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Assistant Managing Editor Michael Stearns
Art Director Lisa Caputo
Executive Editor, Data and Analytics Jim Mathews

DEFENSE, SPACE AND SECURITY

Editors Jen DiMascio (Managing Editor), Jefferson Morris (Associate Managing Editor), Michael Bruno, Amy Butler, Michael Fabey, Sean Meade, Frank Moring, Jr., Bill Sweetman (Chief Editor, Defense Technology Edition)

CIVIL AVIATION/MAINTENANCE, REPAIR AND OVERHAUL

Editors Jens Flottau (Managing Editor), Darren Shannon (Associate Managing Editor), Andrew Compart, John Croft, Leithen Francis, William Garvey, Fred George, Rupa Haria, Kerry Lynch, Guy Norris, Bradley Perrett, Jessica Salerno, Adrian Schofield, Lee Ann Tegtmeyer (Chief Editor, MRO Edition)

Chief Aircraft Evaluation Editor Fred George

For individual e-mail addresses, telephone numbers and more, go to www.AviationWeek.com/editors

EDITORIAL OFFICES

2 Penn Plaza, 25th Floor, New York, NY 10121
 Phone: +1 (212) 904-2000, Fax: +1 (212) 904-6068

BUREAUS

AUCKLAND

53 Staircross St., Green Bay, Auckland 0604, New Zealand
 Phone: +64 (27) 578-7544

Bureau Chief Adrian Schofield

BEIJING

D-1601, A6 Jianguo Menwai Ave., Chaoyang, Beijing 100022, China
 Phone: +86 (186) 0002-4422

Bureau Chief Bradley Perrett

BRUSSELS

Rue de L'Aqueduc 134, 1050 Brussels, Belgium
 Phone: +32 (2) 648-7774

Contributing Editor Cathy Buyck

COLUMBIA, S.C.

1120 Baffin Road, Columbia, S.C. 29212
 Phone: +1 (803) 727-0309

Managing Editor, AviationWeek.com Sean Meade

FRANKFURT

Am Muhlberg 39, 61348 Bad Homburg, Germany
 Phone: +49 (69) 2999-2718 Fax: +49 (6172) 671-9791

Bureau Chief Jens Flottau

LONDON

20 Canada Square, 7th floor
 Canary Wharf, London E14 5LH, England
 Phone: +44 (207) 176-2524

Bureau Chief Tony Osborne

Multimedia Manager Rupa Haria

LOS ANGELES

10 Whitewood Way, Irvine, Calif. 92612
 Phone: +1 (949) 387-7253

Bureau Chief Guy Norris

MOSCOW

Box 127, Moscow, 119048, Russia
 Phone: +7 (495) 626-5356; Fax: +7 (495) 933-0297

Contributing Editor Maxim Pyadushkin

NEW DELHI

Flat #223, Samachar Apartments,
 Mayur Vihar—Phase-I (ext.)
 New Delhi 110091, India
 Phone: +91 (98) 1154-7145

Contributing Editor Jay Menon

PARIS

40 rue Courcelles, 75008 Paris, France
 +33 (06) 72-27-05-49

Bureau Chief Amy Svitak

Contributing Editor Pierre Sparaco
pierre.sparaco@orange.fr

SAN FRANCISCO

380 Brandon Court, Pleasant Hill, Calif. 94523
 Phone: +1 (925) 934-6813

Bureau Chief Michael Mecham

SINGAPORE

12 Marina Blvd.,
 Level 23, Marina Bay Financial Centre Tower 3
 Singapore 018982

Phone: +65 6530-6532

Bureau Chief Leithen Francis

WASHINGTON

1200 G St., NW, Suite 922, Washington, D.C. 20005
 Phone: +1 (202) 383-2300, Fax: +1 (202) 383-2347

Bureau Chief James R. Asker

Administrator of Bureaus Kyla Clark

Art Department Scott Marshall, Colin Thom

Copy Editors Andrea Hollowell, Patricia Parmalee

Director, Editorial and Online Production Michael O. Lavitt

Production Editors Elizabeth Campochiaro, Bridget Horan,
 Ellen Pugatch

Contributing Photographer Joseph Pries

Finance Director Hing Lee

President/Publisher Gregory D. Hamilton
hamilton@aviationweek.com



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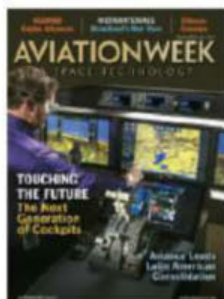
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On the Web

A round-up of what you're reading on AviationWeek.com

Aviation Week's MRO Americas show **drew nearly 10,000 attendees** to Atlanta last week. A hot topic was **the effect of fleet retirements on the MRO market**. Check out the wrap-up (ow.ly/kbN98) and all the latest developments in MRO at AviationWeek.com/mro



AVX AIRCRAFT CONCEPT

THE OTHER JMR/FVL CONTENDERS

Though attention for the U.S. Army's Joint Multi-Role helicopter requirement has focused on Boeing/Sikorsky and Bell, start-up AVX Aircraft, staffed mostly by former Bell employees, is proposing a compound helicopter with coaxial rotors, small wings and dual ducted-fan propulsors. Check it out in our Ares blog (ow.ly/kbInR) AviationWeek.com/ares

GE'S NEW 747 FLYING TESTBED

General Electric's new **Boeing 747-400 flying testbed** has been delivered to Evergreen Aviation Technologies in Taiwan for installation of data racks, instrumentation wiring and instrumentation equipment. Read more about the capabilities of this aircraft in our **Things With Wings** blog (ow.ly/kbM3d). AviationWeek.com/thingswithwings

READER COMMENT

A proposal for a **private, manned Mars flyaround** has fired up some of our readers. DJE51 writes: "Inspiration Mars is awesome, and I commend Dennis Tito for **investing his own wealth** on something he believes in. It seems like some **extraordinary talent** is being tapped to make this a success." ow.ly/kbla9



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BEACON OF TRANSPARENCY

The Viewpoint "Transparency Is Defense World's Achilles' Heel" (AW&ST March 25, p. 58), was misleading since it did not take into account the dramatic and consistent strides that have been made by the defense industry itself in policing and preventing corruption since the mid-1980s. Widespread fraud allegations had called into question the integrity of the defense acquisition process.

The situation prompted then-President Ronald Reagan to appoint the Packard Commission to recommend reforms.

The commission, in its February 1986 interim report, observed that waste, fraud and abuse had eroded the public's confidence in the industry and the Defense Department. The commission urged defense contractors to improve the acquisition process through greater self-governance. "[D]efense contractors must promulgate and vigilantly enforce codes of ethics that address the unique problems and procedures incident to defense procurement [and] develop and implement internal controls to monitor these codes of ethics and sensitive aspects of contract compliance."

Heeding the commission's call, General Electric CEO Jack Welch, along with senior officials of 17 other defense contractors, voluntarily met and drafted the principles that became known as the Defense Industry Initiative on Business Ethics and Conduct. By July 1986, 32 major defense contractors had pledged to adopt DII's core principles. Now, more than 80 major U.S. defense companies are DII members.

Considering that the consolidation of the industry during the 1990s has led to only five prime contractors today (Boeing, General Dynamics, Lockheed Martin, Northrop Grumman and Raytheon), these companies do represent the majority of the industry.

Sharing best ethics and business conduct practices is a fundamental DII commitment. One of the key opportunities for this sharing is the annual Best Practices Forum, held in June. The DII periodically publishes a comprehensive and meaningful Accountability Report—available in full on DII's website.

The Aerospace Industries Association (AIA)—a major supporter of DII from the outset—has as its No. 1 guiding principle for members: "Adhere to the highest standards of ethical con-

duct" and to file this intent in writing. These codes are reviewed periodically to ensure their compliance.

Clearly, the defense industries' ethics stewardship is extremely transparent in its efforts.

*William J. Lewandowski, CEO
Aerospace Supply Chain Solutions*

SEVERNA PARK, MD.

MEASURING SUCCESS

Bill Sweetman's Commander's Intent commentary "Boot-Centric Warfare" (AW&ST April 1/8, p. 12), states that "Iraq and Afghanistan can be called a strategic success."

In those wars, roughly 5,000 Americans have died in combat and 42,000 have been wounded. The direct cost of those wars is \$1.4 trillion and climbing. The ultimate cost, including medical

care for veterans, could surpass \$4 trillion.

Iran is resurgent in the region, especially in Iraq, and increased oil production from Iraq

primarily ends up in China.

The Taliban are expected to play a major role in Afghanistan post-U.S. withdrawal. And the mineral riches of that country will probably end up in China as well.

If this counts as success, please God, never let me see failure.

Guy Wroble

DENVER, COLO.

LESS MEANS MORE

I enjoyed Michael Bruno's Up Front column, "Slaughterhouse Five," in which he requested a list of sacred cows that could be eliminated in order to tighten the U.S. budget (AW&ST Feb. 18, p. 12). I've mulled it over and have more to add:

- Remove troops from South Korea. Its economy must be 10 times that of North Korea, and the latter has no foreign troops. Our presence is definitely an aggravation, so let us get out and leave South Korea to pick up the slack.
- Remove troops from Japan. A lot of bad news is emanating from Okinawa

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awstletters@aviationweek.com

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about what harm our troops are doing there, but seldom is there any news of how they prove beneficial.

● Remove troops from Germany. WW II has been over for more than 60 years, the Berlin Wall has been down for more than 20, and the Cold War is over. Germany is now a good friend and has a strong economy. It can stand alone.

Rich Horvath

HAMILTON, OHIO

OFF-TARGET

Perhaps obscured by the haze of bankruptcy, Beechcraft CEO Bill Boisture has grossly missed the target with the most recent appeal of the light air support (LAS) contract (AW&ST April 1/8, p. 22). The company's AT-6 is an excellent and time-proven platform when it comes to primary flight training, but the same can be said of Embraer's A-29 with regards to light attack.

From the perspective of a former close-air-support pilot, I believe the U.S. Air Force was right to greenlight the A-29 team, (citing mission urgency), amid the on-again, off-again red tape surrounding the LAS acquisition.

Warfighters need battle-tested equipment as soon as possible. I suspect if Beechcraft did not have shareholders to appease, they might actually concede that the A-29 is better suited for the LAS mission. Beechcraft should focus on rebuilding itself by capitalizing on its strengths rather than trying to manufacture political weakness for Embraer, which ultimately hinders the mission capabilities of their mutually intended customer—the warfighter.

Kyle Woolf

MERCER ISLAND, WASH.

VISUAL IMPACT

Let's hope whoever put together the depiction of the two F/A-XXs for "Leading Edge" (AW&ST April 1/8, p. 13) is a better artist than a pilot. It appears that the wingman is doing a high-g pull directly into his flight lead!

Robert Steven

SOUTHLAKE, TEXAS



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George Brady

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David Ashton has been promoted to executive vice president-business development and technology at Wimborne, England-based Cobham plc from vice president of the company's Tactical Communications and Surveillance unit. **Julian Hellebrand** has been promoted to executive vice president for life-cycle management and program management from chief of staff to the CEO and group director of communications. **James Barber** has been named vice president of Cobham Defense Electronics-East, Lansdale, Pa. He was vice president/general manager of ITT Excelsis's Electronic Attack and Release Systems and had held those positions at the company's Integrated Structures unit.

Craig Hoskins has been appointed vice president-safety and technical affairs for Airbus Americas, Herndon, Va. He will succeed **Bill Bozin**, who plans to retire in July. Hoskins has been vice president/chief safety officer and was an A320 captain for JetBlue Airways.

Diego Rodriguez (see photos) has been named director of defense within the Aerospace Strategic Business Unit of Madrid-based Sener. He will remain director of space. Rodriguez also is a member of the boards of the Space Commission of the Spanish Association for Defense, Aeronautics and Space Technologies and Hisdesat. **Guido Casanova** has become Sao Paulo-based general manager in Brazil.

Bruce DeWitt has been appointed CEO of Minneapolis-based Logic PD. He was vice president/general manager of the Armament Systems Div. of Alliant Techsystems.

Joseph Doubleday has been named director of maintenance for Cambata Aviation International's StarPort at Orlando-Sanford (Fla.) International Airport. He was manager of the FAA's Aircraft Maintenance and Engineering Group in Oklahoma City.

Cliff Greenblatt (see photo) has been promoted to general counsel/vice president from deputy general counsel of TASC Inc., Chantilly, Va. He also has been an assistant general counsel at General Dynamics.

Thomas C. Moore has joined the Washington-based Center for Strategic and International Studies as senior fellow and deputy director of its Prolifera-

tion Prevention Program. He has been on the professional staffs of Senate Foreign Relations and Armed Services committees.

Ian Ludlow has been named general manager of Bombardier Aerospace's service center at Amsterdam's Schiphol International Airport.

Keith Chatten (see photo) has become vice president of engineering for Superior Air Parts, Coppell, Texas. He was associate vice president of engineering for Continental Motors.

U.S. Army Maj. Gen. David L. Mann has been nominated for promotion to lieutenant general and assignment as commanding general of U.S. Army Space and Missile Defense Command/Army Forces Strategic Command, Redstone Arsenal, Ala. He has been commanding general of U.S. Army Recruiting Command, Fort Knox, Ky. Brig. Gens. **Ole A. Knudson** and **Gwendolyn Bingham** have been nominated for promotion to major general. Knudson is program executive for programs and integration at the Missile Defense Agency, also at Redstone Arsenal, and Bingham is commanding general of White Sands Missile Range, N.M.

Constance A. Soloway (see photo) has been appointed vice president-human resources of the Northrop Grumman Corp.'s Linthicum, Md.-based Electronic Systems sector. She was vice president-human resources, office administration, facilities and real estate, environmental health and safety, and flight operations for the company's Enterprise Shared Services organization.

Patrick Fitzgerald has been named senior vice president-integrated marketing and communications of FedEx, Memphis, Tenn. He succeeds **Bill Margaritis**, who was corporate vice president-global communications and investor relations.

Greg Arend (see photos) has been promoted to director from manager of commercial programs and **George Brady** to director of product support

and simulator operations from director of simulation operations support, both at Flight-Safety International's simulation design, manufacture and support facility in Tulsa, Okla.

Simon Morris has become vice president of Fairfax, Va.-based ICF International's SH&E aviation practice. He was principal of A.T. Kearney's airport practice and has been a director of Birmingham (England) International Airport and Aeroporti di Roma Handling.

HONORS AND ELECTIONS

Richard C. Beird, former senior deputy U.S. coordinator for international communications and information policy at the U.S. State Department, has received the 2013 Satellite Leadership in Government Award from the Washington-based Satellite Industry Association. The award honors a government official or member of Congress for leadership and dedication to public service in working on issues affecting the satellite industry.

Eric Radtke, president of Sporty's Academy, Batavia, Ohio, has been named distinguished alumnus for 2013 for the University of Cincinnati's Clermont College. The award is given to individuals for professional accomplishment and community contributions. Radtke has been head of the Sporty's Pilot Shop flight school and director of the university's Professional Pilot Program.

He also is a director of the National Association of Flight Instructors.

Jeffrey Carrithers, who is president/CEO of Globalair.com, Louisville, Ky., has been named to the board of directors of the Kentucky Institute for Aerospace Education. ☐

SPACE

Smallest Super-Earth Yet

NASA's Kepler planet-finding space telescope has found three "super Earths" orbiting in the habitable zone of two distant stars, including one only 40% larger than Earth. Kepler-62f is believed to have a rocky composition. It and its larger habitable-zone companion, Kepler-62e, orbit a star dimmer and older than the Sun called a K2 dwarf that is 1,200 light years from Earth in the constellation Lyra. A third exoplanet—Kepler-69c—has been confirmed in the habitable zone of a Sun-like star in the constellation Cygnus 2,700 light years from Earth. It measures 70% larger than Earth, and has a 242-day orbit that approximates that of Venus in our Solar System. "We wouldn't describe these as Earth-like planets," says Thomas Barclay, the Kepler scientist at the Bay Area Environmental Research Institute in Sonoma, Calif., who was lead author on a Kepler-69 system paper published last week. "We simply don't know if other Earth-like planets are out there yet."

Gale Drop-In Wins Collier

The Mars Science Lab Curiosity project team at the NASA Jet Propulsion Laboratory has won the National Aeronautic Association's 2012 Robert J. Collier Trophy "in recognition of the extraordinary achievements of successfully landing Curiosity on Mars, advancing the nation's technological and engineering capabilities, and significantly improving humanity's understanding of ancient Martian habitable environments." Besides the technical achievement of landing in the Gale Crater, the award selection committee noted the Curiosity team's use of social

Lion To Continue Expansion Despite Crash

Indonesia's Lion Air will continue to grow its fleet, despite the April 13 incident at Bali's Ngurah Rai International Airport in which the airline's Boeing 737-800, local registration PK-LKS, landed in the sea—short of Runway 09—and broke in two.

All 108 people onboard survived, but 46 were hospitalized. Lion President Rusdi Kirana said none of the injuries were critical.

Masuri, an investigator from Indonesia's National Transportation Safety Committee, says the flight data recorder was recovered in good shape, but the cockpit voice recorder "has been corrupted by water." However, he is confident good-quality audio data can be extracted. He declined to speculate on the weather at the time of the accident, or whether wind shear may have been a factor, as some observers have suggested. Masuri, as do many Indonesians, goes by only one name.

The carrier's bookings remain strong and the airline is still scheduled to receive 24 737-900ERs and 12 ATR 72s this year, says Rusdi.

Lion was planning to introduce its Indonesian premium carrier, Batik Air, this month, but has delayed the inaugural flight to May 3. The anticipated ceremony has been canceled.



EMILANDOU

media. The award is scheduled to be presented May 9.

AIR TRANSPORT

Flight Delay Warning

The FAA predicts flights at 13 major U.S. airports will experience "heavy to moderate" delays because of sequester-driven air traffic controller furloughs slated to begin on April 21, including an average delay of 50 min. at Chicago O'Hare International Airport and maximum delay of 210 min. at Hartsfield-Jackson Atlanta International Airport. FAA Administrator Michael Huerta says maximum delays are likely to be

infrequent, but that the overall threat to airline performance and passenger convenience is real. Huerta and Transportation Secretary Ray LaHood identified the airports on April 18 and provided delay predictions for six of them.

EASA Nears A380 Wings AD

The European Aviation Safety Agency (EASA) is slowly nearing the issuance of the Airworthiness Directive (AD) that will include the guidelines on how operators have to modify wings of the in-service Airbus A380 fleet. EASA issued notification of a proposal for an AD last week that is based on 14 Airbus service bulletins: five yet to be issued

Airbus Expansion Nears Completion in Wichita

For the second time in a year, Airbus is expanding its airframe design and engineering center in Wichita's historic downtown to accommodate the staff it has been hiring to keep up with its A320, A350 and A380 programs.

Last year, Airbus Americas Engineering expanded on the assumption it would be adding another 100 staff members. The problem, Vice President John O'Leary says, is that it ended up hiring 150. With total staff nearing 400, relief will come on May 1 when refurbishment of a vacant office next door is completed. With the addition, the engineering center's floor space will be 10,000 sq. ft. Airbus opened the engineering office in 2002.

While Airbus's Wichita office supports all of its commercial aircraft programs and has conducted some A400M military transport

work, the increased load is not directly related to development of an A320 final assembly line in Mobile, Ala., which is to open in 2015. Nor is Wichita supporting the wing and fuselage fabrication work that Spirit AeroSystems provides from its Kinston, N.C., factory, says O'Leary, head of engineering for Airbus Americas. Wichita's largest workload is for the company's wing headquarters in Filton, England.

Besides supporting wing-strengthening for the A380, the Wichita center is engineering ribs, stringers and covers (skins) for the A320NEO. "We are approaching a milestone gate in the summer and are on track," O'Leary says of the latter program. The milestone is part of the transition from preliminary to detailed design.

The Wichita facility also has led design work for side panels of the A350's window belt in Section 13-14, which is aft of the cockpit and forward of the Section 15 center fuselage panel area that Spirit manufactures.

AW&ST/S&P Market Indices as of 4/17/2013



and another three are being modified. The AD itself will only be published once all the service bulletins are finalized. The process addresses the planned modification of rib feet and other components inside the wings of the in-service fleet and A380s that are in final assembly but still being built to the old standards. A total of 120 A380s are affected.

AEROSPACE BUSINESS

Daimler Out of EADS

Following French media group Lagardere, German car manufacturer Daimler has sold its remaining shareholding in EADS. The company sold a 7.5% stake for €37 (\$48) per share for a total of €2.2 billion, part of which was picked up by EADS itself. The move came a day after EADS concluded the buyback of a 1.56% stake from the French government for €480 million and on top of a 1.6% stake acquired from Lagardere for €500 million earlier this month. EADS spent another €600 million for 1.95% of its shares previously owned by Daimler, with the remainder going to institutional investors. The French government reduced its stake from 15% to 12% and Spain went from 5.2% to 4%. Germany controls 12%, and Spain, France and Germany hold a combined 28% stake.

DEFENSE

Osprey for COD?

The U.S. Navy is assessing whether the Bell/Boeing MV-22 can operate as a potential Carrier Onboard Delivery (COD) vehicle, in advance of a competition to replace the aging C-2C Greyhounds, which now perform that role. The tiltrotor was slated April 19 to conduct

“palletized cargo and cyclic operations” using the deck of the carrier USS Harry S. Truman, as the first phase of the assessment. In June, the second phase will begin with Navy operational testers evaluating the aircraft’s integration into “cyclic operations” on deck for six days. This will be crucial, as the V-22 cannot be allowed to slow the fast pace of operations on deck if it is to be a contender for the COD replacement program.

