't have large fleets or huge engineering and maintenance staffs, said Thomson.

However, GE is looking beyond business jets and late last year set up Taleris, a joint venture with Accenture, which is specifically aimed at the commercial airline market. Taleris' goal is making "an airline more efficient overall, so it really brings in the operational side," said Thomson. "One of the more interest-

ing services" Taleris provides is service recovery in which they take on the daunting question "How do you best reschedule an airline's operations once you have had an issue or hiccup in the front end of your schedule?"

"We do have customers that from time to time report their improvements back to us," said Jain. For example, "we had a customer report that they after 10 months use of (AHM) technology they (saw a) 64 percent improvement on delay minutes." However, Boeing is also using the AHM data to help bolster its operator services infrastructure by collecting and contextualizing AHM information in the "aircraft maintenance manuals to provide operators, who (may have) just had a fault, key information, including identifying the fault and offering recommended actions … to resolve it."

Market Moves

The following are new contracts and new product announcements from the developers of flight data monitoring and acquisition systems.

► **FLYHT Aerospace Solutions**, based in Calgary, Alberta, Canada, in September signed a contract with a Nigerian airline for its Automated Flight Information Reporting System (AFIRS) 220 for real-time flight data monitoring on 4 Boeing 737s.

In August, the company received certification from Iridium for the commercial use of its AFIRS 228S on the Iridium satellite network. FLYHT has completed the certification protocol to obtain Iridium Compatible Equipment (ICE) certification.

► In June, **Teledyne Controls**, based in El Segundo, Calif, achieved certification for its Wireless GroundLink Comm+ (WGL Comm+) multi-application communication technology to be retrofitted to all major commercial aircraft types.

According to the company, the WGL Comm+ automates and accelerates the data exchange between aircraft and ground systems using 3G/4G, allowing larger volumes of data to be transferred more quickly than previous Wireless GroundLink Quick Access Recorder (WQAR) solutions. The system can now be installed on the Boeing 737, 747, 757, 767, 777 and MD-80 aircraft, and the Airbus A318/A319/A320/A321, A330 and A340.

► Taleris, a joint venture between GE and Accenture, in June announced an agreement with Etihad Airways under which Taleris will supply its web-based prognostics service to help the airline better predict potential maintenance faults and recommend preventive action.

According to the company, the expected benefits include a reduction of unscheduled maintenance, fewer delays and cancellations, increased aircraft availability, enhanced on-time performance, increased maintenance efficiency, reduction in maintenance costs and reduction in lost revenue costs.

The service also can reduce the requirement to store expensive spare parts, which are typically stocked in case of failure.

► Curtiss-Wright Controls Avionics and Electronics in September introduced the CVR-E Encrypted Cockpit Voice and Flight Data Recorder. The CVR-E combines crash survivability and high-grade encryption of cockpit audio/flight data into a single product. The recorder can be configured to encrypt up to three intercom channels, one high-quality area microphone channel and one flight data channel (ARINC 573/717).

Additionally, in August, Curtiss-Wright was awarded a $21 million contract from Irkut Corp. to supply its ISSKOR flight data recording system for Irkut's MC-21 narrow body passenger jet. The system includes dual imaging flight recorders, an integrated cockpit control unit, cockpit area camera and integrated flight data acquisition unit.

A larger goal for the AHM is identifying and predicting trends. “We have in our system 3.6 billion records now to analyze and draw upon to look for trends,” said Jain. The objective is to identify tends with data collected from airplanes and resolve them quicker. This covers not only operational but also quality issues; for example, the company was able to use real -time data to get out in front of a developing fleet-wide issue with cracking toilet seats, Jain said.

Currently, the company is mainly using real-time data to identify issues and fix them now. “The next stage is about developing prognostics to be able to predict when a component may fail, so the customers can take more proactive actions,” Jain said. They could either remove a particular part they know will fail, or “at least be able to plan it so that (the situation) doesn’t turn into unscheduled maintenance.”

This is critical goal of the industry generally now including GE and its Taleris venture.

