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**Chief Aircraft Evaluation Editor** Fred George

For individual e-mail addresses, telephone numbers and more,  
 go to [www.AviationWeek.com/editors](http://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  
**Editorial Administrator** Norma Maynard

## BUREAUS

### BEIJING

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

### FRANKFURT

Am Muhlberg 39, 61348 Bad Homburg, Germany  
 Phone: +49 (6172) 671-9817 Fax: +49 (6172) 671-9791  
**International Air Transport Editor** Jens Flottau

### GENOA

Via Martiri Libertazione 79/3, 16043 Chiavari (Ge), Italy  
 Phone: +39 (185) 308-606, Fax: +39 (185) 309-063  
**Contributing Editor** Andy Nativi

### LONDON

20 Canada Square, 7th floor  
 Canary Wharf, London E14 5LH, England  
 Phone: +44 (20) 7176-7000  
**Bureau Chief** Robert Wall

### 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-1 (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](mailto:pierre.sparaco@orange.fr)

### SAN FRANCISCO

310 Brundon Court, Pleasant Hill, Calif. 94523  
 Phone: +1 (925) 934-6813  
**Bureau Chief** Michael Mecham

### SINGAPORE

30 Cecil Street, Prudential Tower #13-01  
 Singapore 049712  
 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** Angela Smith

**Art Department** Gregory Lewis, Scott Marshall

**Copy Editors** Andrea Hollowell, Patricia Parmalee, Nora Titterington

**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](mailto:hamilton@aviationweek.com)



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# 30

*Biplane passes in front of an Atlas V launching NASA's Mars Science Laboratory from Cape Canaveral in this shot taken on Nov. 26 from nearby Cocoa Beach, Fla. On Dec. 10, controllers plan to oversee the first trajectory correction maneuvers spread over the probe's cruise to Mars that are designed to deliver it to the proper entry corridor at the outer edge of the planet's thin atmosphere.*

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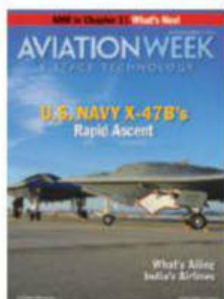
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### COVER STORIES

**54 Northrop Grumman's second X-47B, Air Vehicle 2 (right), has joined AV-1 in flight testing under the U.S. Navy's UCAS-D unmanned combat air system demonstrator program. AV-1 is being moved to NAS Patuxent River, Md., from Edwards AFB, Calif., to begin the work-up to autonomous landings on an aircraft carrier in 2013 and automated aerial refueling trials in 2014. Northrop Grumman photo by Alan Radecki.**



**24 AMR's filing for Chapter 11** bankruptcy protection may fore-shadow both the best and worst of times ahead.

**46 Despite spiraling jet fuel costs, plummeting profits and high debt levels, India's aviation sector is expected to pull through.**





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SAAB



## GET A GRIP

- 💬 **Switzerland chose** the Saab Gripen NG in its fighter competition (see p. 36) and our editors took to **Ares** to report the news Nov. 30 and analyze and comment on some of the history, details and ramifications of the deal. Readers of the blog followed soon after with their own contributions.

[AviationWeek.com/Ares](http://AviationWeek.com/Ares)

## MRO SOCIAL

- 💬 **The Teardown Report** highlights MRO-focused social-media discussions and topics from the week—every week—on our MRO blog, **Turnaround Time**. Report #21 features a discussion on employee-based reporting, one of the newer tactics companies are using to get their messages out. To read more, go to [tinyurl.com/7vjzr28](http://tinyurl.com/7vjzr28). For more **Turnaround Time**, go to [AviationWeek.com/mroblog](http://AviationWeek.com/mroblog)

## WEIRD AND WONDERFUL

- 💬 **Our weekly Strange But True** blog highlights the bizarre, odd and sometimes downright scandalous news from the global aviation industry. Go to our **Things With Wings** each Friday for the latest.

[AviationWeek.com/wings](http://AviationWeek.com/wings)

## INDIA UPDATE

- 📷 **India's airline market** has been expanding along with the nation's middle class, but many carriers are struggling lately nonetheless (see

p. 46). For the latest news on one of the world's fastest-growing aviation and defense markets, and for photos and blog posts on India, go to [AviationWeek.com/India](http://AviationWeek.com/India)



## PREMIUM CONTENT

- ✨ **When AMR announced** it is seeking bankruptcy court protection to reorganize its American Airlines network and American Eagle regional operations (see p. 24), savvy followers of the industry instantly accessed fleet data and more on AWIN—the Aviation Week Intelligence Network. Subscribers to AWIN can view exclusive summaries, photos, supplier information and articles on aircraft, engine, satellite, maritime, UAV and other programs.