F-35 Stand-Up

Lt. Gen. Robert Schmide, deputy U.S. Marine Corps commandant for aviation, says the service plans to declare its first F-35C squadron operational in fiscal 2015, with the first deployment to Japan in fiscal 2017. The service will be the first to declare operational use of the single-engine, stealthy aircraft. Government auditors estimate “rework” costs for the first 10 lots of F-35s will total \$1.7 billion. These costs are referred to by program officials as “concurrency,” because testing activities are taking place concurrent to production of the early lots of aircraft by prime contractor Lockheed Martin. The projected price of retrofitting finished aircraft in the first four lots is \$900 million.

OBITUARY

Jim Swickard, a 40-year aviation communications veteran and contributor to Aviation Week’s *Business & Commercial Aviation* (BCA) magazine, died April 14 from a heart attack at home in Tucson, Ariz. He was 68. Swickard most recently edited the Intelligence column for BCA, and had edited Aviation Week’s *Business Aviation Bulletin* (BCA eBulletin) email. He operated his own marketing and communications company for 17 years after being director of marketing services for FlightSafety International and manager of corporate advertising for Rockwell International. Swickard further held marketing and communications roles with Rockwell’s Collins Avionics Group. He leaves his wife, Jessica Salerno, executive editor of BCA.

The Case for iPad Flight Plans

American Airlines may have unwittingly found a new use for the 8,500 iPads that its pilots now carry to hold aircraft documents and charts: electronic flight plans.

It turns out the computer “glitch” the company experienced on April 16 had nothing to do with the Sabre reservation system, as first reported, and everything to do with flight plans. The glitch caused a shutdown of the carrier’s U.S. network for several hours, resulting in the cancellation of hundreds of flights and lingering disruptions through the next day.

Two American pilots who spearheaded the iPad program explained to Aviation Week that it was the carrier’s internal flight operation system (FOS) that experienced problems, and when the FOS goes down, pilots do not have a way to print out their flight plans. With no flight plans in hand, aircraft cannot depart. The pilots were in Atlanta to participate in a session on electronic flight bags at Aviation Week’s MRO Americas conference when the disruption occurred.

According to David Clark, manager of American’s Connected Aircraft Program, pilots are required to print out and sign hard copies of the 19-page flight plans, which include associated manifest and weather information, at the gate before each departure.

Clark, as it turned out, had four days earlier tested a new application for the iPad on a flight from Dallas to Minneapolis in an MD-80. The program in part allows a pilot to download the flight plan onto an iPad rather than print it out. He says it was successful, and had planned to ask for approval to bring the capability to the fleet once more domestic and international tests were completed.

However, stranded in Atlanta by the shutdown, Clark and John Hale, American’s vice president for flight, began making phone calls back to Dallas to see if officials would clear pilots for certain flights to use their iPads for the flight plans. American officials ultimately decided against it, but the business case for moving to electronic flight plans appears to have been made.



Contributing columnist
Byron Callan is a director
at Capital Alpha Partners.

COMMENTARY

Flawed Logic

U.S. defense spending should be based on needs, not comparisons

As he was recently discussing the pivot of U.S. strategic emphasis to the Asia-Pacific region, Deputy Defense Secretary Ashton Carter repeated an assertion that the U.S. spends more on defense “than the next 16 largest militaries combined.” While Carter’s talking point is more or less technically correct, such a comparison does not indicate what an appropriate level of spending should be. A more useful way to think about U.S. defense expenditures compared with other countries’ is whether the output—military capabilities—is adequate to meet the demands of national security policies.



U.S. DEFENSE DEPARTMENT

First the facts: In March, the International Institute for Strategic Studies (IISS) released its annual publication, “The Military Balance,” that details world military spending. It shows the U.S. defense outlay for 2012 was \$646 billion. IISS estimates of expenditures for the next 16 countries on the list total \$657 billion, which is close enough to Carter’s comparison. Six of those 16 are members of NATO, and the U.S. has defense treaties with two others, Japan and South Korea. Israel and Australia, also on the list, are close U.S. allies.

China and Russia are the only two nations in the Top 16 that could be considered threats to the U.S., depending on circumstances and perspectives. By IISS’s reckoning, the only other country in the Top 25 deemed a threat by the U.S. is Iran, which is credited with \$14.7 billion in defense spending. The combined military outlays of China, Russia and Iran totaled \$186 billion last year, or 29% of U.S. spending.

But such a comparison is incomplete.

The hefty U.S. investments in defense since the 1970s have provided unique military capabilities compared with other states. Those include an ability to move tens of thousands of troops to virtually anywhere and support them for an extended period. With unrivaled intelligence, reconnaissance and surveillance assets, aerial tankers, combat aircraft and aircraft carriers, the U.S. can strike at pretty much any GPS coordinate.

Comparing U.S. spending with that of other nations, as Carter did, seems to suggest it might be better to peg expenditures to some sort of standard. Should the U.S. spend only five times that of the next two states that pose security challenges? Ten times? But other factors have to be considered, starting with comparability of defense outlays. The U.S. shells out about \$50 billion on military health care. It pays military personnel many times more in salaries and benefits than China’s People’s Liberation Army does for its personnel.

Moreover, weapons and services are acquired from companies with U.S. cost structures—not outsourced to India or procured from countries where manufacturing wages are \$1-2 per hour.

A second factor is that U.S. defense spending is also driven by threats that do not even show up in “The Military Balance,” such as those from smaller nations and non-state organizations. There are no data on the Taliban’s defense expenditures in 2012. Yet in fiscal 2013, the Defense Department’s Overseas Contingency Operation budget was \$88 billion—and that says nothing about the equipment that was paid for in the base budget but is used to support operations in Afghanistan. Similarly, the IISS does not attempt to measure North Korea’s defense expenditures. The CIA estimated that nation’s entire GDP was only \$40 billion in 2011, yet its missile and nuclear programs recently prompted the Obama administration move to buy 14 additional Ground-Based Interceptor missiles.

A final factor showing why comparing spending levels is not the best approach to defense policy is that low investments made by adversaries can prompt costly responses by the U.S. and its allies. A \$100 bag of calcium ammonium nitrate fertilizer, combined with some propane, a tarpaulin and some other inexpensive devices can fabricate 6-8 improvised explosive devices (IEDs). The use of IEDs in Iraq and Afghanistan triggered more than \$45 billion of U.S. spending on armored vehicles—such as those shown above—and at least another \$10 billion for training and devices to detect and defeat IEDs. “The Military Balance” shows no data for the defense expenditures of Hamas in Gaza or for Hezbollah in Lebanon, but low-cost rockets used by those groups have spurred major expenditures by Israel on the Iron Dome defense system.

Carter’s comparison is a dramatic one, made at a time when the U.S. is trying to rein in defense spending. But he fails to define what the relationship should be between U.S. outlays and those of other countries. A more useful way to make the comparison is to look at what the U.S. gets for its money, and whether it is enough to meet the demands of national security policies. ☐

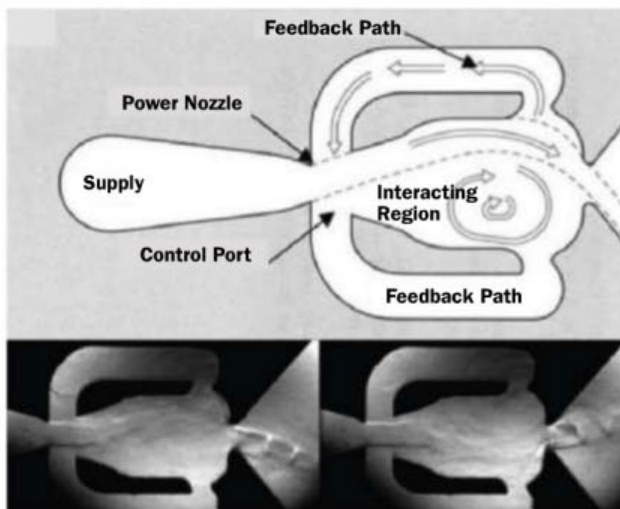


COMMENTARY

Trick of the Tail

On-demand flow control could mean fuel-saving smaller vertical tails

An airliner's vertical tail is hardly used in normal flight conditions, its size instead determined by one rare, worst-case scenario: the loss of an engine on take-off. If the power of the rudder could be increased on demand, then a smaller tail could be fitted across an entire family of aircraft—from the shortest fuselage to the longest—to reduce weight, drag and fuel burn.



On an aircraft with high-bypass turbofans slung under the wing, the vertical tail must be able to generate enough sideforce to counteract the asymmetric thrust of the operational engine at full power and the drag of the windmilling fan on the failed powerplant—at takeoff airspeeds when rudder effectiveness is limited.

On an airliner as large as the Airbus A380, that requires a vertical tail almost 48 ft. tall—longer than the semi-span of a regional jet wing. Also, the vertical tail usually is sized for the shortest variant in an aircraft family, where the rudder's moment arm is at its minimum, and therefore oversized for the longer versions.

Sub-scale wind-tunnel tests have shown that active flow control (AFC) over the rudder using "sweeping jet" actuators on the trailing edge of the vertical stabilizer can increase sideforce by more than 50% at maximum rudder deflection. Now NASA plans full-scale ground and flight tests of the system on a Boeing 757 vertical tail.

The research agency's goal is to

increase sideforce by 20% on demand at takeoff airspeeds. This would allow the vertical tail to be reduced in size sufficiently to trim aircraft fuel burn by 1-2%, says Tony Washburn, chief technologist for NASA's Environmentally Responsible Aviation (ERA) project. AFC could be used on the smallest member of a family, but is not needed on stretched variants.

Sweeping-jet actuators were developed more than 50 years ago at the Harry Diamond Research Laboratories, as fluidic amplifiers for analog computers. They are used as oscillating windshield washers on cars, in showerheads and in irrigation systems. Sweeping jets are attractive for AFC because they have no moving parts and use less air than steady blowing.

A typical actuator (pictured) emits a continuous jet that flips from one side of the nozzle to the other. The jet attaches the one wall of the main cavity and curves as it rushes to the outlet, increasing pressure at the inlet to the feedback channel. This creates the flow in the feedback path that pushes the jet to the opposite side of the cav-

ity, where the process repeats.

This feedback loop causes the jet to oscillate from side to side in a continuous motion that spreads the flow and is more effective than steady blowing at reenergizing airflow over the deflected rudder, requiring substantially less mass flow.

Sweeping jets have been used before in AFC experiments: on a tiltrotor model to reduce rotor download on the wing in the hover by re-attaching separated flow over flaps deflected 90 deg.; and on a lambda-planform wing model to increase lift on approach by delaying separation.

Funded under Phase 2 of the ERA project, the full-scale ground and flight tests on a 757 vertical tail will take the AFC actuation system to a technology readiness level of six by the end of 2014, mature enough to be used in product development. The sweeping jets will be installed on the vertical stabilizer along the hinge line, rather than on the moving rudder itself, for easier integration.

Tests of a 12%-scale vertical-tail model in a California Institute of Technology tunnel in 2012 achieved a 50% increase in sideforce with a moment coefficient (C_m) of 1.5% and minimal incremental drag. C_m is the ratio of jet to freestream momentum, and a measure of the blowing mass-flow required: 2% is the maximum for practical application. Tests suggest a C_p of just 0.2% would be sufficient to achieve a 20% increase in tail lift.

The tests provided pointers for AFC design and integration, including that actuator jet velocities should be at least three times higher than freestream airspeed, but should remain subsonic to be most effective. This means larger nozzles work best as smaller ones reach sonic speed, at which point the jet does not spread as wide.

Tests on the full-size 757 tail are planned for the second half of the year in the 40 x 80-ft. tunnel at the National Full-scale Aerodynamics Complex. "Our wind-tunnel test will determine if the aerodynamic effect of the scaled-up actuator is predictable based on the sub-scale tests," says Washburn.

Modification of an aircraft for flight tests is to begin around year-end and be completed early next summer. Flight tests are expected near the end of 2014 and will include simulated engine-out conditions to demonstrate on-demand enhancement of vertical tail effectiveness. ☐

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By Pierre Sparaco

*Former Paris Bureau Chief
Pierre Sparaco has covered
aviation and aerospace
since the 1960s.*

COMMENTARY

Boeing's French Imprint

Boeing and Airbus, considered an odd coupling by some, provide a much-needed symbiosis

Boeing's 737 twinjet, aviation's most successful commercial transport, is breaking new production records: 38 aircraft are now produced each month at the manufacturer's Renton, Wash., facilities and soon, 42. Recently, the 7,500th 737 was delivered and, in the wake of the MAX next-generation model's promising start, the show is certain to go on for decades to come.

Total orders today exceed 10,500 aircraft from as many as 265 customers. The program's supply chain comprises 325 companies in 41 U.S. states and Puerto Rico, and four countries—Canada, China, France and South Korea. It is considered by many industry observers to be the global supply chain par excellence.

"The 737 is a genuine success story, not only for Boeing, but also for France," says Yves Galland, president of Boeing France, who was instrumental in developing business links between Renton and the French aerospace industry. Although rarely mentioned, each additional 737 order brings essential work to France, supporting 12,500 jobs (and another 12,500 "indirect" positions), an unprecedented contribution involving the 15 members of the so-called Boeing French Team.

According to French historians, William Boeing met French aviation pioneer Louis Paulhan in 1910 and their close relationship contributed to establishing a connection that contin-



The Boeing 737's production rate is being increased to 42 aircraft per month from 38.

ues to work well for the entities they established. But, of course, this is a mere footnote of history. Hard facts show that French aerospace supply chain players were anxious to diversify their revenues and tried hard to obtain business from Boeing Commercial Airplanes. And they gradually succeeded.

The decision to establish the Snecma/General Electric engine joint venture was a major contributor to forging enhanced business links between the U.S. and France. Again, forward-looking personal relationships, in this case between visionary CEOs—GE's Gerhard Neumann and Snecma's Rene Ravaut—helped to pave the way for CFM International and its innova-

tive CFM56. The engine was selected under an exclusivity pact to equip the reengineered 737. The transatlantic joint venture became the biggest Franco-American business undertaking to date and is expected to be extended into the next several decades as the Leap engine gradually succeeds the CFM56.

In such a positive context, French suppliers were encouraged to submit offers to Renton. No offset agreement was considered: Air France, the dominant French airline, with its long history of operating 737s, felt inclined to acquire Airbus A320s, impelled by a touch of economic patriotism. But, later, the airline also ranked the 777 as the best aircraft in its category. The flag carrier now operates more than 50 777s and was the all-cargo 777F launch customer. It also has plans to acquire 787s, as does KLM. The French air force operates aerial refueling Boeing KC-135FRs and E-3F Sentry AWACS (airborne warning and control systems) aircraft.

Galland has continued to explore how best to expand business between Renton and France and, to this end, has transformed the 787 program into another opportunity for such links. The French members of the supply chain now include Messier-Bugatti-Dowty, Thales Avionics, Michelin, Dassault Systemes, Aubert & Duval, Daher Socata and several affiliates of the Zodiac Aerospace Group. According to Galland, France's share in the Boeing supply chain generates €4.5 billion in annual revenues (\$5.8 billion), including €1.5 billion in spare parts.

France's share in the 737 program is rarely celebrated. Indeed, it is hardly mentioned by Gifas, the French aerospace industries association, and this omission casts new light on the Airbus-Boeing rivalry. Or gives a new meaning to the duopoly: The two manufacturers have a lot in common, including a similar supply chain, but are careful to avoid acknowledging this closeness. The reality is they need each other, and know that a duopoly is the bare minimum the airline industry could accept to protect a robust spirit of competition. Would-be competitors, in China and Russia, still have a long way to go. And that is why France's healthy share in the 737 program is most welcome. ☺



By Adrian Schofield

Senior Air Transport Editor Adrian Schofield blogs at: AviationWeek.com/thingswithwings
Adrian_Schofield@aviationweek.com

COMMENTARY

Domestic Dynamo

Local markets give Jetstar a foundation for overseas growth

Australia-based low-cost carrier Jetstar Airways is often in the headlines due to its rapid expansion into Asia. But as with other successful airline models, its forays into new overseas markets are built on strong performance in its own backyard.

The Jetstar group is the low-cost subsidiary of the Qantas group, and includes joint-venture franchises established in Singapore, Japan and Vietnam, with Hong Kong next on the list. Qantas is channeling most of its international growth through Jetstar these days, which has become one of the leading players in Asia's low-cost carrier boom.

Although the spotlight is on its Asian franchises, about 70% of the Jetstar group's 100 aircraft are devoted to the core Jetstar Airways operation in Australia and New Zealand. Eleven of these are Airbus A330s for international flights, and the remaining 58 are A320-family aircraft for flights within and between the two countries.

Jetstar's capacity on Australian domestic routes is up nearly 15% for the first eight months of its fiscal year. Expansion has also been dramatic in New Zealand, with passenger numbers expected to rise 20% this year. "We see strong sustainable growth [potential] in both markets," says David Hall, who heads Jetstar's operations within Australia and New Zealand.

The Australian domestic market has increasingly become a battleground between the Qantas and Virgin Australia groups in recent years, which has resulted in a surge in capacity. This has in turn put pressure on yields.

Hall tells Aviation Week that Jetstar "will respond to the capacity our competitors are bringing in." He notes that the Qantas group strategy is to maintain a 65% domestic market share, and Jetstar will contribute to that aim. "We'll defend [the 65%]," says Hall. Even if boosting capacity might cause short-term pain, "it is important for long-term positioning."

The Qantas group's dual-brand strat-

egy allows it to assess whether the low-cost or full-service product is best suited to each domestic market, says Hall. For example, starting June 4 Jetstar will be replacing Qantas on its route from Sydney to the tourist destination of Ayers Rock (Uluru) in central Australia.

Hall says this switch is being made because Qantas was losing money on the route. But Jetstar, with its lower cost and fare base, is expected to stimulate demand in this market, he says. Ayers Rock will be Jetstar's 19th domestic destination.

Virgin Australia has stated that it is targeting Jetstar with its plan to purchase a majority stake in low-cost carrier Tiger Airways Australia, which operates domestic routes. However, Hall says he is not losing any sleep over the challenge and that Jetstar remains focused on its own operation. He notes that Jetstar has a "scale advantage" over Tiger. While Jetstar has about 60 aircraft in its Australian operation, Tiger has 11. This gives Jetstar an edge on costs, says Hall.

Meanwhile, Jetstar has captured 22% of the New Zealand domestic market. Unlike in the Australian domestic market and the routes between

the two countries, Jetstar is the only Qantas presence on flights within New Zealand.

Hall says he would like to see the Jetstar share grow to 30%, which would be a "good position" in a market dominated by an incumbent national carrier like Air New Zealand. This would mean adding more aircraft, and Hall says such a move "is not inconceivable, and certainly [within] a reasonable time frame."

Any expansion would have to be backed by a strong business case, since Jetstar's operations in Australia and Asia are also growing and are therefore competing for aircraft and capital. But Hall stresses that New Zealand "has a good case and a good market."

The carrier has nine A320s based in New Zealand, with six in Auckland and three in Christchurch. These are used on domestic trunk routes and also handle Jetstar's flights between Australia and New Zealand.

Jetstar's growth ambitions will be supported by its very healthy order book, mainly consisting of an order for 110 A320s that was announced by parent Qantas in 2011. Thirty-two of the aircraft will be current-generation A320s, and 78 will be A320 NEOs, which are scheduled for delivery from fiscal 2016. Hall says these aircraft will be used for expansion in the Asian joint ventures, fleet replacement and some network growth in the Australia and New Zealand operation.

The Qantas group has also ordered 14 Boeing 787-8s to be used by Jetstar. They will replace the A330s, which will be transferred to the Qantas mainline operation. First delivery was expected in August, but Qantas now believes it will slip by up to two months.



KEITH GASKELL



COMMENTARY

Use It or Lose It

Woerner worries ISS is underutilized

More than a year after astronauts and cosmonauts completed the International Space Station, the pace of its utilization continues to lag. The Center for the Advancement of Science in Space (Casis), a Florida-based non-profit set up to organize and promote use of the U.S. National Laboratory portion of the station, finally appears to be getting its oar in the water after an unconscionable startup delay caused by bureaucratic wrangling. But priceless time has been lost, and probably continues to be, as the U.S. gets up to speed using its 50% of the orbiting laboratory.

The problem is not restricted to U.S. utilization. Johann-Dietrich Woerner (see photo), who heads Germany's space program as chairman of the executive board of the German aerospace center (DLR), says he is frustrated with Europe's use of the on-orbit research capability it has acquired through development of the Columbus laboratory module and the Automated Transfer Vehicle.

"We, the whole community—Americans, Russians, Canadians, Germans, Europeans, Japanese—invested a lot of money into the space station," Woerner says. "And we, at least the Germans, invested to use it not just to have a flying object. [I]t is our deep understanding that we should use it now, for science, development and research in general."

Woerner puts a diplomatic gloss on frustration voiced elsewhere about the slow pace of getting the station up to speed. And he worries that, at least in Europe, other nations appear to be backing away from space station research even before it gets well underway.

"We are a little bit concerned about the situation in Europe, because when we discussed it in the last European Space Agency (ESA) council on ministerial level, we saw that many other countries are reducing their interest in the station," says Woerner.

Among ESA member states, he says, only the U.K., Switzerland and Germany increased their contribution to ISS activities. France cut its station spending, leaving Germany to pick up the slack to the point that it now funds about half of the European contribu-



tion, up from 43% before the ministerial in Naples, Italy, last fall.