Other key issues are in a way more fundamental, such as finding ways to collect and offload data in a more efficient manner. For data collection, Boeing is looking down the line at using Quick Access Recorder (QAR), “a function of data acquisition unit, to collect even more parameters … bus (still) one of the big challenges is getting that data off the airplane in an economical way,” said Jain. At the heart of this issue “is the balancing the need for real time information versus … getting information every two weeks or every week from the airplane,” said Jain. The company currently is using ACARS but is exploring the use of cellular and broadband.

In weighing options key statistics provide some clarity. For example, it is worthy to note that “ACARS can cost up to a $1,000 a month per aircraft; in contrast, cell technology using AT&T Wireless and Vodaphone in Europe can be as little $10 dollars per Gigabyte,” said Teledyne’s Cecil. Of course, ACARS is real time, while the cellular would be offloaded on ground, so it calls for determining what data must be sent real time.

There may be middle ground here for some operators. Low cost carrier RyanAir decided, for example, to eschew the high costs of ACARS altogether and do all of its offloading on the ground via Teledyne’s ground based wireless technology, said Collishaw. To date, “it has been a roaring success; now all of the data or 99 percent arrives within one day.” They have been able to address a number key 737NG related issues “and fashion a very successful safety regime.”

Flight Data Recorders

For now, the use of data monitoring systems on aircraft has not impacted directly the traditional safety systems, Flight Data Recorders (FDR), or procedures on commercial aircraft. However, the monitoring systems along with pressure from the flight safety organizations may boost changes to the way safety data is collected and transmitted.

Companies

AgiLynx, Inc.	www.agilynx.com
AIM	www.aim-online.com
Ampex Data Systems	www.ampex.com
Avionica Inc.	www.avionica.com
Boeing	www.boeing.com
Curtiss-Wright Controls	www.cwcontrols.com
ENSCO	www.ensco.com
FLYHT	www.flyht.com
GE Intelligent Platforms	www.ge-ip.com
Honeywell	www.honeywell.com
L-3 Communications	www.l-3com.com
KineticSystems	www.kscorp.com
Meggitt Avionics	www.meggitt-avionics.co.uk
North Atlantic Industries	www.naii.com
North Flight Data Systems	www.northfds.com
Pentek	www.pentek.com
Sagem Avionics	www.sagem-ds.com
Speel Praha	www.speel.cz
Taleris	www.taleris.com
TechSAT	www.techsat.com
Teledyne Controls	www.teledyne-controls.com
Teletronics Technology Corp.	www.ttcdas.com
Thales	www.thalesgroup.com
Universal Avionics Systems Corp	www.universalavionics.com
UTC Aerospace Systems	utcaerospacesystems.com
Zodiac Data Systems	www.zds-us.com

"The use of flight data monitoring, primarily implemented as part of Flight Operations Quality Assurance (FOQA) initiatives, has not had a significant impact on the FDR itself," said Tom Schmutz, vice president of Engineering for L-3 Aviation Products, a major supplier of FDRs. "However, in order to facilitate easier access to the recorded flight data, QARs have continued to evolve," he said noting that these technologies "directly record the same flight data that is sent to the FDR, but provide more convenient access … via removable memory cards or wireless access." In addition, L-3 is investigating "the integration of wireless download of the FDR itself in order to eliminate the need for a separate QAR device."

In addition, the use of streaming and streaming data by aircraft monitoring systems for maintenance applications could make it easier to use that transmission mode in some cases for safety data, said Matt Bradley, vice president business development at FLYHT Aerospace Solutions. Calgary, Canada. The company's Automated Flight Information Reporting System (AFIRS) is designed to among other functions provide real-time streaming via FLYHTStream of emergency data, including flight data recorder information, using Iridium satellite network to dedicated operations personnel.
In its final report last year on the Air France 447 crash, French accident investigation authority BEA recommended at least looking at triggered transmission of key flight safety data via satcom. The recommendation generated interest in AFIRS; however, at this point, industry is not pursuing this course of action, said Bradley. "It takes political will to really drive a solution like (that) … although it has been instrumental in getting our equipment onto other platforms and in developing interest in solutions in general." AFIRS is currently deployed on about 400 civilian and military aircraft, but that number is expected to rise this year as it is deployed on Airbus 320s along with L-3 flight data recorders.