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## FROM THE WEB

Comments from readers  
on AviationWeek.com

**International Editor Robert Wall's recent Ares blog "French UAVs: Who is Up, Who is Down?" prompted this comment:**



**Stan saying:**

Interesting story. As a side note, the senate now has a socialist majority (for the first time). The socialists are not good friends with Serge Dassault, a right-wing senator who owns many newspapers and was CEO of Dassault Aviation.

**Los Angeles Bureau Chief Guy Norris's article "American Sets Stage For NEO Power Battle," which covers American Airlines powering part of its new Airbus fleet with V2500s, drew the following responses:**

**Rowboat68 who notes:**

Just as the J-79 powering the 880 airliner was the cause of the failure of Convair, so will Boeing fail if it ignores the GTF [geared turbofan]. Convair failed by ignoring the twin-spool design. We've been down this road before.

**Frank expands on this:**

Another part of the Convair failure ties in with Rowboat68's comments—the 990 also failed, in large part due to the aft-fan GE engine at the time Pratt introduced the forward fan JT3D.

Pratt has proved the GTF numbers while Leap is still a paper engine. Check out the consumption shortfall for the GenX since its introduction.

**And 123xyz posits:**

The cause of the Convair 880's short production life might be more than just fuel consumption of J79s. Airlines didn't like its 3-2 seating and Boeing's shortened 707—the 720—rendered the 880 uncompetitive in upfront costs alone.

 **Join the discussion at:**  
[www.aviationweek.com/avweek](http://www.aviationweek.com/avweek)

## FEEDBACK

### MANY-PRONGED STRATEGY

In "War in Washington: U.S. Airlines Vs. Boeing" (AW&ST Nov. 21, p. 12) you correctly noted the Air Transport Association's (ATA) position that the Export-Import Bank's practices have a significant adverse effect on U.S. airlines, disadvantaging the carriers and commercial aviation jobs, and thus bears close scrutiny.

Ultimately, we seek reform of the international export credit structure. The action against the bank is one prong of that strategy. The volume of below-market export credit distorts the credit and capital markets, and that distortion ultimately drives excess capacity. Properly functioning credit markets ration the availability of credit to airlines for new aircraft.

Our dispute is with the bank itself to ensure that it complies with its statutory obligations and brings transparency to its process. Our dispute is not with Boeing, which is a key partner for the ATA and our members. We have had many discussions with Boeing about the export credit issue and we expect to work with the manufacturer going forward to find a multi-lateral solution that protects both its interests in fair competition with Airbus and other aircraft manufacturers and our interests in fair competition with the world's airlines. This is a complex issue, and one we are committed to working cooperatively to resolve.  
*Nicholas E. Calio, President/CEO  
Air Transport Association  
WASHINGTON, D.C.*

### ENGINEERING SPIRIT AND DRIVE

In the recent commentary "No Risk, No Reward" (AW&ST Nov. 14, p. 62), John Stopher recounted a great cautionary tale for engineering companies: "External staffs imposed specific design constraints, believing that they understood better than . . . engineers how to build effective spacecraft." He notes, and I agree, that engineers do not need to be "managed," they need to be told what the job is and then be allowed to do it.

Managers should focus on getting the work for the organization; obtaining the resources to do the work (money, equipment, personnel); and defending the work against attempted takeovers by empire builders. Engineers are self-motivated to do the job right.

*Bill Anderson  
CORONA, CALIF.*

Aviation Week & Space Technology welcomes the opinions of its readers on issues raised in the magazine. Address letters to the Managing Editor, Aviation Week & Space Technology, 1200 G St., Suite 922, Washington, D.C. 20005. Fax to (202) 383-2346 or send via e-mail to: [awstletters@aviationweek.com](mailto:awstletters@aviationweek.com)

Letters should be shorter than 200 words, and you must give a genuine identification, address and daytime telephone number. We will not print anonymous letters, but names will be withheld. We reserve the right to edit letters.

### REALLOCATING RESOURCES

The editorial "Debate Defense Spending Honestly" (AW&ST Nov. 14, p. 66) makes excellent points, but does not sufficiently address our military bloated.



We can safely shift \$300 billion a year from the defense budget to NASA and infrastructure development, and still maintain a robust military.

Sure, sacrifices would be needed. We might not be able to continue with 10 Army divisions and 11 aircraft carriers. We might not be able to invade countries like Iraq for sketchy reasons, or defend Taiwan from Chinese aggression. But the irony of preparing to fight China is our reliance on bases in Guam and Hawaii—we claim rights to these islands, yet denounce China's right to Taiwan. Meanwhile, \$200 billion per year would be more than enough to carry out international actions such as in Libya, police our borders and provide natural disaster assistance. An investment of that size in our infrastructure would bring our transportation, utilities and cities into the 21st century. And that massive increase in space exploration funds would foster international goodwill, while guaranteeing we hold every patent and important technology in the ensuing mineral grab from distant planets.