"Our intention was to have a constant contribution, but because France reduced its [portion], we said we have to [make up the difference]," says Woerner.

The German space chief told an audience at this year's National Space Symposium in Colorado Springs that before starting a project, it is always important to ask why it is being pursued, because once a large space development gets started it is difficult to stop. For the space station, the answer goes beyond microgravity research to fields of research not even considered when the orbiting facility was designed and built. "At the beginning, ISS was thought to be only for specialists in microgravity experiments," he says. "It turns out that ISS is much more valuable. Look to [the Alpha Magnetic Spectrometer] (AMS)."

The last major payload delivered to the ISS by space shuttle, the AMS was designed to collect and study subatomic particles originating in space.

The international AMS team re-

cently published its first scientific paper, reporting an usually high count of positrons that could lend weight to the theory that the particles are generated when dark matter collides and annihilates itself. But positrons may also be generated by pulsars, and researchers are happy with the long-duration exposure the AMS will receive on the station because it will add data to the statistics that will shape future conclusions about the positron sources.

The ability to repeat experiments in the same low-gravity, high-vacuum environment can also have benefits in biomedical research, materials science and Earth observation, Woerner says. His U.S. colleague, NASA's associate administrator for human exploration and operations William Gerstenmaier, believes the "tipping point" for deeper human exploration in space is likely to be reached on the ISS, since it is the only facility able to support the research that can generate a return on investment for commercial space activities. If an orbiting pot of gold or killer app is found there, it can lower the cost of access to space for all kinds of exploration (AW&ST April 1, p. 56).

Like NASA, which is relying on Casis to promote commercial exploitation of the ISS, Woerner says government's primary role is that of enabler rather than entrepreneur. "I'm not a missionary to convince industry how to make money. That's their job—[as is innovation]. We can help open the doors."

Gerstenmaier and his colleagues in NASA's human-spaceflight endeavor may soon get a chance to open a door for Dennis Tito's ambitious plan to send a man and woman on a 501-day flight around Mars beginning in 2018. Taber MacCallum, chief technology officer for Tito's non-profit Inspiration Mars venture, says it is likely the closed-loop environmental and life support systems (ECLSS) that will be necessary for the Mars flyaround to succeed are likely to be tested on the space station. An ECLSS expert who spent two years in the Biosphere 2 experimental closed-loop habitat, MacCallum says for simplicity and speed, the Mars ECLSS will be based on station systems. And for the sake of fidelity, they will need to be tested on the station.

"That's what it's for," MacCallum says. ☼



By Michael Bruno

Senior Policy Editor
Michael Bruno blogs at:
AviationWeek.com/ares
michael_bruno@aviationweek.com

COMMENTARY

Meet the Enemy

Top threat to the U.S.: the rest of the world, or us?

Every new warning of war voiced by North Korea, or act of terrorism within the U.S., drives home security officials' cautions about the "era of persistent conflict." So it is a heck of a time to decapitate national intelligence capabilities—but that is exactly what the 2011 Budget Control Act cuts will do.

"We're going to do away with capabilities we can't get back," says James Clapper, director of national intelligence. Testifying last week before the Senate Armed Services Committee, Clapper said the effects of sequestration will be "insidious" to the intelligence community's 16 military and civilian agencies. "The capability we cut out today, you won't know about that; you won't notice it. The public won't notice it. You'll notice it only when we have a failure."

In many ways, sequestration is a greater danger to intelligence capabilities than military capabilities, because intel relies so much on human analysis more than anything else, even technological superiority. In planning budgets, Clapper has worked to protect capabilities that are widely used, like overhead reconnaissance satellites. But the black world is made up of niche analysts who are experts on forgotten corners of the globe. Protecting such "capabilities" is nearly impossible when sequestration requires both furloughs and automatic budget rescissions to programs.

For comparison, think of how long it took the U.S. to gather good intelligence in its wars in Iraq and Afghanistan, despite nearly unlimited budgets. Now imagine new conflicts in the Asia-Pacific region, Africa or little known remote places, with fewer analysts and less money to figure them out. ☹

PATHFINDER

NASA plans a mission concept review this summer to wring out its bold proposal to capture a small near-Earth asteroid and place it in "translunar space" for study by spacewalking astronauts

EPHRAIM LINDOV



'We're going to do away with capabilities we can't get back.'

**JAMES CLAPPER
DIRECTOR OF NATIONAL
INTELLIGENCE**

(*AW&ST* April 1/8, p. 17). But the agency is well along in connecting dots for the mission, which Human Exploration and Operations chief William Gerstenmaier describes as a marriage of the disparate capabilities that would be needed to return samples—and perhaps eventually humans—from Mars and beyond.

"You can do exactly the same technique with sample returns from Mars," he told a Space Transportation Association luncheon on Capitol Hill last week. "None of this is really wasted activity. It's not unique to the asteroid mission." Still to be determined, however, are specifics, such as the rocket that will launch a spacecraft rigged with a 60-ft.-dia. capture mechanism that may be an inflatable "trash bag." The probe also would hold 12 metric tons of xenon fuel for the solar-electric Hall thrusters that would "nudge" the target

asteroid into a "deep retrograde" orbit around the Moon.

Getting the empty spacecraft to the target will take 1.8 years, with another three years to bring the 500 metric-ton object into a stable orbit between the first and second Earth-Moon Lagrangian points. As early as the first possible crewed flight lofted by a heavy-lift Space Launch System rocket in 2021, he says, astronauts would spend 22 days on the asteroid-study mission in a cramped Orion capsule—and nine of those days all on their own while awaiting the proper Earth-Moon lineup for a gravity assist home. That capability and experience feeds into future, far-out missions. Says Gerstenmaier, "This is what we really need to do to break the tie with the planet and start moving out from beyond Earth orbit." ☹

SEEING RED

A final word of warning: Don't think your summer holiday travel plans survived sequestration just because you make it through the airport security line in time for takeoff. You also have to hope each flight arrives on time, or does not suffer other hiccups caused by an expected increase in air traffic congestion.

Not only will air traffic controllers be furloughed beginning April 21, but those left on duty also have to manage the ripple effects if the FAA proceeds with plans to drop funding for 149 contract air traffic control towers in June. Controllers on duty will be consolidated to minimize effects, but in major facilities such as Hartsfield-Jackson Atlanta International Airport or Chicago's O'Hare International Airport that means secondary towers could be abandoned, taking with them the runways only they can control. Fewer runways means fewer takeoffs and landings, of course.

"Something will have to give," says Jim Marinitti, the National Air Traffic Controllers Association representative at the Miami Tower and Terminal Radar Area Approach Control. "Safety is our No. 1 priority, but it will come at a cost of efficiency and capacity. If we cannot open the Fort Lauderdale final or an extra [Miami International Airport] arrival position during a busy push, that means we'll have to reduce the arrival rate." ☹

Slips of State

French auditors cite weaknesses in government control of defense sector

Amy Svitak **Paris**

France has maintained a degree of state control over its strategic defense industries for decades, but government bungling in managing its shareholdings has led to calls instead for U.S.-style veto power over ownership changes on national security grounds, a regulatory shift that is anathema to European Union anti-protectionism rules.

Over the past 10 years, the French state has often proved unable to act with a single voice, and in some instances displayed rank incompetence in handling its equity interests in key defense groups, according to France's audit agency, the Cour des Comptes, an approach that has left the government in a weakened position as shareholder in the very companies it wants to influence.

As it privatized and reorganized the country's aerospace and defense industry, the French government kept significant shareholdings in key companies in a bid to protect an industrial base it viewed as essential to national security. But occasionally poor stewardship of its holdings has gradually eroded the state's ability to achieve that goal, the report reveals. The government's role has deteriorated to where competing companies have become entangled with each other, and with the nation's strategic interests.

European aerospace giant EADS—co-builder of the Eurofighter Typhoon—now is the biggest minority shareholder in Dassault Aviation, builder of the Rafale, the European fighter's main competitor. Dassault, in turn, controls a blocking minority stake—through its holding in electronics supplier Thales—in shipbuilder DCNS, a mostly state-owned company essential to France's nuclear deterrent. A blocking minority gives the minority shareholder rights to reject certain transactions voted by the majority.

"The maneuvering room for the gov-

ernment as a customer of the defense industry is an important parameter for the future of the industrial fabric," says Didier Migaud, president of the Cour des Comptes, which this month released a report: "Weaknesses of State Shareholdings in Defense Companies." To maintain strategic influence, the state needs to adopt a comprehensive strategy for dealing with its industrial partners, he says.

Antoine Gelain, a defense industry

"Government ownership in defense companies is an approach that is out of date, all the more so as the French state does not have any kind of industrial strategy, so they cannot use their shareholdings to influence the industry because they do not know what direction they want the industry to go," Gelain says, adding that government ownership undermines the value of these companies by limiting managerial freedom to maneuver. "It penalizes not only the companies, but also the French government as a shareholder."

In their report, French auditors concede that the nation's record of government shareholding in key defense industrial groups is not all bad. French companies that were once hidebound, uncompetitive, state-owned monopolies have learned to act on the global market and are now among the industry's top ranks by revenue.

But some of these same companies have resisted following the government's direction and have on occasion outmaneuvered the state's efforts to guide strategic interests. The most pertinent example is Dassault, a family-controlled company in



France's audit agency says the state has inadvertently ceded control of certain companies to Rafale prime contractor Dassault Aviation.

analyst with Octagon Partners in London, says that combining a coherent technology and industrial strategy with so-called "golden shares" or other specific control mechanisms could address what has become a conflict of interest between the French state as shareholder and its role as a customer.

which the government has gradually lost shareholding power over the past three decades, much of it through missteps in handling its equity interest.

Moreover, the state has inadvertently ceded to Dassault control of key strategic interests in Thales, in which the aircraft manufacturer holds a 26% stake; and

in DCNS, in which Thales since early 2012 has held a 35% blocking minority.

As a result, the government has at times been unable to impose its will on Thales, and to a lesser degree DCNS, a position for which former Dassault Chief Executive Charles Edelstenne says the state has only itself to blame after privatizing certain strategic defense industries, only to regret some of the inevitable consequences.

"Privatization of these companies was a political act—a sovereign decision by those elected by the French people to make national policy," Edelstenne says. "But once the state has decided to privatize these companies, it is difficult to criticize private shareholders for exercising rights the law gives them, and which the state has accepted through shareholder agreements."

The audit agency also worries that Dassault and the French government have differences when it comes to the future direction of DCNS. While the state wants to keep control of the group, Dassault would prefer to see it

"Maneuvering room for the government as a customer of the defense industry is an important parameter for the future of the industrial fabric"

For example, following the 2005 merger of aerospace supplier Snecma and defense group Sagem, France retained a 30% voting share in the combined company, renamed Safran. Two years later, the French agency that manages state holdings failed to meet a regulatory deadline to disclose through France's stock market authority that it had breached a threshold for accumulating Safran shares, a reporting oversight that cost the state an opportunity to increase its holding to 40%.

Even if it remains the largest

al security through the Exon-Florio amendment.

Such a move could draw negative attention from the EU, which the audit agency says views Exon-Florio as a protectionist measure. In its report, the agency notes only Italy has put in place a regulation that appears to borrow from U.S. law—a March 2012 decree that limits the government's veto power on ownership changes but provides special powers with respect to defense and national security interests.

The EU for years had pressured Italy to open its domestic markets to foreign ownership, though it remains unclear whether this

limited measure, known as the "Golden Power" regulation, will run afoul of the union's rules.

"In the absence, at this juncture, of an Exon-Florio-type regulation, holding stock positions with a majority or blocking minority in these companies, either alone or in participation with other actors, is the favored route, given that state financial means are now limited," the audit agency says, noting that the French government could reduce defense spending based on a new military strategy expected to be released in the coming weeks.

Short of regulatory reform, Gelain says, such budgetary pressure could induce the French state to reduce government interest in defense companies.

"A key step in triggering some level of industry consolidation in Europe is for the government to relinquish its shareholdings. There are other ways to preserve sovereignty over national security interests without the government being shareholder in these companies," he says. "Not only would it make good business sense to reduce government ownership, but the state could raise money to sustain the military budget at a decent level... by selling these stakes in these companies." ■



run as a more industrial entity through Thales.

In its report, the audit agency attributes much of the state's diminished shareholder power to outmaneuvering on the part of defense companies, but in some cases it has been the result of administrative incompetence.

and only major shareholder, the state has limited powers over Safran, as was illustrated in 2012 when the company's board of directors was able to block a government-backed exchange of assets between Thales and Safran in the areas of optronics and avionics.

As the French state's ownership in and influence over its defense industry wanes, the court asserts the govern-

Selex Reboot

New markets are targeted following company shake-up

Bill Sweetman Rio de Janeiro

The legal and ethical troubles that have enveloped Finmeccanica have, so far, left its electronics businesses largely untouched. That has allowed the company to continue with a major restructuring, formally completed in January, that has fused together three Selex-branded units into Selex Electronic Systems—Selex ES—that with 17,500 people and €3.5 billion (\$4.6 billion) in sales is the single biggest unit in the €17 billion Italian company.

Now, Selex ES CEO Fabrizio Giulianini, in an interview at the LAAD defense show in Rio de Janeiro, says that the new unit can be a “world champion” in both its new and traditional markets, citing both existing businesses, such as fighter radars, along with new ventures like homeland security and cybersecurity, as places where it can expand.

While the former Selex companies were product-centric—Selex Galileo on sensors, Eltag on communications and Systemi Integrati on large-scale systems—Selex ES is divided into “customer-facing” divisions: airborne and space; land and naval; and a third unit, security and smart systems, that is primarily aimed at commercial, institutional and government non-military customers. “We needed to eliminate one of the issues that we had in the past, which was competition at the divisional level,” Giulianini says. Too often, Selex companies would find themselves on opposing teams. The new company will develop stronger central organizations for engineering and manufacturing, he says.

Giulianini expects that Selex ES will shut down some product lines “that may not be attractive to the market. We don’t plan to exit any specific business sector, but we have some duplication, and we need the resources to launch new products, such as cyber.”

The biggest single group of Selex employees is in Italy, but the company has 5,000 people in the U.K. and intends to become “more and more global” as traditional markets stagnate, Giulianini says. In a move reminiscent of BAE Systems’ multi-domicile strategy, Selex ES is targeting key markets with joint ventures and subsidiaries.

Brazil is one of these, Giulianini says, and the company just launched Selex ES do Brasil. Its initial task is to support radars on Brazilian systems such as the F-5BR (with Grifo) and the KC-390, which will be outfitted with a Gabbiano radar. “One of the biggest opportunities we are pursuing here is the F-X2 fighter,” Giulianini says. Saab’s JAS 39E contender includes Selex’s Raven ES-05 radar as well as the company’s Skyward-G infrared search-and-track (IRST) and identification friend-or-foe systems. Selex already has an agreement with AEL Sistemas—Brazil’s largest avionics supplier and an Elbit subsid-

iary—to support the Raven in-country if Gripen is selected.

Selex wants to bring its experience to bear on Brazil’s potentially huge SisGAAs (Blue Amazon Management System), a project to establish surveillance and security in Brazil’s littoral waters. “We understand the strategy, that these big projects will be awarded to local primes,” Giulianini states, “but what we have said to the Brazilian armed forces and industry is that Brazil is buying a lot of large programs”—not just SisGAAs, but the SisFron border security project and Prosuper warship program—“and that these need to be addressed in a coherent way.” Selex was the lead integrator for Italy’s ForzaNec digital army program, and “we have put our experience on the table,” Giulianini says. “We learned something from our mistakes.”

The company also chose LAAD for the announcement of its light intelligence, surveillance and reconnaissance system, comprising a compact version of the Atos mission system, Gabbiano radar and other sensors integrated on the Italian-developed Omasud Skycar light twin-engine aircraft. This “cross-division” project is seen as a solution for

countries requiring surveillance over long coastlines or borders on a limited budget—the small, simple platform makes it possible to distribute the fleet around multiple bases. It is the company’s second air system announcement this year, following the disclosure of the Hammerhead project for an unmanned version of the Piaggio P180.

Other strategic markets are India and Saudi Arabia, where the foundation of the company’s presence is via the Tornado F3 and Typhoon. “We have €14 million on board each Typhoon,” Giulianini notes, including the radar, IRST and electronic warfare system, and Selex is supporting Typhoon campaigns in the United Arab Emirates, Malaysia and Kuwait.

The Selex CEO now sees the Captor-E active, electronically scanned array radar as a near-certainty for the Typhoon, and like some other Eurofighter participants detects a renewed ambition and determi-

nation among the partner governments to push the program forward. However, his view of the fighter’s chances in South Korea, an upcoming decision, is that “I would have been more optimistic a few weeks ago,” with the confrontation in the region now pointing to a U.S. order.

The new “security and smart systems” unit combines elements from the former Systemi Integrati and Eltag units, Giulianini says. Significant recent wins in this area include NATO’s Computer Incident Response Capability and a technology partner arrangement with Expo 2015 in Milan—the latter, a world fair focused on sustainable technology, will be set up as a small “smart city” with Selex providing security and information systems. The new Selex division is bidding for the event security role in the 2014 Glasgow Commonwealth games in Scotland.

Some of this work could flow back into aviation, Giulianini says, through the emerging idea of an “integrated airport” in which ground and air surveillance radar, air traffic management, ground movement control, baggage handling and security would be combined. ☐



Selex ES CEO
Fabrizio Giulianini

Big and New

Uninterested in used aircraft, Chinese buyers may wield considerable clout in business aviation markets

Bradley Perrett Shanghai

When a group of buyers insists on buying new products, never secondhand, and likes to update frequently, it wields disproportionate influence on the market. Business aircraft buyers in China, it seems, comprise such a group.

Chinese buyers like big aircraft. Unless their tastes change considerably—and so far there are scant signs that they are—mainland China is likely to heavily import newly built large, super-large and ultra-long-range business jets, plus corporate versions of airliners. It will export them as used aircraft. Logically, that will boost the supply of big business aircraft in the global secondhand market, perhaps nudging their prices lower.

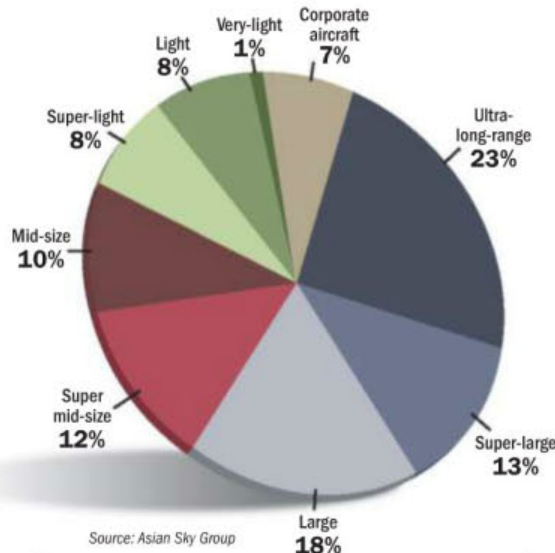
The phenomenon, if it fully develops, will be driven by a widely understood cultural factor, the Chinese keenness for prestige. A big aircraft is more prestigious than a small one. A secondhand aircraft simply will not do. And an owner will not want to be seen flying around in the same jet after six or seven years.

So far, the strong preference for size and newness is confirmed in the belatedly blossoming Chinese business aircraft market. The habit of frequently updating aircraft is only expected by some, and suspected by others. The market took off only five years ago, so it is too soon to gauge the average frequency of updates.

Of mainland China's 193 business aircraft, 61% are large, super-large or ultra-long-range jets, or corporate adaptations of airliners, according to a survey conducted by Hong Kong business aviation consultancy Asian Sky Group. This preference was expected when the Chinese market first began to move. About two years ago, manufacturers began reporting rising interest in smaller aircraft, and they did so again at the Asian Business Aviation Conference and Exhibition held here April 16-18.

But Asian Sky Group's figures show little trend movement in favor of the smaller aircraft. Although there are more of them in mainland China now than a few years ago, from late-2011 to late-2012 the most prominent rises in mainland Chinese business aircraft fleets were still among the big ones, notably the larger Gulfstreams, Dassaults

Chinese Business Aircraft



Aircraft of at least large-cabin size account for 61% of Chinese mainland business jets.

and adapted Airbuses and Boeings.

"In the past three or four months I have had several customers who have wanted an aircraft and said 'I just want the biggest one,'" says Ronan Li, head of the private leasing operation of ICBC Financial Leasing.

One reason for surmising that the mainland Chinese market will normalize and begin to seek more small aircraft is that users will begin to see aircraft more for their utility than their showiness. Moreover, manufacturers note that early buyers in a market, usually the richest, inspire people with less means to buy necessarily smaller aircraft as the market matures.

Interestingly, however, the domi-

nance of large aircraft is more obvious in figures that also encompass Taiwan, Hong Kong and Macau—which are more mature markets than the mainland but still ethnically Chinese. For all of so-called Greater China, large aircraft account for 70% of the total.

China is far from dominant in the global market, however, and by the time the country is highly influential its tastes may have changed. Growth is fast from a low base: the late-2012 fleet of 193 was up by 55 (or 40%) on a year earlier. But globally, manufacturers delivered about 700 business aircraft in 2012, and more than 1,200 in their last good year, 2008.

Only a tiny fraction of mainland Chinese users want secondhand aircraft. Gulfstream has sold two used aircraft into the market, says Roger Sperry, senior vice president for international sales. Bombardier has sold "a few," says Bob Horner, senior vice president for sales. Notably, both succeeded by selling used aircraft under conditions that most nearly matched those of new aircraft: supplied by the manufacturer with its warranty.