Along with focusing on "real time flight transmission off aircraft," the BEA report generated "considerable discussion about the possible implementation of 'deployable recorders' … to avoid the time consuming process of identifying submerged recorder position and retrieval from deep ocean locations," Schmutz said. "However, for now, deployable recorders and/or real time data transmission, from a regulatory perspective, still face considerable cost and logistical challenges." avs

Avionics Magazine's Product Focus is a monthly feature that examines some of the latest trends in different market segments of the avionics industry. It does not represent a comprehensive survey of all companies and products in these markets. Avionics Product Focus Editor Ed McKenna can be contacted at emckenna@accessintel.com.

Airborne Server PMA

Kontron received FAA Parts Manufacturer Approval (PMA) on its next-generation ACE Flight 600 general purpose airborne server. According to the company, this milestone signifies that the airborne server meets the high safety and regulatory standards required for commercial aviation, and is suitable for aircraft installations worldwide.

The Kontron ACE Flight 600 integrates dual core 1.5 GHz Intel Core i7 processor, 16GB of DDR3 memory and up to 1.8 terabytes of combined SATA SSD storage. This ARINC 600 4MCU form factor system also features 6 Rx/ 3 Tx ARINC 429 channels, six inputs and four outputs of discrete I/O . The Kontron ACE Flight 600 features GSM USIM access, 2x removable SSDs, VGA, 2x RS-232, USB and 10/100/1000Base T ports. Visit http://us.kontron.com.

Databus Test

Data Device Corp. (DDC), of Bohemia, N.Y., introduced dataSIMS Version 4.3.1, which adds software support for its AFDX/ARINC 664 PMC Card. DDC's dataSIMS data bus test and analysis software provides a graphical interface for advanced data simulation, visualization, analysis and integration, the company said. The DD-82101F AFDX/ARINC 664 PMC card, which is also available in PCI and cPCI form factors, provides two full duplex AFDX/ARINC 664 network interfaces that can be operated in either independent or dual-redundant mode, and offers comprehensive error injection/detection, filtering and triggering features. Visit www.ddc-web.com.

Force Trim System

Cool City Avionics, based in Mineral Wells, Texas, received FAA Technical Standard Order (TSO) authorization for its FT-100 Force Trim System for helicopters. The STC installation in the Robinson R44 has been completed and the STC issuance is pending, the company said.

The new FT-100 holds the cyclic in place using a Force Gradient System that provides a "force feel" as the control is moved away from its center "engage" position. The system gives the pilot short-term "hands-free" time to perform other activities besides flying and reduces his stress and fatigue, the company said.

Visit www.CoolCityAvionics.com.

Data Agreement

Jeppesen data is now available for Garmin, Avidyne, Dynon Avionics and Aspen Avionics units for general aviation pilots, through the new bundled service agreement with Pacific Coast Avionics, a Portland, Ore.-based provider of avionics, pilot supplies and aircraft services.

The Pacific Coast Avionics bundled service options provide Jeppesen's data, including NavData, JeppView charting, Jeppesen obstacle, terrain and cultural

information and eCharts for Multi-Function Display. Garmin GTN PilotPak bundle plans with Jeppesen data are also available through Pacific Coast Avionics.

A Pacific Coast Avionics Web portal has been created to order Jeppesen bundled services. Visit www.jeppesen.com.

Rugged Display

Curtiss-Wright Controls Defense Solutions expanded its Skyquest family of rugged mission displays, with the AVDU5008-EP rugged 20-inch LCD display.

Designed for mission display applications such as moving maps, the AVDU5008's 1366x768 resolution display features a glove-operable touchscreen to simplify control of programs driven by the embedded PC, the company said. The system is designed to meet the demands of airborne defense, coast guard and law enforcement applications, such as surveillance, patrol and search & rescue, according to the company.

The AVDU5008-EP features hard bezel keys for core controls such as power and brightness, and LEDs to indicate the state of connected recorders. The AVDU5008-EP has a dual-backlight design to support sunlight readability during the day and compatibility with night vision goggles at night. The display can be integrated into an aircraft's lighting bus to provide remote control brightness of bezel-mounted keys and LEDs, the company said. Visit www.cwcontrols.com.