Horner, cautiously, believes business aircraft users are likely to trade in or trade up more frequently in China than elsewhere, but adds that it is hard to predict how often. Sperry believes it is too early to make any predictions. Li, on the other hand, is looking forward to a wave of business in the next few years as buyers begin replacing. (He also believes that most potential buyers have already bought, although that is not evident in the recent fleet growth.)

One factor that should facilitate frequent updates is easy finance, says a Hong Kong executive with long experience in obtaining money for aircraft. "They can get 100% even 105% financing," she says, noting that lease arrangements also bring tax benefits for Chinese mainland buyers.

However the Chinese market develops, the big winner so far has been Gulfstream.

When mainland Chinese buyers enter an unfamiliar foreign market, they naturally reach for a known brand. In business aircraft, the name that they know best is Gulfstream. Among those large aircraft that dominate the Chinese market, users operated 48 Gulfstreams at the end of 2012, according to Asian Sky Group. There were 27

Bombardiers and 12 Dassaults.

Because potential Chinese buyers are quickly learning more about other brands, Gulfstream's challenge must be to translate that starting advantage into a long-term strength in the Chinese market, relying on recommendations from its early customers, say industry executives keenly watching the company's progress. Word of mouth is a powerful factor in selling business aircraft, notes Sperry.

Not surprisingly, then, the U.S. company and its partners are investing in keeping Chinese customers happy, opening a service center at Beijing in November and building up stores of spare parts worth \$56 million at that facility and in Hong Kong and Singapore. A training center with a simulator for the Gulfstream G450 and G550 opened in Hong Kong in February. Like other manufacturers, Gulfstream is assigning staff to show Chinese users

how best to exploit their aircraft.

The industry finance expert credits Gulfstream with cleverly reinforcing its brand in China around 10 years ago by selling a single aircraft cheaply to Metrojet. The manufacturer knew that the Hong Kong management company would use the aircraft for charters, so the first business-jet flight for many mainland Chinese would be on a Gulfstream.

Not all the market advantages are

Chinese Cessnas

Avic subsidiaries advance toward delivering U.S. business and utility aircraft from plants in Chengdu, Zhuhai and Shijiazhuang

Bradley Perrett **Beijing** and John Morris **Shanghai**

Negotiations are much easier between two parties than three. As Cessna and two Avic subsidiaries move toward setting up factories in China that will turn out aircraft from the U.S. company, the projects that will come under the wing of general aviation specialist Caiga are advancing a little faster than the one that will be handled by fighter-maker AAT.

One unresolved issue is whether and where to build a new factory for the AAT project at Chengdu.

Altogether, the complex process of setting up assembly lines for at least three Cessna aircraft in China, adding to the manufacturing of another that is already done there, appears to be going smoothly. The AAT deal, to assemble Cessna Citation Sovereign business jets, is lagging the two Caiga projects because it also involves a third party, the Chengdu government, says Bill Schultz, Cessna's senior vice president for business development in China.

AAT, whose agreement was announced in March 2012, is getting help from its city government for its project. Caiga's agreement with Cessna was announced in November 2012, but that Avic subsidiary had already secured backing from local authorities for the plants that will assemble Citation XLS+ jets in Zhuhai and Caravan utility turboprops in Shijiazhuang.

The first Caravan should emerge from its Chinese factory in the third quarter of this year, and the first Citation XLS+ by the end of the year, both on time. "The facilities have been constructed," says Schultz, speaking at the Asian Business Aviation Conference and Exhibition in Shanghai. "We've equipped them with tooling and are training the employees."

The first Chinese Citation Sovereign is also due at the end of the year but may be delayed until early next, says another official. If negotiations go smoothly from here, it might be possible for AAT and Cessna to meet the target by doing just the last stages of assembling an aircraft in China, putting together major modules shipped from the U.S.

Meeting the end-2013 delivery target for the Citation Sovereign may not matter much, anyway, at least politically. Aircraft

programs in China are hardly known for being on schedule, and negotiations to move assembly to China from another country were always going to be difficult. For all three projects, the talks must include the Civil Aviation Administration of China and the FAA. "Now we're awaiting approvals from the central government, and hope to receive those by mid-year," says Schultz.

The joint venture operations are intended to import airframe structures from Wichita and conduct final assembly, paint, testing, interior installation, customization, flight testing and delivery of the Cessna aircraft to Chinese customers. As they become more adept, the Chinese factories will take on more work.

Embraer and Avic unit Harbin Aircraft, meanwhile, have already begun assembling a Legacy 650 business jet at Harbin. It is also due for delivery by the end of the year. There, the partners have had the much simpler task of converting a regional-jet assembly line to putting together derivative business jets. Most regulatory issues there were solved a decade ago for the regional-jet line.

In Cessna's deals, the partners and government authorities have to agree on such details as runway and airspace use, the extent of local assembly, and regulatory approvals for production processes. For Chengdu, it is not even clear yet where exactly the assembly will be done. The partners are still discussing whether to use a current factory at Chengdu, build a new one on Avic's site there, or build a new one on a new site in the southwestern city.

A new plant would normally produce at lower marginal unit costs, but reusing old facilities would be more economical for a low production rate. Getting local-government funds for aircraft programs, as in the case of Citation Sovereign assembly, is a big part of Avic's development strategy. In general, Chinese local governments, such as Chengdu's, are keen to see new factories, so over-investment in the Citation Sovereign facilities will not be surprising. That will not



with Gulfstream. Bombardier's Challenger 800 and 850, like other business aircraft adapted from airliners, offer a lot of cabin space for their price. For a buyer seeking prestige, the performance of a powerful, long-range aircraft with a smaller cabin is not so valuable. Horner believes that in this respect the Chinese market is changing, however. Customers increasingly appreciate the performance of dedicated business jet designs, such as the

Bombardier Global series, he says.

In another development in the Chinese business aviation market, HNA Group aircraft operating company Deer Jet has begun offering China's first fractional ownership service, partly in response to requests from users who have found they were getting little use of their airplanes.

In its first stage, the company is offering shared ownership of G450s, G550s and Dassault 7Xs, beginning

with one of each type, says Wu Wendeng, deputy general manager of Deer Jet's aircraft asset management department. For the second stage, the offerings will be Bombardier Global 6000s and 5000s, Challenger 605s and Gulfstream G280s.

While many Chinese customers will find fractional ownership unattractive because it is not as prestigious as owning a complete aircraft, Wu says some potential customers would not care. ☐



A joint Avic-Cessna company will assemble the Cessna Citation XLS+ at Zhuhai.

bother Cessna if the city pays the bill.

AAT builds fighters, trainers, drones and missiles, encompassing the well known fighter factories at Chengdu and Shenyang and the

trainer plants at Nanchang (the Hongdu Group) and Guizhou. At Shenyang, AAT is already manufacturing the Cessna Sky-catcher light sports aircraft. Harbin Aircraft is part of Avic rotary-wing specialist Avicopter.

"We're still in discussions, and those talks have not yet been completed," says Schultz, referring to the AAT deal. For that reason he could not put a target date on the delivery of the first Citation Sovereign. The second official says the Chengdu talks are so far focused just on that aircraft, not on a second Cessna business jet that AAT would also like to assemble, the Citation Latitude, which is not due to fly until

2014. "At this stage it is one step at a time," that person says.

The Latitude is due to be certified in 2015. Beyond the Latitude, Cessna and AAT have mentioned the possibility of jointly developing a business jet at Chengdu.

For that, Avic may have an alternative to Cessna. A senior Avic official said at the air show in Zhuhai last November that the group was also in talks with Israel Aerospace Industries (IAI), although it seems those negotiations have not gone as far as those with Cessna; there has been no announcement of a framework agreement on objectives, for example. At that show, Avic displayed a model of a proposed aircraft dubbed the New Generation Business Jet that seemed to share design roots with the IAI 1126 Galaxy, which was built until 2011 as the Gulfstream 200.

Asked whether IAI could use the design, Gulfstream President Larry Flynn points out that his company owns the type certificate. Still, the Israeli company's willingness to sell know-how may turn out to be the key to Avic's business-jet operations going beyond assembly of foreign designs.

Production schedules for the Cessna aircraft will depend on market demand in China, says Schultz. To that end, the manufacturer has beefed up its China sales staff to nine over the last year. There are now 32 Citations based in Greater China, with just three added in 2012, according to a survey by Hong Kong-based business aviation consultants Asian Sky Group. ☐

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Slim Chance

Kymeta uses metamaterial technology in new ultra-thin satellite broadband receiver

Amy Svitak Paris

Cloaking devices that render aircraft invisible to the naked eye remain in the realm of science fiction, for now, but the metamaterials research on which they may be based could enhance inflight connectivity on business and regional jets and commercial airliners in the next couple of years.

Kymeta Corp., a Redmond, Wash.-based start-up backed by Microsoft founder Bill Gates, is using metamaterials research to develop a new software-defined satellite aperture aimed at fixed, mobile and portable high-speed K_a-band broadband applications in the aeronautical, maritime and land-based markets.

A spinoff of Bellevue, Wash.-based patent-mining company Intellectual Ventures (IV), Kymeta was founded by Nathan Kundtz, a leading researcher in the field of metamaterials who has spent the past decade studying the technology. Along with Gates—Kymeta's largest financial backer and a member of the board—co-investors Liberty Global and Lux Capital helped close a \$12 million round of financing last summer to launch Kymeta after the company gained exclusive license from IV for satellite applications of metamaterial surface-antenna technology.

In addition to developing a laptop-sized portable satellite hot-spot device to access high-speed Internet service absent Wi-Fi or mobile broadband signals, Kymeta plans to leverage the coming wave of satellite-based K_a-band broadband with a new fuselage-hugging surface antenna that has no moving parts, is roughly the size of a pizza box and uses only a tiny fraction of the power typically needed for phased-array antennas.

Known as the Aero Antenna, the satellite receiver relies on microscopic synthetic structures carefully engineered to embody properties not found in nature that can be used to manipulate and bend incoming electromagnetic radiation, such as light or radio waves.

Kymeta Chairman and CEO Vern Fotheringham says the ultra-thin structure of the surface antenna's

waveguide is designed through a blend of circuit-board manufacturing, chip-fabrication and liquid crystal display techniques. In the case of the Aero Antenna, metamaterial surface elements are tuned to electronically point and steer a radio signal to low, medium or geostationary orbit, providing a continuous broadband link between satellite and aircraft.

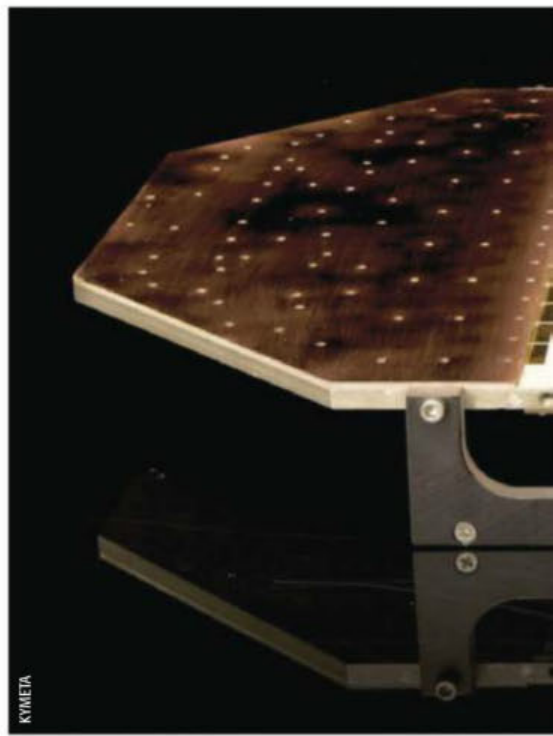
Unlike mechanically steered gimbal apertures that are typically large, cumbersome, heavy and prone to wear, the Aero Antenna is a small, low-profile aerodynamic receiver that could be ideal for business jets and other light aircraft. Compared to phased-array antennas, which can require more than a kilowatt of power to drive the aperture, Kymeta expects to achieve comparable performance using just 0.5 watts to drive the beam. And because the antenna's metamaterial elements can be manufactured through lithographic printing techniques, the final product is expected to be low in cost.

"We think this is going to open up a lot of opportunities in the smaller aircraft market—single-aisle and busi-

In addition to mobile, fixed and portable ground receivers, Kymeta will explore the potential to develop metamaterial antennas for use on spacecraft

ness jets—and ultimately commercial aviation will find a lot of applications that could not be served due to form-factor and cost considerations," Fotheringham says.

Last November, Kymeta entered into an exclusive two-year engineering contract with Inmarsat, an opportunity that will link the emerging technology to the new all-K_a-band Global Xpress satellite network slated to launch this year.



Aimed at the business aviation market, the Aero Antenna will be available only to Global Xpress users, providing an alternative to antenna hardware provided under an exclusive agreement signed last year with aerospace supplier Honeywell, valued at \$2.8 billion over the next 20 years.

"Honeywell prides itself on advanced technology and innovation and is pleased to support this research endeavor," says Jack Jacobs, vice president of marketing and product management at Honeywell. "We are continuously looking to help deliver the most efficient and affordable connectivity products to the industry."

On April 5, Kymeta tested the first link between a geosynchronous satellite and one of the company's metamaterial antennas using a receive-only aperture pointed at a K_a-band feed from a DirecTV satellite in geostationary orbit.

"It was the first time for a flat-plate, holographic, beam-forming, electronic software-defined antenna to actually see a signal from a satellite," Fotheringham says of the test, which comprised eight of 32 subchannels that will eventually make up a full-scale aperture. "But the fact that it was seeing all the carriers and providing sufficient confirmation of link margin was a big deal."



Kymeta is developing an experimental satellite broadband receiver for business jets under an agreement with Inmarsat.

telecommunications satellites fleet operator by revenue. Near the end of a satellite's service life, the gradual loss of onboard propellant leaves it circling in an inclined orbit from which ground tracking can become a challenge.

"Because most satellites still have plenty of performance left in their solar panels, we're thinking about the ability to allow a satellite to continue its useful life with a low-cost ground segment that can track the inclined orbit," Fotheringham says.

In the meantime, Kymeta is expected to deliver the Aero Antenna to Inmarsat by November 2014, and separately plans to release its commercially available laptop-sized portable satellite receiver in the first quarter of 2015.

"We're getting a lot of pressure to go faster, but we're disciplined enough to stick to our plan and take a crawl-walk-run approach to becoming a viable contributor to the community," Fotheringham says. ☺

In the coming months, the company plans to refine the antenna's design and increase performance, culminating in a first transmission demonstration later this year.

"What we are working on now is to assemble a full-sized panel and actually close the link with a satellite," Fotheringham says, adding that some of the challenges associated with metamaterial antenna technology have to do with efficiency, which improves at higher frequencies.

"The practical realities of scale direct us toward X-band and above," he says. "We could build an S-band or L-band version of this. It'd just be really big, and there are better ways to do that at those frequencies."

In addition to mobile, fixed and portable ground receivers, Fotheringham says Kymeta will explore the potential to develop metamaterial antennas for use on spacecraft. "We are exploring reconfigurable beams on satellites looking at the ground as well as links between satellites as we grow into maturity here," he says.

Kymeta's first contract was a study initiative awarded last year by start-up fleet operator O3b, which this year will launch the first eight satellites of an initial 12-satellite constellation in medium Earth orbit designed for K_a-band broadband applications in the oil and gas exploration, cellular backhaul, maritime, military and cruise ship markets.

"The project involved providing them a tracking antenna solution to get them

an alternative to mechanically steered infrastructure," Fotheringham says.

"The work study project came to conclusion a few months ago, and we're actively engaged with them to work to a prototype development here shortly."

The company is also discussing the potential for metamaterial surface-antenna technology to extend the life of on-orbit satellites with Luxembourg-based SES, the world's second-largest



Watch an animation of Kymeta's antenna at work on our On Space blog: <http://ow.ly/kaeqM>

WHAT ARE METAMATERIALS?

Metamaterials technology is an emerging field based on the development of tiny, man-made structures that at certain frequencies exhibit acoustic, electromagnetic or optical properties not found in nature.

These artificial structures can be made from microscopic bits of conventional metals and plastics that are carefully assembled in precise arrangements to affect light, sound or radio waves in unconventional ways. This is possible because these tiny structures are sub-wavelength in size, making them considerably smaller than the light, sound and radio waves they can be used to direct.

In the field of aerospace and defense, metamaterials technology applications could range from novel antennas and sensors to smart structures and even invisibility cloaks.

In the case of metasurface antennas, radio waves are propagated beneath a thin circuit board engraved with sub-wavelength elements that are arranged—or tuned—to resonate at specific frequencies. As the waves pass under the surface, radiation is emitted in different directions based on the tuning of each element.

Today, metamaterials offer the near-term potential for use in antennas and other practical applications. But the field is also being explored for use in the area of cloaking technologies, where the same wave-bending concept may be applied to refract light or radar around an object, rendering it invisible. ☺



EUROCOPTER

Heading for a Fix

Eurocopter hopes gearbox surveillance repair can get grounded EC225s back in service

Tony Osborne **Marseille, France**

Eurocopter has implemented a software change to its health and usage monitoring systems (HUMS) in an effort to return the grounded fleet of oil and gas drilling and exploration industry EC225 to operation.

The European helicopter manufacturer is working with regulators and accident investigators to validate the idea that real-time surveillance of the gearbox on the aircraft is enough to get the helicopters flying again while the company works on a permanent solution.

CEO Lutz Bertling says the interim fix might allow for the rotorcraft to be flying again by the third quarter of this year. The EC225 was grounded by U.K. and Norwegian authorities in October 2012, following the second of two forced landings in the North Sea. The groundings have had a dramatic effect on North Sea helicopter flights, and some operators such as Bristow are only now returning to capacity and normal flight operations.

The two ditchings, one in March 2012 and the second seven months later, were initiated by failures in the bevel gear vertical shaft, a critical component in the main gearbox (MGB) that drives the two lubrication pumps.

The ditchings were necessitated when the flight crews were presented with warnings that a falsely indicated that the emergency lubrication system for the MGB had failed, a glitch that has been corrected.

As an interim fix, the company is planning to update the EC225 HUMS—known as M-ARMS (modular aircraft recording monitoring system)—with a capability to monitor gearbox vibration in real-time. With some modifications to the cockpit, the enhanced HUMS will warn pilots immediately if cracks are propagating into the bevel gear shaft. Pilots will be alerted to land within a specific, as yet undecided, period of time. This is a key point being discussed with regulators. According to Bertling, the final fix will involve a new design of the bevel gear shaft.

“We can reproduce the fault at any time; it has been clearly identified,” Bertling said at the company’s facilities in Marignane, near Marseille, on April 17. He said the issues with the shaft include “residual stresses from the manufacturing process” and corrosion on the component. The company is sending data from its findings to the authorities as well as to independent experts from the Georgia Technology

Research Institute, an organization selected by the helicopter operators to verify the manufacturer’s findings.

Officials close to the program told Aviation Week that engineers had purposely cracked eight of the components during bench testing and that one of the gearboxes would now be fitted to aircraft to carry out flight tests

Eurocopter is working on gaining regulators’ permission to return EC225s to the skies.

to determine whether the cracks propagate the same way in flight. Bertling says he would like to see the fix ready before he leaves at the end of May for his new role as president and COO of Bombardier Transportation. He emphasizes that resolving the matter is a top priority and is one of the biggest challenges in Eurocopter’s history.

Operators say they are concerned that the aircraft may not return to full capability until next year. According to Bristow, the incidents and the subsequent grounding demonstrated just how important the helicopter has become to the offshore oil and gas industry. Speaking at the company’s analyst day on April 10, Mark Duncan, senior vice president for commercial business, said that although the helicopter only represented around 5% of the cost of running oil and gas platforms, the loss of rotorcraft service “affects the other 95%”

“The incident has highlighted the criticality of our service,” Duncan said. “Security of supply [of helicopters] has become more important than the cost.”

While none of Bristow’s helicopters were involved in the two incidents, the company, like other North Sea operators, was ordered to ground its fleet. For Bristow, this means 16 of its aircraft remain parked. In the days immediately after the grounding, the company had just two helicopters available to service the platforms.

Six months later, the company is only now returning to full-fleet strength, achieved via the arrival of new S-92s and by repositioning its international fleet, as well as by pulling old Aerospatiale AS332Ls, known as Bristow Tigers, out of retirement.

Despite the grounding, the aircraft in both its military and civil variants is in full production, and Eurocopter plans to ramp-up output in 2014 with an extension to the Marignane assembly line. 

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A conceptual image featuring a glowing blue globe with a white silhouette of the world's continents. The globe is set against a dark blue background with a subtle starry pattern. In the foreground, three hands of different skin tones (light, medium, and dark) are reaching upwards towards the globe, symbolizing global unity and shared success. A horizontal white line passes through the center of the globe, just above the text.

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Chinook Redux

Heavy-lift helicopter is set to enter 60th year with another major upgrade

Graham Warwick

Gaining weight with age is a familiar curse, and after 50 years of service the Boeing CH-47 Chinook can no longer carry the loads it did when the heavy-lift helicopter was first introduced. With weight growth averaging 100 lb. a year, the U.S. Army wants to reset the clock to take the tandem-rotor Chinook well into its second half-century.

Boeing and the Army are working to define a "Block 2" upgrade that would be introduced after 2020, once all of the service's CH-47Ds have been replaced by new-build and remanufactured F models. "We are really after payload improvements," says Col.

Bob Marion, cargo helicopter program manager. The latest CH-47F has boosted international sales of the Chinook, and the Block 2 program could keep the line rolling into the next decade.

"The D to F upgrade introduces a machined airframe and digital cockpit [and flight controls], which are real game changers for the Chinook fleet," he says. "The new frame improves sustainment and the cockpit enhances controllability and situational awareness. The next thing is payload improvement—we need to take weight out of the aircraft."

Work to define Block 2 is getting underway as the Army prepares to award

Boeing the second and final multiyear procurement contract for the CH-47F. Expected to be signed in May, the five-year contract for 155 helicopters, plus 60 options for export aircraft, will save \$810 million, or 19.2%, over year-by-year contracting, says Marion.

Many of the modifications added post-production to Chinooks built under the first multiyear award will be incorporated on the assembly line under the new contract. Additionally, the second multiyear agreement will see the introduction of the first upgrades planned for Block 2, including an advanced rotor blade that will increase lifting capacity by almost 2,000 lb.

"Block 2 would follow Multiyear 2, and we are looking at what [non-recurring development] work we need to start executing now," says Marion. "The key thing is the JLTV [Joint Light Tactical Vehicle, the planned replacement for the Humvee]. As it goes through development, we have to ensure that the CH-47 can carry a combat-equipped JLTV and crew."

The Army's goal for Block 2 is to make sure the post-2020 Chinook can carry a 22,000-lb. payload 50 nm., with 4,000-ft./95F high/hot hover performance. "We are still working toward that, and in the future will look to increase that to 6,000-ft./95F," he says. Today, the CH-47F can carry 16,000 lb. in 4,000-ft./95F conditions, "and we

New blades and uprated engines will increase lifting capacity, but Chinook will have to shed some weight to restore payload.



U.S. ARMY

are adding 100 lb. a year [of airframe weight].”

While the D-to-F upgrade improved the airframe, cockpit and flight controls, it added empty weight. Other modifications, such as armor, engine inlet particle separators and exhaust infrared suppressors, as well as added survivability equipment such as laser missile jammers, have also increased weight. Block 2 will seek to “buy back” lost payload by both boosting lift and trimming weight, Boeing says.

“We are working with Tradoc [Army Training and Doctrine Command] on the requirements for the future Chinook and the lifting capacity needed after 2020,” says Lt. Col. Joe Hoecherl, CH-47 modernization product manager. “We are also working with Boeing, doing initial development with the focus on payload, primarily JLTIV.” The upgrade is expected to be fiscally constrained, so trade studies are under way to identify potential changes and determine what will be affordable.

Because of budget limitations, the Block 2 is expected to involve remanufacturing existing F-model Chinooks, a process some airframes already have gone through twice, having been built as CH-47As then rebuilt first as D models, later as Fs. The D-to-F upgrade has modernized the airframe and avionics, so the Block 2 program is focusing on the dynamic system and other areas of the aircraft.

One of the first pieces of Block 2 is the advanced Chinook rotor blade (ACRB), which is already under development and planned to be cut into production during the second multiyear contract, in late fiscal 2016. Drawing on experience from the canceled Boeing/Sikorsky RAH-66 Comanche, the ACRB has new airfoil sections, increased twist and a redesigned tip. This increases lift capacity by more than 1,900 lb.

Blade length is unchanged and no detrimental loads are introduced into the rotor hub or controls, says Boeing, allowing the hub to remain unchanged and enabling existing Chinooks to be upgraded, which is important as there will be approximately 400 aircraft in the field by the time the new blade becomes available.

It is expected the engines will be upgraded, with Honeywell’s T55-715 turboshaft offering 20% more power than the 4,900-shp -714A now powering the CH-47F. “We are looking closely at increasing the power capability,” says

Hoecherl. This would require modifications to the combiner and nose gearboxes and, unlike the ACRB, would come at the cost of extra weight. So Boeing is looking for modifications that will remove weight from the Chinook.

Foremost among these is a new fuel system derived from that used in the special-operations MH-47G and Canadian CH-147F variants. Instead of three tanks per side—forward, center and aft in the fuselage sponsons, each with their associated pumps and plumbing—there would be a single tank. “There are two main and four auxiliary tanks, so there is potential to consolidate them as eliminate pumps and plumbing,” he says.

While the MH-47G and CH-147F have “fat” sponsons housing extended-range tanks with twice the fuel capacity, Boeing is investigating a “skinny”

“The new airframe improves sustainment and cockpit controllability and situational awareness. Next is payload . . .”

single-tank solution for standard Chinooks—with the potential that eliminating the extra tank hardware could allow the sponsons to be slimmed down to reduce download from the rotors and so increase lifting capacity.

Another expected element of Block 2 is the active parallel actuator system (APAS), a next-generation version of the CH-47F’s digital advanced flight-control system. APAS would provide tactile cueing for pilots and improve rotor torque management. On today’s Chinook, pilots do not know the exact split of torque, and therefore lift, between the fore and aft rotors so a safety margin is built in. APAS would reduce that margin and allow more of the rotor system’s performance to be used.

“We have been flying with the same torque split since the Chinook was designed,” says Marion. “In Block 2 we will measure torque precisely at the rotor head.” APAS would use the sensors to provide tactile feedback on torque margin to the pilots via “soft stops” on the flight controls. The system is planned to be retrofittable by removing the existing force-feel pallet and installing the APAS.

Another potential change is incor-

poration of the redesigned electrical system developed for the CH-147F, a hybrid between the CH-47F and MH-47G now in flight-testing. The new system has increased capacity—three 60 kVA generators—to power additional survivability equipment and provide addition growth capability. “We always want more, and cleaner power,” says Hoecherl.

By beginning work on Block 2 now, the Army is hoping to keep the Chinook line rolling beyond the end of the second multiyear contract. Current planning is for the last CH-47D to be modernized to an F in 2019, and the first aircraft to be inducted for Block 2 remanufacturing in 2019-20, budget permitting.

The second multiyear contract, meanwhile, will provide the Army with some flexibility to manage budget cuts. The base contract is for 121 remanufac-

tured and 34 new-build CH-47Fs for the Army plus options for 60 aircraft, principally for foreign military sales (FMS). Deliveries are to begin in April 2015, but bridging a gap between the first and second multi-years is a contract

for 14 helicopters, the first to be built in Multiyear 2 configuration, to avoid a break in production.

Only one of the Chinooks under the bridge contract is for the Army—a “production-representative Multi-Year 2 aircraft”—and will be used to reduce risk, says Marion. Configuration changes from the first to the second multiyear award center on incorporating on the assembly line approximately 30 modifications now performed post-production. These include installing the roller-floor cargo on/off loading system, an health-monitoring system and some rewiring to tackle avionics obsolescence.

Because any FMS aircraft built under the second multiyear contract will be in the same configuration as those for the U.S., the Army has the contractual flexibility, if there are further budget cuts, to move FMS helicopters into the base 155-aircraft program and still achieve the targeted cost savings, Marion says. Of the 60 option aircraft, 16 “are already spoken for by FMS customers,” including Turkey and the United Arab Emirates, says Lt. Col. Reese Hauenstein, CH-47F product manager. ☐

Money for Nothing?

NextGen equipage fund is primed, but questions linger for airlines

Sean Broderick, John Croft and James R. Asker **Atlanta**

Though more than \$1 billion in government-backed loans for FAA Next Generation Air Transportation System (NextGen) avionics could soon be available, airlines remain cautious about investing in the technologies even as the first milestone—equipping with automatic dependent surveillance-broadcast (ADS-B)—is rapidly approaching.

Per FAA mandate, airlines must have ADS-B “out” installed as a surveillance source by Jan. 1, 2020, to gain unfettered access to the FAA’s air traffic management system. To meet that date, carriers say they must begin planning and investing now to fit the upgrades in with usual maintenance cycles.

At issue are uncertainties in the some of the accuracy and timing requirements for ADS-B “out” and, potentially more damning, a lack of clarity on what airlines will gain by investing in the technology.

“There are no clear financial economic benefits for an airplane for ADS-B ‘out,’” says Kent Horton, director of engineering for Southwest Airlines. “There are some illusions of better air traffic control or flight times.”

Questions aside, the NextGen equipage fund, set up by NEXA Capital Partners, is moving forward with loan talks. The company’s managing director and CEO, Michael Dymant, says he is in advanced talks with three airlines—including one very large U.S. carrier—and expects to announce at least one customer by mid-year.

The upgrades are required to meet the FAA’s goal of transitioning to a more efficient system over the next decade, but they have been a tough sell for operators. Speaking at Aviation Week’s MRO Americas conference on April 16, Dymant said NEXA’s analysis shows that operators will start to reap real benefits from satellite-based air traffic management when 60-65% of the fleet is upgraded. Right now, the figure is not anywhere near that.

This puts early adopters in a tough position, a lesson Southwest learned the hard way when it invested heavily in Required Navigation Performance (RNP) to use more efficient satellite-based approaches at many airports, only to find its aircraft stuck in lines of unequipped planes that could not take advantage of the new procedures.

“We have already invested in NextGen for RNP operations, but the procedure side of that has been very slow in coming,” says Horton. “It’s starting to get traction now, but we’ve been equipped for several years.”

Southwest financed its own upgrades, but most other airlines will likely not be in such an enviable position. “We have really good credit compared to the other operators,” Horton says. “There’s not a lot of advantage of going to the FAA for funds. We just need to make a business case for the investments.”

Dymant estimates that the cost of a NextGen package for a Boeing 737-800, including labor and avionics for ADS-B “in”



Government-backed loans could soon be available for operators of thousands of aircraft that must be upgraded with NextGen avionics, but airlines say there are still too many unknowns to make the investment case.

and “out,” RNP 0.3, and pilot/controller data communications is about \$550,000. A winglet package for the same aircraft costs \$885,000, he says.

NEXA says the investment will pay off in less than a year, provided about 75% of the fleet is similarly equipped. Horton says 6,000-7,000 aircraft will require NextGen avionics modifications.

Winglets are a less controversial investment, and operators reap instant benefits from them, even though the return-on-investment cycle is longer. By contrast, a NextGen package will not do much good if you are the only one so equipped—or if the FAA does not follow through on its end of the infrastructure development bargain.

Dymant says the public-private partnership fund does not just provide cheap, government-backed loans, and NEXA also is working with the FAA to ensure specific NextGen targets can be met as part of operator commitments. For instance, a given carrier may commit to upgrade if NextGen capabilities are rolled out at its main hubs by a certain date. If the FAA fails to deliver, the carrier could defer payments until the agency meets its commitment.

Dymant says the fund, partially backed by ITT Exelis, is ready to cover \$1.3-1.4 billion in retrofits as industry moves to meet deadlines for leveraging satellite-based air traffic management systems being deployed. A second fund for general aviation aircraft is prepared to back about \$550 million in upgrades, and a third fund is being created for export aircraft.

Horton says the “biggest conundrum” about ADS-B is how accurate the GPS navigation source will have to be to gain the best routes. The specification remains somewhat of a moving target, though the FAA is expected to release a draft Advisory Circular soon that will clarify what is needed.

Without a firm commitment on the specifications, however, airlines are fearful of hidden costs down the road.

“The expense of guessing wrong is what we must avoid,” says Joe White, managing director of engineering and maintenance at Airlines For America. “We need accurate forecasts of these elements that affect architecture. We can’t afford a miscalculation. In particular, we can’t afford recurring retrofits as things change.” ☞

Laying New Concrete

Could new airports to the west of London solve the city's airport capacity problem?

Tony Osborne **London**

Looking down on Heathrow Airport from its 87-meter-high (285-ft.) air traffic control tower, the challenges that face the world's busiest two-runway airport suddenly become very clear.

With an aircraft landing or taking off approximately every 2 min., runway and parking-stand capacity is at a premium, and the site offers little room for expansion. On every side, the airport is hemmed in by development, which has a dramatic effect on airport efficiency. A single day of inclement weather can bring about a domino effect on operations resulting in hundreds of canceled flights, leaving passengers stranded and the airport's reputation in tatters. No wonder managers are considering moving operations to another site.

Heathrow Airport Holdings has been quietly exploring options for future airport configurations and two new locations never previously examined for the siting of a major new airport. Aviation Week has seen the *Heathrow 2025: Masterplan Options & Indicative Layouts* documents produced by the Mott MacDonald consultancy that propose 10 op-

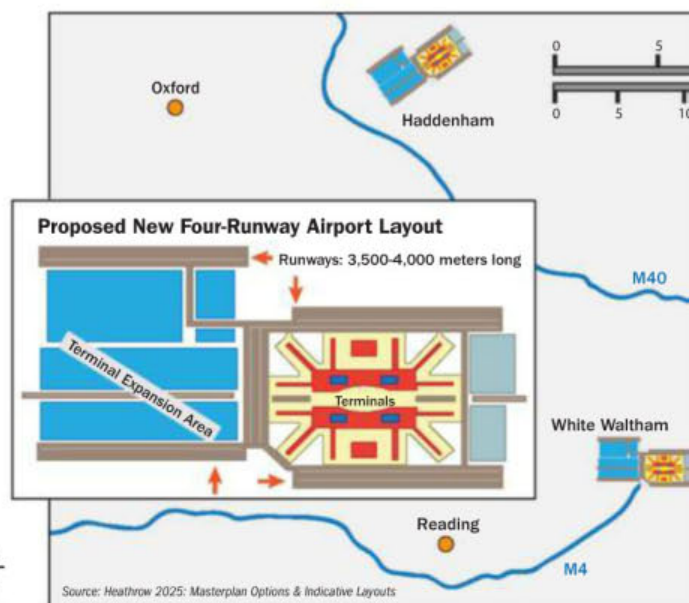
tions, ranging from a reconfiguration of the current airfield with two runways and new a terminal layout to an entirely new four-runway facility built on green-field land at one of two locations in the nearby counties of Berkshire and Buckinghamshire to supplement, or more likely replace Heathrow.

The two new sites suggested by the consultants would feature a four-runway layout, not unlike the configuration of Madrid's Barajas Airport (see map). Two runways would be located on either side of a main terminal core, while the other two runways, parallel to the first two, would be slightly offset but more than 1 km (0.6 mi.) apart allowing parallel landing and takeoff operations. The newly built facilities could potentially handle 140 million passengers and 800,000 air traffic movements a year, just under twice Heathrow's capacity today.

One site suggested is at White Waltham, a small general aviation air-

field about 15 mi. west of Heathrow and close to the town of Maidenhead. The other is Haddenham, the location of a old World War II glider airfield about 15 mi. from the city of Oxford but more than 30 mi. from the center of London. Local parish councillors contacted by Aviation Week were taken aback by the suggestion that the countryside near their homes could be turned into a major international airport.

The Haddenham site would perhaps be the most controversial, as the layout suggests the virtual removal of two villages, Chearsley and Long Crendon. Both sites are in open countryside, however, and have the advantage of being close to major transport links. White Waltham, would be built almost on top of the M4 motorway and is close to major rail links, while the Haddenham location is close to the M40 motorway and within a few miles of the government's planned but controversial High Speed 2 (HS2) rail route to Birmingham, a move that would boost transport times into Central London.





Heathrow Airport officials tell Aviation Week the documents are early drafts developed by consultants last year. "They are not designs that have been endorsed by Heathrow Airport," the officials say. "Heathrow will be making its considered submission to the Airports Commission in July."

A new facility to replace Heathrow is a highly unlikely scenario, so the focus is likely to be back on the current airport's ability to retain its position as the U.K.'s main hub into the future.

Politicians regularly highlight the failures of Heathrow and its ability to stay open in the face of snow or fog, but they are considerably more reticent about helping to fix it. The building of new runway capacity in the south-east of England is seen as a political "hot potato" and ministers have been reluctant to make a decision which could bring extra noise to hundreds of thousands of city dwellers. And if a third Heathrow runway is unpopular, politicians are going to be even more reluctant to approve the building of a

new airport, even if its creation could deliver a long-lasting economic legacy to the region.

Since the coalition government came to power in 2010 and withdrew support for another runway at Heathrow—reversing a 2009 decision made by the previous Labour administration—no fewer than seven new airport options have been suggested. Six of them would lie east of the city, using reclaimed land in the Thames Estuary. One of those, suggested by London Mayor Boris Johnson, was enthusiastically dubbed "Boris Island."

But many believe an airport in the Thames Estuary is the wrong location for a London airport, since it would be difficult to reach for many people. Indeed, a key part of Heathrow's success has been its location to the west of London, and its proximity to the M4 corridor, where some of the world's largest multinational companies are headquartered.

The Heathrow 2025 masterplan also highlights a range of options for change at Heathrow, including two configurations for a third runway to the north of the airport. One features a short runway, to be primarily used for short-haul and domestic flights, combined with a new terminal in between the new runway and the current northern runway. The other suggests a third longer runway and another set

of satellite terminals in the northeast corner of the airport.

Three options for four runways on the Heathrow site are also suggested. One proposes building a new fourth runway to the south of the current southern runway, construction of which would require demolition of the airport's current cargo facilities. Another alternative would see the runway moved toward the east, necessitating the demolition of both the freight areas and Terminal 4. And the third option, which has made it into the national press, would essentially rebuild Heathrow with four runways on land just west of the current airport, a move that could also reduce the number of people effected by noise, at least in London.

Heathrow air traffic has been affected by the economic downturn, dwindling since its peak in 2008, but it is forecast to rebound by 2018-19, and figures from the U.K. Transport Department indicate that all of the airports serving London will be full by 2030—and perhaps by 2025, if no new runways are built.

The Airports Commission, launched last November, is due this year to report assessments and recommendations to improve airport capacity in the next five years, but it will not announce longer-term recommendations, for the next 25-30 years, until the summer of 2015, after the next election. ☺

Crunch Time

Avianca's model seems to work, with constraints at Bogota its biggest risk

Jens Flottau **Bogota**

Three years after the merger of Avianca and Taca, the group is growing profitably, but the integration is not complete and infrastructure bottlenecks have to be cleared to ensure further growth.

Avianca, which will go to a single brand and drop the Taca name at the end of May, has emerged as one of the two big Latin American airline groups, along with the newly formed Latam Group. Given Colombia's politically and economically difficult past, and considering Avianca's bankruptcy re-

structuring in 2004, the turnaround is all the more remarkable. Following the announced departure of TAM Brazil, Avianca will also be the Star Alliance's sole partner in South America. And Bogota is its most important base.

CEO Fabio Villegas is about to launch the next stage of the group integration that will likely span another 2-3 years. Avianca has "come a long way already," he says. In its initial integration phase, the airline went to a single administration (most functions are now based in Bogota), merged the frequent-



Avianca will keep its Airbus A330s a bit longer, even after it begins taking delivery of Boeing 787s.



flier programs into the Colombian carrier's "Life Miles," and introduced joint revenue management and a combined network.

Overall, the first stage of the group building process was about increasing revenues. And it worked: In 2009, the two airlines together carried 15 million passengers; three years later, the figure has risen to 23 million. In the same time frame, revenues grew to \$4.2 billion from \$2.5 billion. The integration had a positive \$219 million impact on operating profit even before specific cost-saving initiatives were launched.

AviancaTaca Holding recorded an 8.3% increase in sales in 2012, reaching 7.6 billion Colombian pesos (\$4.2 million), and achieved an operating profit of 506 million Colombian pesos. Both capacity and demand grew by 10.3% last year.

Now Avianca is about to launch the second integration phase, in which it hopes to save another \$150 million. While the two entities will continue to exist as separate companies (although operated under a single brand), Villegas

gas wants to introduce more joint processes in operations and maintenance and harmonize the two airlines to allow quick reallocation of aircraft and crews where needed. An outright merger into one carrier with a single air operator's certificate is deemed unrealistic given the different jurisdictions in which it has to work.

Integration efforts are not limited to the Taca operation. Avianca has taken full control of Ecuador's Aerogal, which operates a dense domestic network and has some limited international exposure following the phase-out of its Boeing 767 operation last year. Aerogal will eventually also become part of the Avianca brand, once its information technology infrastructure is upgraded.

The investment comes at a time when uncertainty clouds the development of the important Ecuadorian domestic market. The move of all airlines to the new Quito airport, which is still difficult to reach from the city because the main roads are not opened yet, has meant a significant decline in demand

for domestic air travel, and airlines are cautiously watching.

Villegas is also taking a cautious approach to possibly integrating more closely with Avianca Brazil, which uses the Avianca brand and is also owned by Avianca's parent company, Synergy Group Corp. "We have a lot of projects coming up," he says, explaining that he is therefore concerned about the amount of management attention that would be required if the project were given higher priority. A merger is something "that has to be explored," Villegas concedes, while pointing out that Avianca, unlike Avianca Brazil, has more than one shareholder, which must be involved in any action.

The Star Alliance is keenly interested in fast growth at Avianca Brazil in hopes that the carrier can at least partially replace TAM, which is leaving Star as a result of its merger with LAN to form the Latam Group. Avianca Brazil is in the process of phasing out its Fokker 100s and operates a mixed fleet of A318s, A319s and A320s.

Cutting Ties

TAME, forged by the military, extends its commercial franchise from domestic to global

Jens Flottau Quito, Ecuador

TAME was founded as Transportes Aereos Militares Ecuatorianos and its affiliation with the military has had a deep influence on how it is run. Now, after 50 years as an affiliate of the Ecuadorian military, TAME is attempting to relaunch itself as a strictly commercial entity.