Messaging Capability

Blue Sky Network, of La Jolla, Calif., said its portable Bluetooth device, HawkEyeLink, now supports access and transmission of electronic forms. HawkEyeLink enables two-way messaging on smartphone and tablet devices via the Iridium satellite network and works in conjunction with Blue Sky Network's D1000. The new feature enables users to access, edit and transmit dynamic electronic forms on an iPad while in the air via the Iridium network.

With the upgrade, the HawkEyeLink serves as an extension to electronic flight bag capabilities and enables operators to send electronic forms from an iPad to Blue Sky Network's cloud-based web portal, New SkyRouter. By allowing fleet operators to build and fully customize forms — such as flight plans, weight and balance, and flight manifest — HawkEyeLink supports the industry's movement towards paperless fleet operations, according to the company.

Visit www.blueskynetwork.com.

ADS-B Integration

FreeFlight Systems, based in Waco, Texas, is interfacing its Model 1201 WAAS/GPS sensor with the Garmin GTX 330 Mode S transponder to provide an additional 1090 MHz Extended Squitter (1090ES) ADS-B Out upgrade solution for GTX 330 owners.

Under a technology licensing agreement between FreeFlight and Garmin, FreeFlight Systems is enabling the 1201 WAAS/GPS sensor to serve as the approved high-integrity position source paired with the GTX 330 with ES functionality in a rule-compliant 1090ES ADS-B Out installation. The upgrade solution increases ADS-B Out equipage choices for aircraft owners based on their on their aircraft type, existing avionics and flying requirements, according to the company.

Visit www.freeflightsystems.com. avs

BY ANNE SWANSON

FCC INTERFERENCE APPROACH

Since the Federal Communications Commission (FCC) released its "National Broadband Plan" in 2010, the agency has been aggressively trying to make more spectrum available for broadband. Besides exploring various allocation and auction mechanisms, the FCC recently released a study from its Technical Advisory Council (TAC) proposing to modify its approach to analyzing interference thresholds as one way of advancing broadband services. The TAC was chaired by the President's nominee for FCC Chairman, who is expected to be confirmed this fall and likely favors its recommendations, so aviation equipment manufacturers will probably hear much more about them in coming months.

Besides exploring various allocation and auction mechanisms, the FCC recently released a study from its Technical Advisory Council (TAC) proposing to modify its approach to analyzing interference thresholds as one way of advancing broadband services.

Since its inception, the FCC has always held newcomers responsible for interference they may cause to incumbent services. The TAC study suggests "turning the tables," proposing an interference limits policy approach that would define the radio environment in which receivers operate. This probabilistic method known as "harm claim thresholds" would place limits on in-band and out-of-band interfering signals that must be exceeded before existing receivers can claim harmful interference.

Although the novel proposal is several administrative steps away from even being proposed as official rules, it drew a number of strong critiques when the FCC sought public comment. In joint comments, the GPS industry, including Garmin, noted that, as the study itself recognized, use of harm claim thresholds may not be appropriate, or may be particularly difficult to administer in certain circumstances, including when adjacent services are dissimilar, receivers are not controlled by license holders, and a service is not under FCC jurisdiction or involves safety-of-life systems like aviation. The GPS interests said the FCC must balance any benefits from this new approach against the cost of equipment replacement, R&D expenditures, and decreased functionality of existing devices. They emphasized that aviation equipment takes more than a decade to develop and certify and that, in the recent LightSquared case, FAA was never able to identify a mutually agreeable interference model that would provide confidence that LightSquared's proposed service would not compromise aviation safety.

The Aeronautical Frequency Committee (AFC) also filed comments, noting that the proposal is not practical for the unique environment in which aviation services operate; it indicated the study's proposed implementation process may actually create additional complexity, cost and uncertainty for various spectrum users — not the manageable concept the study's authors envisioned. AFC said any process should incorporate existing international standards, and a uniform "worst case value" should be applied to calculations for all locations. AFC also suggested that any implementation process should provide detailed frequency selection criteria and a notice period affording all interested parties, not just land mobile services, sufficient time to assess the new or revised interference limits; assign a minimum period of validity to any harm claim thresholds, so users will not face short-notice changes to previously agreed upon RF environments; and use a multi-stakeholder process to derive appropriate parameters for the thresholds, clarify areas of responsibility and investigation standards, and assign additional margins to account for unknown effects and protect existing services.

Rockwell Collins also expressed concern that the TAC study fails to consider the great costs, regulatory inefficiency, and potential risks to aviation safety that would result from new harm claim thresholds for GPS receivers. It noted harm claim thresholds are incompatible with existing receiver design and would impose unacceptable retrofitting costs on the installed GPS base. Expert domestic and international bodies already conduct a well-functioning standards process, which should continue for avionics.

Numerous other parties commented on the TAC study, but none specifically addressed aviation interests. These others presented mixed views on whether receiver performance standards in general are necessary and whether harm claim thresholds might improve receiver performance. Most parties opposed a one-size-fits-all solution and advocated the use of multi-stakeholder groups to investigate what thresholds might be appropriate."For the TAC proposals to become codified rules, the FCC first will have to conduct a notice and comment rulemaking proceeding. That could be preceded by a more informal Notice of Inquiry proceeding to gather initial comments for drafting the proposed rules. Given the significant support the TAC study has within the FCC and broadband communities, aviation interests need to follow the FCC process. avs

Anne Swanson is a partner at Dow Lohnes PLLC, where she uses her administrative law expertise to help communications, equipment and navigation companies solve their regulatory problems. Her practice also focuses on complex spectrum issues and new technologies, such as unmanned vehicles and "smart transportation" systems.


Bill Darbe

Bill Darbe

Satcom Direct, of Satellite Beach, Fla., named Bill Darbe its director of dealer programs. Darbe will be responsible for implementing aftermarket dealer programs to support the introduction of Satcom Direct's new hardware systems. His initial focus will be to create Wi-Fi certification programs for the new Satcom Direct Router and to work with the distribution channel to help promote and sell Satcom Direct products and services.

Darbe brings more than 25 years of experience in the business aviation industry. He spent the past 15 years with Aircell and was responsible for aftermarket sales and key charter and fractional accounts. Before that, he spent several years at Global Wulfsberg in various program management and engineering positions for the company's FM and phone product lines.

Marisa Von Wieding, John Allen

JetBlue Airways promoted Marisa Von Wieding to vice president, System Operations Control. In this role, Von Wieding is responsible for the airline's operations of 850 daily flights in 79 locations throughout the Americas, including Dispatch, Air Traffic Management, Crew Services and Emergency Response and Care. Most recently, Von Wieding, who joined the airline in 2007, was director of JFK Operations and Customer Service.

The airline also named John Allen vice president, chief safety officer. Allen retired from FAA in August after 22 years with the agency in a variety of roles, culminating as director of flight safety standards. Allen retired from the Air Force Reserves in 2009 as a brigadier general after 31 years of active-duty and reserve service.

Curtis Reusser

Esterline Corp., based in Bellevue, Wash., named Curtis Reusser president and CEO. Reusser most recently was president of United Technologies' Aircraft Systems business.

Before UTC, Reusser was president of Goodrich's Electronic Systems Segment. In previous years with Goodrich, he held various positions, including president of its Aerostructures business. Prior to his tenure at Goodrich, Reusser had an early career as an engineer with General Dynamics.

David Gitlin

United Technologies named David Gitlin president of the Aircraft Systems business segment of UTC Aerospace Systems.

Gitlin has been with UTC since 1997, holding leadership positions in legal, business development, program management and customer service. Before the acquisition of Goodrich, he was president, Aerospace Customers and Business Development, at Hamilton Sundstrand, where he oversaw aerospace customer service and support, business development activities, strategic partnerships, and mergers and acquisitions.

Russell Ford, Marc McGowan

StandardAero named Russell Ford CEO. Ford joins StandardAero from Precision

Castparts Corp., where he was president of Carlton Forge Works and Dickson Test Group of the Forged Products Division. Ford previously was president and CEO for private equity companies including ClearEdge Power, Prestolite Electric and Holley Performance Products. Additionally, he held positions at Lockheed Martin, AlliedSignal, Bell Helicopter and AT&T.