TAME has long been Ecuador's largest domestic airline and now is the country's only airline. Its key competitors, LAN Ecuador and Aerogal, have become subsidiaries of multinational airline groups—Latam (with hubs in Chile and Brazil) and Avianca (with hubs in Colombia, El Salvador and Peru). TAME remains state-owned, but formally cut its ties to the military a little more than a year ago. "It is a different airline now," says Rafael Farias. The new CEO was appointed in late 2011 to oversee the airline's transformation into a public company. Essentially the entire top management was replaced. Farias began his career in the industry at Saeta, a now-defunct

Ecuadorian airline, and most recently worked for rival Aerogal.

"We brought in the key people we needed with a lot of industry experience," Farias says. "We were able to quickly make the airline more efficient. The biggest change was in introducing transparency. TAME used to be managed secretly."

The key objective behind the government-sanctioned initiative has been to turn TAME into a profitable operation. That goal was achieved Jan. 1, 2012, in spite of the rescission of the Ecuadorian fuel subsidy, which allowed local airlines to operate at about one-third of the fuel prices common in the world market.

"2013 is going to be a challenging year," Farias says. The airline is facing additional costs related to the move to Mariscal Sucre International Airport, the new facility, in February. Also, the airline is concerned that domestic traffic—particularly on the busy Quito-Guayaquil route—will suffer if travelers choose not to make the now far longer commute to the new airport, which is situated in an valley outside of the city limits. The situation is unlikely to improve until late 2014 at the earliest, when a new direct road will open and cut down on commuting times. While many airlines had been concerned that the domestic market would experience a 20% plunge in demand, initial figures indicate the drop-off is not that dire.

Partly because of its military background, TAME has had limited exposure to international routes and hardly any links to other carriers, but that is now changing. The airline will even be entering the widebody and long-haul market for the first time, when it introduces its first Airbus A330-200 in

According to Villegas, the two airlines are negotiating mutual recognition of their frequent-flier programs. But like Ecuadorian subsidiary Aerogal, Avianca Brazil still has work to do on the information technology side to become fully compatible.

Villegas says Avianca is not looking to add more airlines to its portfolio in the short term. "We have already achieved what we wanted to achieve, which was to diversify the risk over more than one market," he says. Avianca formerly had just one hub, in Bogota, and now it has two others, in Lima and San Salvador, El Salvador. "To grow is good, but it is not enough," Villegas says, pointing to examples of large airlines in Europe and North America that are still struggling. Nonetheless, he believes the group has "the option to do something else if it makes sense."

Capacity constraints at Bogota's El Dorado International Airport are probably the most serious risk to Avianca's future growth. The facility's recently opened international terminal was designed to bring its capacity to 15 million passengers annually. But Villegas notes that Avianca "reached 21 million passengers last year." While the international complex is "a huge improvement," he says the airline still needs

"a larger airport in order to continue growing." Service levels at the facility are not where they should be, with 50% of departures from remote stands rather than direct gate positions. Air traffic control procedures are also a serious issue since the airport's two parallel runways are far enough apart to be operated independently.

In spite of the Bogota troubles, Avianca is aiming for strong growth, even if that entails adding capacity to secondary routes within and from Colombia as well as Lima, San Salvador and San Jose, Costa Rica. The airline is looking at extending leases on its A330-200s for several more years to further the expansion of its long-haul operation. Originally, Avianca intended to replace its A330 fleet with 10 Boeing 787-8s on order, but Villegas says it is now looking at ways to secure a stronger widebody presence in its key markets.

Avianca now operates just four aircraft types, down from 10 in 2009, and plans to simplify still more. The Fokker 50 fleet is to be replaced by 15 ATR 72-600s, the first of which will arrive in June, and the remaining Boeing 767-200Fs at its cargo subsidiary Tampa will be phased out. Tampa will take delivery of two more A330Fs this year, bringing its fleet to four and nearly

doubling its cargo capacity. The A330F can carry 70 tons, compared to the 767-200F's 40-ton capacity.

The last of 10 A330-200s on firm order are scheduled to arrive before year-end. One A330 based in Lima to serve the Buenos Aires and Bogota routes will soon also be deployed to Miami. Villegas says that widebody base is likely to grow, but Avianca is still studying how many aircraft are sustainable in Peru.

It is slated to receive its first 787-8 in October 2014 and plans to base the 787s in San Salvador, Lima and Bogota. Villegas says the 10 A350-900s ordered by parent Synergy Aerospace will not be operated by Avianca. And the proposed Boeing 777X "is too big for us," he says.

Europe is one target of Avianca's long-haul expansion. The airline is introducing twice-daily services from Bogota to Madrid and is eager to start services to London's Heathrow Airport. A lack of suitable slots there is keeping the plan on hold for now.

The first of 33 A320NEOs is to arrive in 2017, so Avianca is taking delivery of more "Sharklet"-equipped A320s to bridge the gap. In spite of the generally poor economics of the A318, Avianca plans to hold on to the aircraft for "as long as possible," Villegas says. ☼

July. The aircraft will be flown on the New York-Quito route.

"The nice thing about widebodies is their cargo capacity," Farias says. "We have identified that as an opportunity." TAME is looking at adding a second or third A330 at some point, mainly for longer routes within Latin America and to destinations with heavy cargo demand. European services are an option for the medium term, but Farias says the airline needs to gain experience in long-haul flying before it can turn its attention to other markets.

Closer to home, the carrier has added Bogota, Sao Paulo and Lima, Peru, to its network. The strategic aim is to realize about 40% of revenues internationally, up from the current 10-20%. TAME plans to open new services to Buenos Aires in May, using Airbus A319s for the 6-hr. flight.

As the airline's presence grows internationally, partnerships with other airlines are also on the agenda. "We need each other, we can complement their networks," Farias says. With Latam

soon to be solidly ensconced in Oneworld, and the Avianca group of airlines linked to the Star Alliance, many Skyteam members are finding it difficult to line up local partners for Latin America feed. TAME already cooperates with Delta Air Lines and Alitalia and it is finalizing an agreement with KLM, which serves Quito daily from Amsterdam. But Ecuadorian airline also plans "close relationships" with Brazilian carrier Gol and Aerolineas Argentinas. The Argentinian airline is a Skyteam member, whereas Gol has links with Delta. TAME itself "is not even close to joining" an alliance, but wants to focus

on bilateral deals for the time being, its CEO notes.

Farias says the carrier is likely to add a fourth ATR 42-500 for its new domestic regional operation. TAME has introduced the ATRs for services to secondary markets. Large losses were posted on these routes when they were served by Embraer E-Jets or Airbus narrowbodies. "Some of the routes are still not profitable, but we are almost there," he says. ☼

TAME is increasingly using its Airbus A319s on international routes.



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Flight-Ready

Test results could be key to swinging undecided A320NEO engine orders toward Pratt

Guy Norris and Joseph C. Anselmo West Palm Beach, Fla.

Pratt & Whitney's promises over the geared turbofan's step change in fuel burn for mainline single-aisle airliners are about to be put to the acid test as the first PW1100G for the Airbus A320NEO is prepared for flight.

The flight tests, due to begin by June on one of Pratt's two Boeing 747SP flying testbeds, will be critical to assessing not only fuel consumption, but also operability and overall performance in advance of flights on the first reengined A320 late next year. The PW1100G is the first of the new-generation mid-thrust turbofans to fly. The competing CFM Leap-1A from the alliance of General Electric and Snecma, is not due to begin ground trials until September, and will start test flights in 2014.

Many of the operators that have ordered the A320NEO—but have yet to choose an engine—will be watching the flight-test results closely. According to data released by Airbus, the two engine makers are virtually neck and neck. The Leap-1A has been selected for almost 630 A320NEOs on firm order, while the PW1100G has been chosen for 590. However, engines for more than 900 further aircraft on firm order have yet to be officially announced.

The mood at Pratt is optimistic as

it begins mating the first engine to a strut developed by L-3 Communications for attachment to the 747 at the Mirabel Aerospace Center in Quebec. Confidence stems from favorable results during ground tests that were completed on the first engine at the company's facility here in early April. The engine, rated at 33,000 lb. thrust, accumulated 120 hr. in trials that began in early December and ended with acoustic tests on April 10.

Pratt & Whitney President Dave Hess says performance evaluations to date are positive. "We feel we're on the mark, and meeting the projections we made," he says. Pratt originally targeted the PW1100G at a 12% better fuel burn on the A320 than the CFM56-5B and now believes it has a 16% advantage. "In the development program, we're where we need to be. In fact, we're right on the mark for delivering on fuel burn on all three of the platforms," he adds, referring to the geared-turbofan-powered A320NEO as well as the Mitsubishi Regional Jet (MRJ) and Bombardier CSeries.

A second PW1100G engine is undergoing structural trials and is poised for crosswind evaluations. The tests will assess fan characteristics and flutter

margin before the engine moves on to other low-pressure system stress tests. The fan blade is a larger version of the same bi-metallic blade developed and tested for the CSeries that has proven highly robust in testing, says Bob Saia, vice president of Pratt's Next-Generation Products Family. "We hit a home run

After ground runs in Florida (pictured), the first PW1100G is now in Quebec for flight tests.

with this new fan blade," he says.

The blade had greater flutter margin than predicted, which enabled Pratt to discard the variable area fan nozzle (VAFN) from the CSeries's PW1500G engine late last year. The feature dynamically alters exit nozzle area for different phases of flight to maintain blade stability. It remains part of the baseline on the Pratt-powered A320NEO and will be certified in this configuration. On larger engines, such as the PW1100G, the VAFN offers the potential for additional fuel savings as well as maintaining flutter margin. For smaller engines, like the PW1500G for the CSeries, the specific aim is to safeguard the fan, and Pratt says fuel efficiency will be better without the feature.

A third NEO engine will begin high-pressure spool tests next month, while a fourth PW1100G has begun endurance testing for certification at Pratt's Manitoba icing facility. The first four engines are expected to collectively amass 1,000 test hours in the run-up to full certification testing, which is due to get underway in "two to three months," Saia says.

Four production PW1500Gs have meanwhile been delivered to Bombardier, the first two of which are mounted on the initial CSeries aircraft that is expected to be powered-up shortly. The Canadian airliner is slated to make its first flight in June. A fifth engine is in the test cell at Pratt's Mirabel production facility where another four engines are now in final assembly.

Test work on the PW1200G for the MRJ is also advancing and is now at the halfway point, Saia says: "We completed all block testing and fully validated the design, and its readiness for certification." The company is now assembling the fifth engine. 

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Mode Masters

Avionics makers strive for user-friendly and connected flight decks

John Croft Cedar Rapids, Iowa; Olathe, Kan.; Phoenix and Tucson

In September 2012, Rockwell Collins gathered 18 airline, business aviation and owner-operator pilots in its Cedar Rapids hometown for some straight talk on the automation problems with today's integrated cockpits. What they learned could help the avionics company create next-generation flight decks that are safer and more mission-efficient.

"Mode surprises are a real problem today—they happen nearly daily," says Geoff Shapiro, senior systems engineer in Rockwell Collins's advanced technology center. Shapiro had assembled the group to gather input on an advanced technology project to simplify the autopilot or "autoflight" modes that accompany flight management systems. A legacy airliner or business jet can have nearly 40 distinct autoflight modes for lateral, vertical or airspeed maneuvers.

"Pilots are busting altitudes. They have unintended stalls because the auto-throttle trips off and they don't know why," Shapiro says. "The aircraft has a mind of its own and it's not really talking about why it's doing what it's doing."

Mode confusion is one of many high-priority items on the to-do list of avionics makers like Rockwell Collins, Honeywell, Thales, Garmin and others that are striving to build cockpits of the future that will balance existing and emerging technologies such as fly-by-wire controls, broadband connectivity and increasingly complex automation.

From weather to traffic to pilot and aircraft performance and health, those flight decks will have unprecedented amounts of data that the avionics must transform into clear and concise information pilots or automation systems can use to take action—or perhaps not.

Pilots for their part will become more

tightly coupled to their aircraft via a growing number of man-machine interfaces, known in human factors circles as "modalities." Included are interactions with increasingly complex automation systems, larger displays complete with touchscreen capability, voice-recognition systems and visual systems that will soon be capable of "seeing" the real world through practically any weather. Farther out could be brain or heart activity monitors that pilots might use for taking actions.

"The next frontier is the connectivity

of everything," says Carl Esposito, vice president of marketing and product management at Honeywell Aerospace. "Most of the aviation systems we've designed to date have been relatively self-contained with little communication to the outside world." He says the change is being driven by what we've come to expect in the consumer electronics market, where anyone with a smartphone and a connectivity plan can pull data from multiple sources and use applications to aggregate that data into useful information.

The connected aircraft will also require better man-machine relations to help pilots make optimal and safe decisions.

"Ten years ago, we introduced highly interactive flight decks that brought a high degree of capability, but we're still learning how to properly exploit it and the relationship with the human," says Matt Carrico, senior engineering manager of advanced concepts for Rockwell Collins. "The next 10 years will be optimizing that interaction to balance the capability we provide versus the complexity of using the automation. We need to be more effective at using automation to help the crew accomplish the mission in a way that decreases training, increases awareness, re-



Tap the icon in the digital edition of AW&ST to see a video of next-generation cockpit technologies being developed by Honeywell and Rockwell Collins, or go to AviationWeek.com/video



The convergence of ubiquitous data and advanced autonomy is fueling a new marriage of technology and human factors to build a flight deck of the future that will be more intuitive while optimally completing the mission.

duces workload and increases safety.”

Key to reducing the workload will be engineering simpler interfaces to the equipment, an improvement that will go into future products, but could also be helpful in legacy cockpits to cut down on “mode confusion,” situations where the pilots become stumped by the seemingly capricious actions of the automation system.

Shapiro brings airline and corporate pilots into his laboratory to look at potential product improvements, one of which is a flight deck simplification. He says one pilot reflected that “the busier he gets, the less he uses” the automation. “That’s a big failure for automation” says Shapiro. “Automation should offload you, so you can focus on the piloting tasks.”

How did automation fall out of synch with pilot capabilities?

Shapiro says it is because capabilities historically were introduced with federated boxes “and engineers making what they thought were good decisions. . . . But if they don’t understand the pilot’s point of reference, they miss the target,” he says. “We’re going to reengage the pilots—building a completely pilot-driven interface versus an engineering-driven interface.”

Carrico notes that the industry has

been wrestling with simplifying auto-flight modes for more than two decades, but there is significant inertia preventing a step change. “Any radical changes to the flight management and autopilot human-machine interface will need to address the mixed fleet operations and cross-training issues caused by having a mix of ‘old’ and ‘new’ operational procedures in the fleet,” he says. “There will need to be a compelling cost/benefit story for the airlines to adopt.”

The Rockwell Collins’s advanced technology team is researching a “revolutionary flight deck” that includes mode simplifications along with increased situational awareness and FAA Next-Generation Air Transportation System (NextGen) features like 4-D time elements and self-separation.

“We’re looking at multiple interface technologies that let your intentions get into the system faster,” says Shapiro. “You can’t take five minutes to do something that should only take three minutes to do when you’re getting close to the airport.”

Honeywell is investigating the new modalities as well. “As you get more different ways to interact with the systems and the aircraft, we want to make sure we do that up-front work of how pilots interact with systems, and what is the best way to present information at different times,” says Esposito.

The presentation, as it turns out, might need to be customized to the pilot’s upbringing. “What are potentially regional differences in how people grow up, or how they understand certain visual or audio cues?” he says. “If you look at human factors, it’s not only ergonomics, but its ethnocentricity or ethnic cultural pieces. We have done some things we can’t talk about yet, but it involves



Thales is investigating futuristic cockpit designs that include reconfigurable curved displays for hyper-situational awareness.

customizing some products for different areas around the world, because of how different people react under stressful situations.”

Esposito says Honeywell by necessity is growing its ranks of human factors experts. “We always have had our pilot experts, but now we have such a confluence of data on the aircraft, and the ability to show so much data, that it’s more critically important to show that data logically to pilots—so they can understand and absorb it quickly.”

Bob Witwer, vice president of advanced technology at Honeywell, says the “big challenge” in having a “totally connected” aircraft is translating data to actionable information. “Ten years and beyond, will have to develop more expert systems to sift this data out and provide actionable information to pilots,” he says, adding that there will likely be new FAA certification approaches needed. “I think we’re going to start to approach and get into, over time, situations where full determinism of every single operation will start to become geometrically more complex,” he says. “We’ll see more automation of the certification process.”

Honeywell, Saab Sensis and other companies are working with NASA to define and develop automated certification criteria, which would be needed to bound the performance and safety of so-called indeterminate systems, those with an infinite number of output states depending on the input and system state.

For the new technologies it is developing, Honeywell is placing more emphasis than in the past on the impacts



they have on the mission and pilot.

"For the cockpit of the future, we try to understand what's the environment the crew will be in as opposed to 'let's put cool technology in to give new capability,'" says Witwer. "There's going to be so much data available to that aircraft, we have to make sure the cockpit systems we build will make it easy and intuitive for the pilot to constantly know what's going on inside and outside the aircraft. The pilot also must have a clear and intuitive understanding of whether there is action he wants or needs to take, and the cockpit systems must make it crystal clear to him what to do. That's incredibly hard to do well."

Witwer says a question Honeywell is asked "a lot" is whether glass and touch screens will proliferate across the entire cockpit. "We had a customer that told us that for their next airplane they wanted to have even more glass," he says. "We asked, 'Are you sure? Is more really better?'" He says modalities like touch screens or voice recognition cannot be "gimmicky." "We've got to make the modality match the mission. We have to do mission analysis. That includes nominal situations, off-nominal and abnormal situations," he says. "We also have to provision for backups. What if that modality isn't available? Will you have appropriate backups to keep the pilot's workload low?"

He says when Honeywell's human-centered systems "tech guys" look at additions to the cockpit, there are four criteria that must be met: Does it give the pilot what he needs, only what he needs and only when he needs it? And does it give him the information in a way that is intuitive, unambiguous and easy to understand? If not, it's clutter."

Rockwell Collins's Carrico says a properly designed, highly automated next-generation cockpit will not necessarily require fewer pilots. "We're agnostic on the topic," he says. "We're focused on workload reduction and the right role of automation versus what you let the pilot do. Whether that results in a plane that could be safely flown by one pilot is not an objective, but it could fall out from the result."

He suggests there may be social and human problems with a one-pilot flight deck. "What do you do under failure conditions, or unusual operating conditions? Can a single human do that? Who backs up that human?" He says decision-making is best done with two people "overseeing" each other. ☼

Pilot in the Loop

Human factors have the last word in next-generation flight decks

John Croft Cedar Rapids, Iowa; Olathe, Kan.; Phoenix and Tucson



HONEYWELL

A line from The Beatles' rock anthem "Back in the U.S.S.R." nicely sums up a recent morning for Capt. Roger Moore as he piloted an "airliner" from New York to San Francisco: "On the way, the paper bag was on my knee. Man, I had a dreadful flight . . ."

Moore had just endured 5 hr. of constant turbulence, but along with getting paid, he did it for a good cause: making sure certain next-generation avionics are a good fit for the flight deck.

A retired airline captain who is now a "program pilot" for Honeywell, Moore was flying a full-motion simulator in the crew interface motion simulation (CIMS) laboratory at the company's Deer Valley facility, near Phoenix. The simulator did not really fly coast to coast, but Moore did endure moderate turbulence for 5 hr., the duration of such a trip.

The human-factors project illustrates the lengths to which avionics providers must go to develop equipment for next-generation cockpits for 2015 and beyond, where safety, efficiency and usability will trump technology for technology's sake. From touch screens to voice-recognition software to automation systems, the man-machine interfaces coming to cockpits five

Honeywell researchers are testing the trade-offs between mounting location and technology for touch-screen displays in next-generation cockpits.

or more years from now are being rigorously evaluated in anticipation that airframers will want the devices and technologies in their next-generation new or retrofit cockpits.

Moore's flight was part of a recent six-week simulator study by Honeywell and the FAA to evaluate data entry by 24 pilots on various types and positioning of touchscreen devices while hand-flying in turbulence. For Moore's flight, the subject technology was an 8-in. capacitive-based touch-screen device mounted above him in the pilot's seat, though other touch-screen mountings and technologies including infrared and resistive are also part of the testing.

Honeywell's next human-factors study in the CIMS lab, starting this summer, will investigate "more types of touch screens" as well as control devices and electronic flight bag positioning," says Rakesh Jha, director of Honeywell's crew interface and platform systems group.

The backbone of the CIMS is a six-

axis, full-motion cockpit simulator that can be programmed for random, light, moderate and severe turbulence at g-levels up to 2.25g. "I don't typically run subjects in severe turbulence because they wouldn't be using a touch screen in severe turbulence anyway," says Sonia Dodd, a Honeywell senior research and development scientist. "I typically do moderate [turbulence]."

Along with qualitative measurements of how various touch technologies work in turbulence for pilots, the researchers are also capturing certain quantitative data, including fatigue aspects of display placement.

"Does it make sense to put a touch screen up above versus in the forward position or even as a primary flight display?" asks Jha. "You get that 'gorilla arm' feeling if you're holding your arm out too long." He says Honeywell has done nerve conduction (electromyography) testing on pilot subjects to measure how tired their arms become when reaching for displays in certain locations.

The research in part is directed at finding the optimal functional allocation between touch screens and tradi-

Rockwell Collins researcher Geoff Shapiro uses eye-tracking and muscle-monitoring systems to develop better interface methods for "revolutionary" flight decks.

tional mechanical "hard" buttons.

Bob Witwer, vice president of advanced technology at Honeywell, says touch will have to prove its merit when replacing the legacy man-machine interfaces. "We're not here to make touch a gimmick," he says. "There are people who think touch on forward displays can be a good thing. In some cases it might be—but you have to do a mission analysis."

Virtually every avionics manufacturer is wrestling with similar issues on the assumption that touch-screen technology will be making its way into the cockpit in one form or another.

In its laboratories in France, Thales is working several prototypes of touch-screen-intensive futuristic cockpits, one of which will be unveiled at the Paris air show this year. Officials say the project is an evolved version of the Odicis cockpit unveiled at Paris in 2011. The idea for Odicis was to develop a single large, touch-interactive display with a variety of man-machine interfaces,

including those accepting voice commands, to replace multiple screens in legacy cockpits.

Denis Bonnet, Thales's cockpit innovation lead, says touch-based systems, to be optimal, must be designed into the cockpit from the start. For Odicis, Thales had favored a projection technology that beams light from red, green and blue LEDs reflecting off of liquid-crystal-on-silicon modulators to back-project images on a seamless, curved virtual instrument panel. Chief among research topics was how pilots would be able to interact with such a system. It is not clear if the company has changed its approach with the new prototype.

In Kansas, Garmin continues to hone its infrared-based touch-screen controllers with customer pilots on a

for "bouncing" in order to distinguish "true touch" from non-true touch.

Universal Avionics says it is pursuing a hybrid approach to touch screens that will also give pilots the option of using keyboard or line-select keys for the same commands. "The touch screen will enable you to enhance the experience to use it when it makes sense," says Paul DeHerrera, Universal's chief operating officer. "Our secret sauce is going to be the user interface and when it makes sense to use the touch screen," he says. "We think we've got a pretty good idea of when it makes sense and when it doesn't. That's the trick."

Honeywell has not said when or where it plans to introduce touch-screen capability for business jets and commercial aircraft.



ROCKWELL COLLINS

simulator in its human-factors laboratory. During Aviation Week's visit in February, the simulator featured a Garmin G5000 integrated avionics suite in a Cessna Sovereign configuration, and tests were focused on how pilots were interacting with four 5.7-in. touch-screen controllers that act as the command centers for the cockpits.

The G5000 suite is slated for use in the Cessna Sovereign refresh, the new Cessna Latitude and Longitude business jets as well as the new Bombardier Learjet 70 and 75 business jets. Bill Stone, avionics product manager at Garmin, says the company has developed algorithms to account

Though some artist concepts of advanced cockpits appear to have all touch screens and no traditional mechanical buttons, including Thales's Odicis, Honeywell appears to be more traditional in its aspirations. "I don't see all switches going away, but touch can provide some incredible human-factors features for an aircraft," says Honeywell's Witwer. As for the types of switches that will remain, he thinks fire extinguishers might be a good candidate. "I'm not sure I want to be on an airplane that has an engine fire switch on the touch display," says Witwer. "If the cockpit is full of smoke, I want the pilot to be able to put his hand down

TRAINING TIME

Chances are pretty good that the pilots who will fly the cockpits of tomorrow are today sitting in front of a computer, playing very life-like 3-D video games. Studying how those young minds learn will be crucial to developing not only the cockpit and interfaces, but also the training regime.

If my house is any indication, today's primary operations manual for new games, no matter how complex, is either the game itself, or YouTube. My sons, age 12 and 14, do not go to paper instructions or the manufacturer's website for tips beyond the basics (which are made obvious by the design of the game), they scour cyberspace for gaming videos posted by other players who have figured out clever ways to excel in the game.

Could that be a model for the future—develop a system such that it remains within certain safe bounds, but then let the users figure out the optimum or best-fit way to operate it?

Experts from top avionics companies weighed in on the topic.

"My personal feeling is that the more intuitive you make it, the less training you need," says Geoff Shapiro, senior systems engineer in Rockwell Collins's advanced technology center in Cedar Rapids, Iowa. Shapiro is working on a project to greatly simplify the flight-deck automation that pilots use, and by association, the amount of training it takes to learn and stay fluent in operating that automation. "Training is not a substitute for bad design.

In a perfect world, you put [the pilots] in there and they bump their way through it. The device should lead you through [its operation] with automation that 'talks to you' and communicates its intentions."

Thales's cockpit innovation lead, Denis Bonnet, says "it is clear that we cannot design the [next-generation] cockpit without thinking about the training that goes with it." And for Thales, that means the cockpit itself has to make training easy. "Our main goal regarding the user interface [to the avionics] is to be able to achieve this," he says. "Things could be slightly different from the cockpit of today in that we'd probably not train so much to the interface, but to the mission itself."

Bonnet says training primarily focuses on unexpected situations rather than optimally completing a mission. "We're working with behavioral psychologists and others to design an interactive display that is tuned into human psychology so that the right displays come up in an emergency. What are the failures we should show the pilots? What failures should we process automatically? We need to deal with the question of how much we want to keep the pilots in the loop."

Bob Witwer, vice president of advanced technology at Honeywell, also acknowledges that training must become simpler. He says systems must be designed "so that it becomes clear" what

without knowing anything and feel the switch and the cover and be able to get to it with [a] smoke bag on [his] head."

While the consumer world has largely moved to capacitive touch for single multi-touch (pinch and zoom) and gestures, exemplified by the Apple iPad, the technology is problematic for aviation. "It doesn't work through gloves and it's quite finicky with respect to electromagnetic environments," says Paul Ekman, senior director of Rockwell Collins's head-down display center of excellence, noting that external electrical fields, including thunderstorms, might cause inadvertent button activations.

The company is using a resistive touch method, which requires a push on the screen, for its new Pro Line Fusion touch-screen display for the King Air 350, set for certification in mid-2014. What remains to be determined from a human-factors standpoint is how far Rockwell Collins will be able to take multi-touch and gesture with resistive technology, as it requires the protective glass on the front of the display to be made thinner to provide a comfortable input to the screen. For the King Air flight deck,

Ekman says the company is defining a "minimal gesture set" that can be certified with resistive technology. "We'll start with simple two-touch items like pinch zoom or rotate," he says.

Research continues on ways to use capacitive-based touch, given the economy of scale of falling in line with the consumer market as avionics companies typically buy commercial dis-

"The idea is to harmonize the autoflight system with the flight management system. Today, they're designed independently and have their own sets of rules and logic."

plays and then install their own protective and anti-glare coverings.

"Can we control projective capacitance so we have maybe an algorithm in the controller to give inadvertent touch immunity?" asks Larisa Parks, vice president of crew interface products for Honeywell.

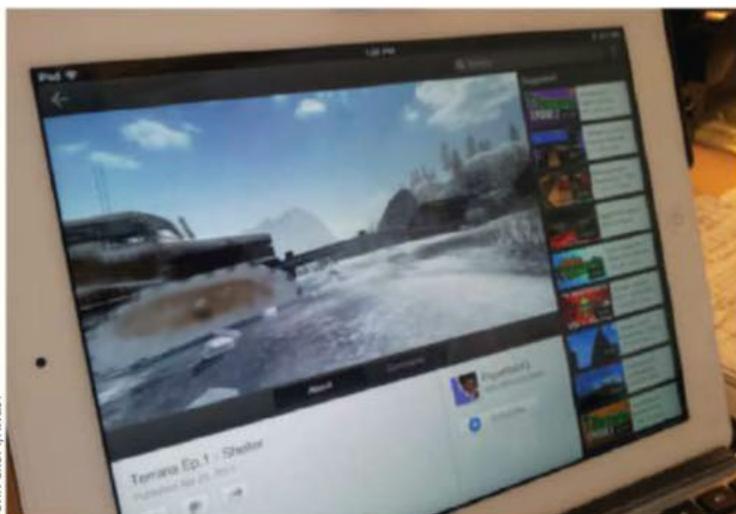
An associated research area is haptics, or methods of providing physical feedback to the pilot that would indicate a response from the touch screen. Parks says Honeywell is not currently researching the topic but has studied the possibility in the past.

Rockwell Collins continues to investigate haptics, but Ekman says he is a "little torn" by the concept, as it runs counter to "all the work we do to minimize our size, weight and power envelope" for an avionics box. "To get feedback, you need to move the mass of the display using solenoids in the corner of the display," he explains, adding that the desired feel for the feedback may require heavier components and the associated higher size, weight and power penalties.

Other key modalities being investigated from a human-factors perspective include voice recognition and interfaces to an aircraft's "autoflight" modes.

Last June, Rockwell Collins started a "mode simplification project" to ad-

Continued on page 48



It is possible that iPads and YouTube will be primary training tools for the next generation of pilots.

you should do and what the consequences are of what you are getting ready to do.

"I think we've already shown that if you design a system that meets the human factors mantra—give them what they need, only what they need, only when they need it, and give it to them in a way that is unambiguous, intuitive and easy to understand—

then the notion of training can take on a new approach," he says.

The consumer electronics industry is one good example of this approach. "You can buy consumer devices today that have virtually no instructions, or the instructions are there just in case you want to go find out in-depth what to do," Witwer says. "I think we're going to start seeing aircraft systems that are more intuitive that way. You will not need a 60-page manual to see how an avionics system works, necessarily." He says training will incorporate "different forms of media that people are already steeped in," based on devices that new pilots, most of them not from the military, "would have grown up with."

It is a good bet that those new pilots will want to set up the avionics in their own way.

"We are getting mixed messages from customers regarding simplification versus highly configurable avionics," says Matt Carrico, senior engineering manager of advanced concepts at Rockwell Collins. "Some like it highly configurable, especially young people that have grown up with it, and like to fiddle with it a lot," he says. "Other pilots do it one way [only], train and practice to that and write it into the procedures. We try to find the balance." ☺

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Continued from page 46

dress confusion that pilots are having with automation and, in particular, autoflight modes. The project was a result of a senior leadership mandate to take a "system-level approach" to the overall flight deck, including the human-machine interface and design of systems.

Of particular concern in the industry are the dozens of modes, also known as autoflight modes, that direct the aircraft through the flight management system (FMS) and autopilot to perform thrust, lateral and vertical maneuvers, with automatic transitions between modes.



Last September, the company brought in 18 independent airline, business aviation and owner-operator pilots for a study in its fixed-base "revolutionary flight deck" simulator, to begin researching mode confusion.

"The idea is to harmonize the autoflight system with the flight management system," says Geoff Shapiro, senior systems engineer in Rockwell Collins's advanced technology center. "Today, they're designed independently and have their own sets of rules and logic. There's all kinds of safety data that says it's a problem."

The 18 pilots made that clear—"mode surprises" happen nearly daily, in some cases leading to altitude deviations or unintentional stalls.

Though the industry has been discussing and researching the problem for decades, change has been difficult because autoflight systems are ubiquitous, making major modifications difficult from a cost-benefit and training standpoint. However, new opportuni-

ties are arising due to the new functionality that will be required by FAA NextGen air traffic system capabilities.

"We sat down and walked through their typical flight, gave them a couple of curve balls and asked them, 'What would you want the avionics to do in those situations?'" says Shapiro. "We wanted them to forget about the current systems, and instead think, 'What do you want it to do?' Otherwise we would keep them in a box."

"We have a lot of autoflight modes, and it turns out we don't need most of those," says Shapiro. The problem goes back to the origin of the autoflight modes—they were added piece-wise to

the FMS and autopilot architecture in order to introduce new capabilities.

For example, "vertical speed" is a mode and "FMS-driven vertical speed" is a different mode that works a little bit differently, Shapiro notes. "This is a problem across aviation with every avionics manufacturer. We're trying to make a paradigm shift here, making automation an assistant and keeping the pilot in the loop," he says. "A lot of efforts have been made to try to fool the automated flight deck, and they failed miserably. The pilot still needs to be in control of the aircraft and know what it's doing."

By looking at three primary goal-based functions—arriving at a certain point, at a given time and with a certain amount of fuel—Rockwell Collins was able to reduce the number of autoflight modes to seven from 38.

"Those modes will still be there, but they're beneath the floor boards now," says Shapiro. "You don't have to expose that to the pilots."

While voice-recognition technologies are commonplace in consumer electronics, the consensus is that there is more work to be done before they are ready for avionics.

"We've been monitoring [voice-recognition software] for well over 10 years," says Matt Carrico, senior engineering manager of advanced concepts at Rockwell Collins. "The promise has always exceeded the performance. I don't see that changing very soon."

Issues include pauses and "umms" that humans interject into phrases or sentences, especially with more complex commands such as a taxi route clearance. "It throws off the recognizer," says Carrico. "We have some work to do to get it to work with natural language."

Word recognition also depends on wheth-

Will iPads and YouTube be primary training tools for the next-generation airline and business-jet pilot?

er the speaker has an accent, says Carrico, adding that state-of-the-art speech-recognition systems apply to a limited number of

JOHN CROFT/AW&ST

accent groups. That means certain English words spoken by pilots who are native speakers of French, Russian or Chinese, for example, may not be recognized with the same accuracy as pilots whose native language is English. "So far that's been a problem for recognizers," he says.

"Our customers tell us if it only works for our English-speaking population, it's no good," Carrico says. "They sell these aircraft all over the world. They expect them to work all over the world with all kinds of crews."

Honeywell's Jha agrees that there is potential for using the technology in the cockpit if human-factors issues can be overcome, and he says Honeywell is "definitely" investigating it.

"Initially, it will be a slow introduction with limited vocabulary and functionalities," he says. "Don't expect to see Siri-like devices in the cockpit in the near future," he cautions, referring to the Apple mobile device virtual helper. ☐

Room with a View

Vision and display technologies frame next-generation cockpit

John Croft Cedar Rapids, Iowa, Phoenix and Tucson

New technologies focusing on the sense of sight will boost the utility and efficiency of the cockpit within the next few years. From advanced synthetic-vision applications to unique head-up devices and enhanced-technology head-down displays, avionics makers are perfecting a palette of designs in the laboratory and on the flight-test fleet that aircraft makers will likely choose from for their new and upgraded products.

While first-generation synthetic-vision systems (SVS) are becoming commonplace on the flight deck as a situational awareness (SA) tool, second-generation SVS, now in the laboratory and flight-test phase at several manufacturers, will boost SA to new levels but also likely bring economic benefits.

Honeywell, Rockwell Collins and Universal Avionics are among a select group of SVS-equipped avionics makers who are investigating the possibility of "landing credit" with next-

Rockwell Collins's prototype synthetic-vision surface guidance system could help pilots taxi to and from the runway in low- or no-visibility conditions.

generation SVS on head-down or head-up displays (HDD and HUD, respectively).

The concept is to augment basic SVS, which renders a conformal picture of the "expected" external world on the primary flight display (PFD), with a second source of high-fidelity information that validates that scene. By incorporating a second source, the idea is that manufacturers will be able to certify with the FAA a system that will allow for lower than standard decision heights and visibilities for Category 1 or satellite navigation-based localizer performance with vertical guidance (LPV) instrument approaches.

Initially, companies will attempt to obtain approval for a 150-ft. decision height (down from 200 ft. normally) and 1,400-ft.-runway visual-range (RVR) visibility (down from 2,400 ft. normally). The change would significantly reduce the cost of onboard and ground infrastructure needed to gain the lower minimums, which today generally require either Cat. 2 or Cat. 3 instrument landing systems or an enhanced flight vision system (EFVS), which by necessity requires a cooled infrared camera system, HUD, special training and additional maintenance requirements.

Honeywell has begun internal testing of a prototype SmartView-Lower Minimums (SV-LM) system on a modified Dassault Falcon 900EX and plans to begin proof-of-concept flight test with the FAA to evaluate the concept for instrument flight conditions by the end of May, to be followed by a simulator study to evaluate its use in visual conditions.

The proof-of-concept (POC) is not a substitute for a certification program, but follows a certification-type process that



Tap the icon in the digital edition of *AW&ST* for an interactive look at the process of assembling primary flight displays and other devices at Universal Avionics' facility in Tucson, or go to AviationWeek.com/futurecockpit

provides FAA input and comment on the program. "At the end, we would know the requirements for the system," says Honeywell test pilot Sandy Wyatt, project pilot of the POC. System performance requirements are also being developed by an RTCA group that has also been investigating lower minimums for EFVS. "In the end, the FAA will say, 'Yes, if you build to that set of requirements, this is the credit you could probably get.'" If the POC is successful, Honeywell aims to decrease the landing minimums to 100 ft. in a program that would likely start in the fall.

Universal Avionics is somewhat less confident in the outcome. "The FAA has concerns on the head-down concept," says COO Paul DeHerrera, referring to the regulator's uncertainty about whether pilots can safely transition from a head-down environment to an out-the-window view so close to



ROCKWELL COLLINS

the ground. "Universal, along with the other members of the RTCA group, is working through the issues. Until the FAA's concerns are resolved, no dynamic proof of concept demonstrations are required nor planned by Universal Avionics."

Universal Avionics, the first company to certify SVS for the primary flight display on a Part 25 aircraft in 2006, will unveil this fall its second-generation SVS along with its launch customer for the as-yet-unnamed product.

The company's original SVS, called Vision-1, in recent years has fallen behind with respect to the technology advances made by competitors such as Honeywell and Rockwell Collins, who include runways and other advanced features into their systems. "We were always working on SVS," says DeHerrera. "The struggle we had was how to approach it, but we are real happy with what we have come up with."

He says the new SVS will again feature egocentric SVS on the (PFD) and an option for exocentric SVS on the center-console multifunction display (MFD). But he says the new system will include a runway database, taxi diagrams, 3-D taxing capability and an assortment of other features.

To date, taxi systems have shown the aircraft's position on an airport map in 2-D (from above) on the MFD. While that capability will continue, 3-D systems will offer taxi positioning and guidance information, eventually including the route clearance from the tower, in an ego- or exocentric view on the PFD. Honeywell is working on the capability for its head-down PFD while Rockwell Collins is developing the technology for HDD and for its synthetic vision-capable HUD.

One advanced feature DeHerrera revealed will be a "remaining runway" option that will give the pilot a readout on the distance remaining on the runway from wherever he or she places the cursor on the display. DeHerrera says the tool will aid pilots with making intersection takeoffs or for judging the safety of a land-and-hold-short operation. He says the company is flight-testing the SVS on its Cessna Citation VII, conducting the experimental work before launching a formal certification program with the FAA "later this year," with a technical standard order and type certificate for the installation on the Citation VII expected by year-end.

Rockwell Collins is also planning a proof of concept for lower minimums, but with augmented synthetic vision on the HUD, which first entered service on Bombardier Global 5000 and 6000 business jets in March 2012. The company is a relative newcomer to SVS, compared to Universal Avionics and Honeywell, which first certified SVS for the air transport (Part 25) market in 2006 and 2007, respectively.

Like Honeywell, Rockwell Collins is aiming at 150-ft. minimums at the start, but using the HUD. "We're also trying to get relief on the amount of training and maintenance requirements to descend to 150 ft.," says Matt Carrico, senior engineering manager of advanced concepts at Rockwell Collins. "Right now to descend below 200 ft., which you can do on certain HUD-equipped airplanes, you need additional training and a little bit higher level of maintenance on the airplane. With our HUD, we believe no additional training is required, and modern avionics and monitoring built into the system mean no additional maintenance is required. We are trying to make a case for that with the regulators, but it hasn't been granted yet."

Carrico says the technology is part of an airframer's certification program for an existing Pro Line Fusion platform, but he could not yet reveal the details. He expects certification could be achieved "in the next year or two."

Key to Rockwell Collins's approach are active sensing tech-

nologies to monitor the vertical height on the approach. "When you get below 200 ft., vertical accuracy using WAAS [wide area augmentation system] GPS is not sufficient." For runways with a Cat. 1 instrument landing system (ILS), the monitor could be based on the existing ILS beams, which Carrico says are accurate below 200 ft. Other technologies would be required for LPV approaches, but in both cases, Carrico says, the HUD-capability will be beneficial. "We think when you operate below minimums, you should be head-up and eyes-out," he says. "What we've seen in tests is that HUD promotes bet-

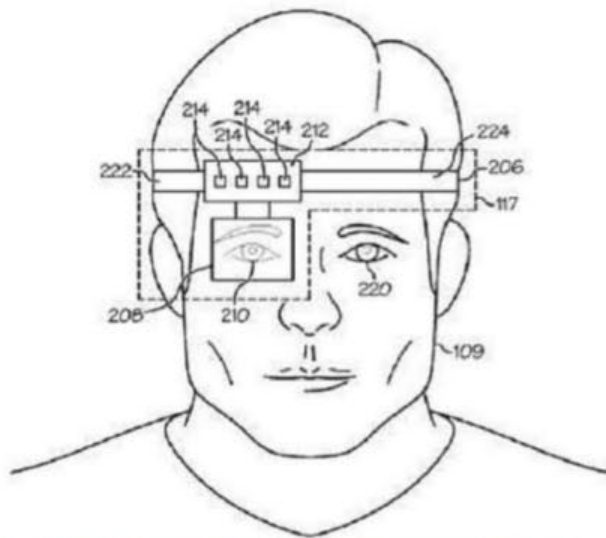
ter flight technical error (FTE) on most approaches. With SVS on the HUD you get additional cues to help you find the runway. As you transition to the outside view, if you're already heads up, your eyes are already focused at infinity." Honeywell has similar studies however that show that FTE for its head-down solution is equivalent to that of pilots using a HUD on the approaches.

Honeywell could have an ace up its sleeve if the FAA ultimately rejects the lower landing minima using HDDs. The company in 2012 received a U.S. patent on a near-to-eye display that is effectively a personal HUD that the pilot wears over one eye and includes head-tracking capability. While Honeywell would not discuss this patent, it is conceivable the technology could be used for applications like lower landing minima.