Marc McGowan was appointed senior vice president of StandardAero's Business Aviation Sector. McGowan, who joined StandardAero in 2011, most recently was vice president of business development and strategy for Business Aviation. Prior to joining the company, he served in a wide range of senior leadership positions for Honeywell. In addition to his civilian career, McGowan served 28 years in the U.S. Navy as a commissioned Naval Flight Officer and Naval Reserve Officer.

Jerry Redondo

Ducommun named Jerry Redondo vice president of operational excellence for its electronics and aerostructures business units. He will be based in Carson, Calif.

Redondo joins Ducommun from Crane Aerospace & Electronics where he was group vice president of operations, global supply chain, quality and operational excellence. He previously was with the Aerospace Group of Parker Hannifin where he was director of operations and global supply chain for the company's Control Systems Division.

William Gibson, Brent Monroe

William Gibson

Gulfstream Aerospace appointed William Gibson director, Product Support Global Distribution. In this newly created position, he manages all processes, procedures and operations related to the movement and warehousing of spare parts throughout the Gulfstream Product Support global distribution network. For the past 10 years, Gibson worked for Honeywell, most recently as senior manager, Customer Operations for its Space and Defense segment.

The company also named Brent Monroe vice president, North American Sales, Western Division. He is based in Dallas. Monroe began his aviation career in the U.S. Army as an aeroscout pilot and his private sector general aviation career at a fractional aircraft company. Most recently, he was a leading sales executive for Bombardier Aerospace, where he was responsible for aircraft sales in Texas.

Brent Monroe

Thomas D. Grunbeck

Thomas D. Grunbeck has been named vice president of sales and marketing for Stevens Aviation, based in Greenville, S.C. Grunbeck brings more than 25 years of aviation experience, in sales and marketing, business development, engineering, manufacturing and contracts to Stevens.

His previous positions include vice president of sales and marketing for Safe Flight Instrument Corp.; vice president and group director for Barnes Aerospace; director of business development and a business unit leader for Goodrich; and director of business development for Gulfstream Aerospace Technologies. avs

November

17-21 Dubai Airshow, Dubai World Central, Dubai. Visit www.dubaiairshow.aero.

2014

January

21-22 Aviation Maintenance Summit Europe, London Olympia Exhibition Centre, London. Visit www.avm-summit.com/europe.

February

24-27 Heli-Expo 2014, Anaheim Convention Center, Anaheim, Calif. Visit www.rotor.com.

March

4-7 World ATM Congress, IFEMA, Madrid, Spain. Visit www.worldatmcongress.org.

11-13 ATC Global, Amsterdam RAI Center, Amsterdam, the Netherlands. Visit www.atcglobalhub.com.

12-15 Aircraft Electronics Association (AEA) International Convention and Trade Show, Nashville, Tenn. Visit www.aea.net.

April

7-9 Navy League Sea-Air-Space Exposition, Gaylord National Resort & Convention Center, National Harbor, Md. Visit www.seaairspace.org.

8-10 Aircraft Interiors Expo, Hamburg Messe, Hamburg, Germany. Visit www.aircraftinteriorsexpo.com.

14-17 AMC/AEEC Joint Meetings, Sheraton Centre Hotel, Toronto. Visit www.aviation-ia.com.

15-17 Asian Business Aviation Convention and Exhibition (ABACE), Shanghai Hongqiao International Airport, Shanghai, China. Visit www.abace.aero

May

12-14 Association of Unmanned Vehicles Systems International (AUVSI) Unmanned Systems 2014, Orange County Convention Center, Orlando, Fla. Visit www.auvsi.org.

May

20-22 European Business Aviation Convention and Exhibition (EBACE), Geneva PALEXPO and Geneva International Airport, Geneva, Switzerland. Visit http://ebace.aero/2014/

July

14-20 Farnborough International Airshow, Farnborough Airport, England. Visit www.farnborough.com.

16-19 Airborne Law Enforcement Association (ALEA) Annual Conference, Phoenix Convention Center, Phoenix. Visit www.alea.org.

28-Aug. 3 EAA AirVenture, Wittman Regional Airport, Oshkosh, Wis. Visit www.eaa.org. avs

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