Longer term, all three avionics makers plan to develop combined, or fused, vision systems that integrate synthetic-vision and other active sensors, potentially infrared and radar, to create one single, validated view of the actual environment ahead of the aircraft on the PFD or in Rockwell Collins's case, the HUD. Such a system will ideally be capable of landing with zero visibility without the significant onboard and airport infrastructure needed for traditional low- or zero-visibility landing systems. In preparation for that eventuality, the compa-

nies are creating surface guidance, or taxi systems, that take advantage of synthetic-vision capabilities.

Rockwell Collins is developing a 3-D egocentric HUD and PFD view for taxiing that includes a variety of situational awareness cues and a highlighted taxi route keyed in by the pilots, or eventually, automatically data-linked into the aircraft from the control tower. The 3-D portion of the HUD shows airport buildings as the centerline and edges of the taxiway are depicted as a line and diamonds, respectively, suspended above the route. Included as data fields are ground and target



Honeywell plans to enter a synthetic-vision-for-lower-landing-minimums proof-of-concept (bottom) flight-test campaign with the FAA by late May, but has not yet said its intentions for a near-to-eye display system for which it received a U.S. patent last year.

speeds, distance to the next turn, direction of the next turn and distance to any "holds" in the taxi clearance. Audio callouts include an alert when the pilot strays off the entered route, distance to the next turn, direction of turn and distance to a hold.

Honeywell's prototype surface guidance system is a visual extension of its SmartRunway option, which issues aural position reports and alerts, as well as some text notes, based on the aircraft's position during taxi. Pilots will select the surface guidance system by toggling a switch, which converts the PFD to a primary taxi display that shows an exocentric 3-D view from behind and above the aircraft in an active compass rose. In one version of the system, the pilot-entered taxi route is displayed mid-screen, with the route highlighted with a magenta line and ground speed shown. "Hot spot" locations identified by the FAA as having a heightened risk for incursions are highlighted with red and white segmented circles, and runway hold-short lines are emphasized by a depiction of

development laboratories at Rockwell Collins and Honeywell recently were about 0.5-in. thick.

Liquid crystal displays (LCDs), the primary technology for cockpits, require a bright light source at the back of the display, which drives the display to be several inches thick. The pixels act as shutters to either block or color the light going forward.

"OLEDs are causing some excitement in industry," says Ekman. "The technology can be made very thin and it provides great contrast. Black is the absence of light versus light trying to shine through shutters [of an LCD]. It's a very saturated color space that looks good. It is successful in smartphones today and devices where manufacturers are trying to differentiate with each other."

Researchers say the technology is not yet ready for cockpits.

"The entire industry has the same issue—the maturity of OLEDs coming out of companies like Samsung and LG," says Rakesh Jha, director of engineering for crew interface



Avionics manufacturers are cautiously optimistic that very thin organic light-emitting diode displays (OLEDs) can be made rugged and long-lasting enough for aerospace, which could lead to curved, conformal displays.

a wall in front of the aircraft. The positions of other aircraft and vehicles based on automatic dependent surveillance-broadcast "In" data, are shown as tetrahedrons.

While avionics makers may not agree on the best approach to advanced navigation functions, they are unanimously optimistic that a new type of display technology making its way into the consumer electronics market—organic light-emitting diode displays (OLED)—would be a great addition to aerospace, if the bugs can be worked out.

The technology, available in some Samsung and LG mobile phones and televisions, will allow for thinner, lighter and more luminescent displays that can conform to curved surfaces once reliability and durability concerns are addressed.

OLEDs emit light of various colors at the pixel level, allowing the display to be "tremendously thin," says Paul Ekman, senior director of Rockwell Collins's head-down display center. Prototype units Aviation Week viewed in advanced

and platform systems for Honeywell. "The key question is when the technology they are producing is mature and can be customized for aerospace applications."

Both Honeywell and Rockwell Collins buy commercially available displays and add ruggedizing transparencies and other treatments in-house to make the devices ready for cockpits. Honeywell is testing an OLED primary flight display and backup display at its laboratories in Phoenix.

Ekman says Rockwell Collins purchases the latest commercially available OLEDs and tests the devices in its labs. Whereas mobile phones typically last from 3-5 years, a cockpit display must work much longer and has to be turned on and "very bright" all the time. "An OLED can't handle that rigorous environment for as many hours as our devices need," he says.

Along with longer life, OLEDs are also problematic from a glare standpoint due to the metallic structure of the display material. "We would have to tame that," says Ekman. Rockwell Collins in 2012 built a prototype OLED touchscreen device to study the reflectivity problem.

"We had to pull some of the existing polarization technologies off of the screen," says Ekman. "I don't think the results are pleasing yet." ☐

Intercontinental Push



Defense cuts at home give added impetus to European companies' international expansion

Leithen Francis **Langkawi, Malaysia**

LEITHEN FRANCIS/AW&ST

Some European aerospace companies are shifting their focus—and staff—to markets where there are more growth opportunities.

Saab recently established an Asia-Pacific regional headquarters in Bangkok headed by Dan-Ake Enstedt, who was president of Saab North America. "I was covering the U.S. and Canada. It is the same concept. What we did there, we are trying to do in Asia and the rest of the world," says Enstedt.

All Saab employees in the Asia-Pacific region report to Enstedt, and he reports directly to Saab CEO Hakan Bushke. Saab's business and reporting lines were restructured to reflect geographic markets under the direction of Bushke, who joined the Swedish aerospace giant in November 2010. Enstedt says reporting directly to the CEO means decisions can be made more quickly.

Before this restructuring, Saab largely had its managers and employees in Sweden. They would fly out from time-to-time to meet with prospective customers for a sales campaign overseas. In the past, that may have made sense because, as Enstedt points out, 20 years ago Sweden accounted for 80% of Saab's business. Times have changed, however, and 70% of Saab's business is now outside of Sweden, he notes.

Enstedt sees this shift coming for U.S. defense companies, as well. "They are where we were 20 years ago," he

says. "Eighty-five percent of their business is in the U.S." But the recent cuts to U.S. defense spending, and the prospect of more cuts in future, means U.S. defense companies will have to move more workers to markets outside of the U.S., predicts Enstedt.

Saab has divided its global business into six regions: Europe/Middle East, India, Asia-Pacific, Nordic nations, Africa and the Americas. Besides Bangkok, Saab has Asia-Pacific offices in Kuala Lumpur, Tokyo, Singapore, Canberra, Seoul and Jakarta. "We are trying to be closer to the customer. We also have a strategy to team up with local industry and to do transfer of technology," Enstedt says.

In Malaysia, Saab is partnering with industrial conglomerate DRB-Hicom to meet offset requirements that will arise if Saab, for example, wins the competition to provide fighters and some airborne early warning aircraft to the Malaysian air force.

Malaysia has also become an important market for Swiss aerospace giant Ruag Aviation, which has generated work helping to maintain the Malaysian air force's Northrop F-5s, Boeing F/A-18 Hornets and Pilatus PC-7s, the same aircraft types that the Swiss air force operates. Ruag Aviation, being a Swiss-based company, used to derive nearly all its revenue from Switzerland; it helps maintain the Swiss air force fleet.

Ruag Aviation's vice president

for subsystems and products, Stephan Jezler, says the amount of revenue the company generates from Switzerland has fallen to 50%, as a result of a steady

A Ruag 228 turboprop was on display at the Langkawi air show in Malaysia in March. The Malaysia maritime enforcement agency wants more maritime patrol aircraft.

decline in the Swiss defense budget. He predicts the percentage will drop further. "Switzerland's defense budget is slowly going down. It is slowly shrinking, as is the case with all countries in Europe," Jezler says. "That is why needed to have this

international strategy."

One way Ruag is expanding internationally is through acquisitions. For example, it acquired Rosebank Engineering in December to gain a strong footprint in Australia. Rosebank helps maintain aircraft for the Australia and Malaysia air forces and an agreement with BAE Systems to manufacture components for the Lockheed Martin F-35.

Ruag is also looking closely at Latin America, a growth market where there is still a sizable fleet of F-5s, a type that Ruag has much experience maintaining. Brazil's air force has been upgrading its F-5s with help from Embraer, but Jezler says Ruag has the advantage of access to a large stockpile of F-5 spare parts. When the Swiss air force sold some of its F-5s a few years ago to the U.S. Navy for training use, the sale excluded spare parts, he adds.

Ruag is also hoping it can win contracts to help support Gripen NG customers thanks to an agreement it has with General Electric, the maker of the Gripen NG's F414 engine, which also powers the Boeing F/A-18E/F Super Hornet. Ruag will support the Swiss air force's future fleet of Gripen NGs, and Jezler says the agreement with GE allows it to support Gripen NG and Super Hornet operators overseas as well. Brazil is seeking to buy new fighters, and the Gripen NG and Super Hornet are in the running along with other types. ☉

Protecting Paradise

Maldives Defense Force is looking to add UAVs and patrol vessels

Leithen Francis Langkawi, Malaysia

The Maldives are internationally renowned for their pristine natural environment spread across 1,192 coral islands and an exclusive economic zone (EEZ) of around 920,000 sq. km (355,214 sq. mi.). Protecting it is a mammoth task.

Unmanned aerial vehicles (UAV) would offer the Maldives the best means for surveillance of its vast EEZ, and the tiny nation is eager to hear from companies looking to conduct trials or research, says Brig. Gen. Ahmed Shiyam, head of the Maldives National Defense Force. "For the coast guard, it is a very big challenge to patrol our waters," Ahmed says. "They are looking for innovative ways to do this using modern technology and proven local methods."

Ahmed says UAVs represent the best answer compared with manned aircraft. "Acquiring and operating UAVs initially may be expensive and the country may not be able to afford it [straight away], but I think it is a necessity," he says, adding that having the technology in the Maldives "will be good for our people." Ahmed says "operating manned aircraft is an expensive business . . . I don't think it's very cost-effective."

The Maldives National Defense Force oversees not only the country's armed services, but also the coast guard.

Ahmed says he spoke to several

UAV manufacturers exhibiting at the Langkawi International Maritime and Aerospace Exhibition (LIMA) late last month. There he emphasized that the country would require a waterproof UAV that was recoverable from the ocean.

While the National Defense Force has no plans to acquire manned aircraft, Ahmed says it has a plan in mind to outfit some of the country's commercial seaplanes with surveillance equipment. The Maldives has many island resorts that are served by commercial seaplanes, mostly de Havilland Canada Twin Otters, that fly at low altitude.

Other than UAVs, the National Defense Force would like to acquire more patrol vessels, although it wants to find a cost-effective, local supplier. Ahmed says the Maldivians have a centuries-old tradition of shipbuilding. Ideally, foreign shipbuilders will work with local personnel to design and develop a vessel to meet the unique requirements of the coast guard, he says.

The open ocean is just a few miles from shore, so the coast guard needs vessels large enough to cope with high seas. But maintaining large, foreign-produced sea vessels has turned out to be expensive, Ahmed says. "We are thinking of ways to develop a boat based on proven local expertise that also incorporates modern technology. [The] ship must be equipped with radar and diesel power, but also sails."

He believes that the coast guard could minimize the operational costs of such a vessel if it consisted of a locally built hull, but with modern systems on board. The ship's captain would then have a choice of diesel, solar or wind power.

"We would need at least 10, as a bare minimum, but the ideal situation would be 20," Ahmed adds. Today's fleet comprises fewer than 15 vessels.

If the ship is made in the Maldives, then it means it can be repaired in the Maldives, Ahmed says. Operating foreign-built vessels is expensive, because whenever one needs to be repaired or refitted, it has to be sent to a shipyard overseas, for example, to Sri Lanka, he says.

Ahmed also says: "We are looking at developing a boatyard and repair facility in the country for our coast guard," and are seeking foreign joint-venture partners. "I'm sure it will be a very viable enterprise and make business sense," he says, adding that the venture also can generate business from the Maldives' fishing fleet and boats used by tourism operators. The local partner in the new venture would be Sewac, a servicemen's welfare cooperative, and the site for the shipyard has already been selected—a reef called Uthuru Thila Falhu (north shallow reef) that is very close to Male, the main island and capital of the Maldives. The reef forms a natural lagoon, and the plan is to fill in the lagoon and reclaim the land, Ahmed says. Reclamation work will start this year, he adds. ☐

The Insitu ScanEagle UAV on patrol over open ocean.



BOEING

Help from Above

International Charter offers free satellite imagery to aid disaster relief

Amy Svitak **Paris**

German Aerospace Center DLR is taking over the rotating chairmanship of the International Charter on Space and Major Disasters, a multinational network of space agencies that for more than a decade has provided bureaucracy-free satellite assistance in the form of imagery to countries in the grip of natural or manmade disasters.

Created in July 1999 by French

have used the charter, which has been activated 369 times since the network was formed over a decade ago. Last year, it was called on 40 times in response to major natural disasters. In addition to Hurricane Sandy in the Caribbean and along the U.S. East Coast, these included a typhoon in the Philippines in early December that killed 1,900 people, floods in Pakistan in September that left 500 dead and an

and make a map product—this is a step not in the charter but which can take six to eight hours.”

The charter relies on nearly 20 optical and radar-imaging satellites owned by governments or companies in Argentina, Brazil, Canada, China, France, Germany, Japan, India, Russia, South Korea, the U.K., the U.S. and Taiwan.

DLR provides Earth-observation data from two German radar satellites, TerraSAR-X and TanDEM-X, that can acquire very detailed images regardless of cloud cover or daylight.

“Radar images are ideally suited to mapping flood disasters, as they clearly distinguish between expanses of water and land,” says geographer and charter secretary, Jens Danzeglocke. In some cases, DLR also assists with optical data from the RapidEye satellites, in the event of forest fires, for example, or after particularly extensive incidents, such as the March 2011 earthquake and tsunami in Japan.

Since the charter was formed, founding member CNES has been among the most active members in terms of responding to disaster relief

France's SPOT 5, which produces images for the International Charter on Space and Major Disasters, will be placed into a graveyard orbit in 2015.

and security needs. The agency is involved in more than 80% of charter activations at a rate of 30-40 times per year via its SPOT 5 Earth-observation satellite, which provides the bulk of French imagery; it has delivered 100 pictures a year since 2000.

For now, SPOT 5 imagery is complemented by data from the U.S. National Oceanic and Atmospheric Administration and the U.S. Geological Survey's (USGS) Landsat satellites as well as high-resolution optical satellite imagery provided by U.S. commercial fleet operator DigitalGlobe to the USGS through the National Geospatial Intelligence Agency.

With SPOT 5's retirement expected in 2015 and no French-government-owned successor to follow, the organization will use imagery from the European Union's Sentinel 2 Earth-observation satellites—slated to launch in 2014 but likely to be delayed—and France's new twin sub-meter-resolution Pleiades optical-imaging satellites launched in 2011 and 2012. ☐



space agency CNES and the European Space Agency (ESA), the charter's core membership comprises 15 national space organizations, with Ukraine expected to join soon. In addition, authorized users in 41 countries can activate the charter on their own, while more than 90 nations participate through agreements with authorized users, via the U.N., or through regional emergency response networks, including the 32-nation Sentinel Asia.

Using satellite imagery, relief workers are able to identify roads or bridges that remain passable after an earthquake or a flood, as well as which buildings or towns are damaged.

To date, more than 110 countries

earthquake in Iran in which 300 lives were lost.

To trigger the service, authorized users request activation of the charter, and within 3 hr. a satellite is tasked with collecting imagery. Over the next 24-48 hr., satellite images are processed before being transmitted hours later to the users.

“Actually receiving the image is one of the longest and most unpredictable steps, because while we're in a situation now where we have a lot of satellite resources, we can have situations, for example, involving poor weather, so optical imagery isn't so useful,” says Steven Hosford, International Charter program manager for CNES. “Once we get the image, we extract some data

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General Secretary

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May 14-15—MRO Eastern Europe. Vilnius, Lithuania.
Sept. 9-11—NextGen Ahead. Washington.
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Oct. 29-31—MRO Asia. Singapore.
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May 1-2—SpeedNews 11th Annual Aerospace & Defense Industry Suppliers Conference. Charleston (S.C.) Place. See www.speednews.com/ConferenceInfo.aspx?conferenceID=22

May 6-9—Regional Airline Association Annual Meeting. Montreal. Contact Cheryl Goldsby of Emerald Media at cheryl@emeraldmediaus.com

May 13-14—65th Naval Helicopter Association Symposium. Town and Country Hotel, San Diego. See regonline.com/nhasymposium2013

May 14-16—Imdex Asia. Singapore. See www.imdexasia.com/media-coverage.aspx

May 21-23—American Helicopter Society's 69th Annual Forum and Technology Display. See www.vtol.org/forum

June 11-14—Sixth Chaotic Modeling and Simulation International Conference. Yeditepe University, Istanbul. See www.cmsim.org

June 17-23—50th Paris International Airshow. Le Bourget. See www.paris-air-show.com/

June 24-27—American Institute of Aeronautics and Astronautics Fluid Dynamics and co-located conferences and exhibit. San Diego.

June 25-26—International Civil Aviation Organization's Regional Aviation Safety Group. San Jose, Costa Rica. See www.alta.aero/2010/?q=nonaltanode/contact

June 25-27—JEC Asia. Singapore. See www.jeccomposites.com/events/jec-asia-2013

Oct. 22-24—National Business Aviation Association's Annual Convention. Las Vegas. See www.nbaa.org/events/name/

Nov. 17-21—Dubai Airshow. See www.dubaiairshow.aero/

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Calling All Readers

A big challenge of the digital revolution is finding ways to attract the next generation of readers without upsetting venerable subscribers, many of whom tell us they like Aviation Week exactly as it is. Every day is a balancing act. But as we continue our rollout of new digital products and services, one longtime truism has not changed: Quality is king.

If Aviation Week expects to remain the market leader, we must continue to set ourselves apart with depth, accuracy and context that cannot be found anywhere else, in print or online. If we lose sight of that, it really does not matter whether content is delivered via an iPad, mobile phone, social media feed or print magazine that arrives in the mailbox.

Our team of editors is up to the task. The ongoing battle about the U.S. Air Force's selection of the Sierra Nevada/Embraer A-29B Super Tucano over Beechcraft's AT-6 for Light Air Support in Afghanistan has been widely covered in the trade press. But Aviation Week had a unique advantage: a staff writer who had piloted both aircraft. In our April 15 issue (page 58), Chief Aircraft Evaluation Editor Fred George provided readers with his first-hand evaluation of the two competitors and outlined why he believed the Air Force had made the correct call.

Subscribers have also been treated to Fred's pilot reports—accompanied by videos—of the Gulf

(page 28) is representative of our effort to provide regular coverage of the rotorcraft market and its key players. Our new London bureau chief, Tony Osborne, is a veteran reporter on military and commercial helicopters. Earlier this month, he teamed up with Managing Editor for Technology Graham Warwick to detail Bell Helicopter's efforts to get the U.S. Army to consider a tiltrotor for its Future Vertical Lift program (AW&ST April 15, page 34).

Commercial Space: Senior Editor Frank Morning, Jr., one of the world's preeminent space journalists, has provided readers with in-depth analysis of SpaceX and other fledgling commercial ventures. And Paris Bureau Chief Amy Svitak is leading an effort to increase Aviation Week's coverage of the commercial satellite industry. This week, she details how a startup backed by Bill Gates has adopted metamaterials technology for a new ultra-thin satellite broadband receiver (page 26).

European regulatory issues. From our new Brussels bureau, Contributing Editor Cathy Buyck has bulked up the magazine's coverage of European aviation and regulatory issues that affect airlines and aircraft makers.

Overarching all of this is our commitment to delve into the technologies that underpin the aerospace, defense and airline industries. Case in point: Senior Editor Guy Norris has been at the forefront of reporting the battery saga that has forced the grounding of the 787 and he detailed Boeing's efforts to develop a fix that will allow the jet to return to service. Meanwhile, next week's magazine will feature a special report on advanced manufacturing in aerospace.

I realize that may not be enough to satisfy readers who remember the days when Aviation Week was essentially an engineering magazine. I recently corresponded with Arthur Lee, a retired U.S. Navy commander who has been a subscriber since 1957. Interviews with CEOs belong in *Business Week* or *Time*, not *Aviation Week & Space Technology*, he says. "The 787 battery coverage is, however, great."

Conversely, other subscribers tell me they count on us for coverage of key program, policy and business decisions in the industries that we follow. What do you think? Where can we do better? My email address is joe_anselmo@aviationweek.com. Please write. We value your input. ☺



“If we lose sight of quality, it does not really matter how content is delivered”

stream G650 and Boeing 787. In a few weeks, we will be featuring his test flight of the Airbus A400M military transport.

Aviation Week also is listening to its readers, increasing our focus in several key areas you tell us you want to see more of. Among them:

Avionics. In this week's cover package, Senior Avionics Editor John Croft provides an in-depth look at new technologies that will shape the next generation of cockpits, such as advanced synthetic vision, head-up displays and touch screens (page 42). Since joining Aviation Week last September, John has reinvigorated our coverage of avionics. And when the FAA announced plans to stop funding control towers at 149 airports, he hopped in his Piper PA28 Archer II, flew to some of the affected facilities and went up into the towers to talk with controllers firsthand. His reporting highlighted what a poor job the agency had done in planning the closures, which have since been delayed.

Helicopters: This week's article on Eurocopter's efforts to get the grounded EC225 back in the air

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