All that money would still be going to the large manufacturers, leading to a net increase in jobs. If we do not act this boldly, what is there going to be left to defend?

*Jeremiah Farmer  
SANTA CRUZ, CALIF.*



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**H**oward Eng has been appointed president and CEO of the *Greater Toronto Airports Authority*, starting late in the first quarter of 2012. He is executive director-operations at Hong Kong International Airport.

**William H. Jolly** (see photo) has been named president of Huntsville, Ala.-based *WestWind Technologies*. His 25-year career in mechanical and aerospace engineering includes executive positions in technical services and manufacturing for government customers.

**Christian Schleifer** has been appointed to a one-year term as president of the *International Civil Aviation Organization's* Air Navigation Commission, based in Montreal. He comes from a 13-year tenure at the Austrian Civil Aviation Authority in the department of certification and airworthiness.

**Michelle James** (see photo) has become director of marketing and communications at *Universal Avionics*, Tucson, Ariz. She was relationship marketing manager.

**Troy Miller** (see photo) has been appointed regional VP-military and special mission sales at Savannah, Ga.-based *Gulfstream Aerospace*. He was a Gulfstream V pilot for Corporate Jets.

**Jason Chamberlain** has become president and CEO of *HDT Global*, Solon, Ohio, succeeding **John Gilligan**, the company's chairman, who has been interim CEO since March. Chamberlain was president and chief operating officer.

USMC Gen. (ret.) **James Cartwright**, former vice chairman of the Joint Chiefs of Staff, has joined the board of Chantilly, Va.-based *TASC Inc.* Before his appointment to the Joint Chiefs, he was the commander of the U.S. Strategic Command. USAF Maj. Gen. (ret.) **John T. Brennan** has been appointed to lead TASC's Air Force Business Unit. He comes from the Science Applications International Corp., where he headed an operation serving the Central Intelligence Agency.

**Trudy Carson** (see photo) has become air service development manager at the *Metropolitan Nashville (Tenn.) Airport Authority*. She held a similar position at Tampa (Fla.) International Airport.

**George Schindler**, president of *CGI Federal*, Fairfax, Va. has been appointed president of the parent company's U.S. operations. He will be succeeded by Donna Ryan and follows Donna Morea, who is retiring.

**Chaz Counter** (see photo) has been named air operations and change management consultant for *Baines Simmons*, Chobham, England. He was a military air operator for the Royal Air Force and a consultant in human performance improvement.

**Bob Del Zoppo** has been promoted to assistant VP-advanced technology programs at Syracuse, N.Y.-based *SRC Inc.*, formerly Syracuse Research Corp.

**Dave Sprague** and **Rick Wells** have moved up to assistant VPs for information technology.

**Tracey McCarthy** has become assistant VP-operations in the Information Science and Engineering Div.

**Martin Murray** (see photo) has been appointed finance director at Hong Kong-based *Cathay Pacific Airways*, succeeding **James Hughes-Hallett**, who will return to the U.K. Murray was deputy finance director at Swire Pacific Ltd.

**Dave Hopkins** has been named director-aircraft programs and commercial agreements for *California Pacific Airlines* in Carlsbad. He comes from Air Transport Business Development Inc.

USN Capt. **Kevin Peterson** has become the new program manager of the Network Enterprise Domain Program Office of the Joint Tactical Radio System in San Diego, succeeding Capt. **Jeffery Hoyle**.

USAF Maj. Gen. **Ronnie D. Hawkins** has been nominated for promotion to lieutenant general and assignment as director of the Defense Information Systems Agency, Fort Meade, Md. He has been deputy director for command, control, communications and computer (C4) systems for the Joint Staff at



William H. Jolly



Michelle James



Troy Miller



Trudy Carson



Chaz Counter



Martin Murray



Sean O'Keefe

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the Pentagon in Washington. Brig. Gen. **Linda R. Medler** has been appointed director of C4 at U.S. Cyber Command at Fort Meade. She has been assistant deputy director for netcentric capabilities for the Joint Staff. Brig. Gen. **John R. Ranck, Jr.**, has been named deputy director of program/deputy chief of staff for strategic plans and programs at USAF Headquarters at the Pentagon. He was director of warfighter systems integration in the Office of Warfighting Integration and chief information officer in the Office of the Secretary of the Air Force, also in the Pentagon. Ranck has been succeeded by Brig. Gen. **Jeffrey B. Kendall**, who was commander of the Kandahar Airfield, U.S. Forces-Afghanistan. Brig. Gen. **James F. Martin, Jr.**, has been appointed deputy assistant secretary for budget in the Office of the Assistant Secretary of the Air Force for Financial Management and Comptroller at the Pentagon. He was director of financial management at Air Force Materiel Command Headquarters, Wright-Patterson AFB, Ohio. Martin will be followed by Col. **Mark A. Brown**, who has been selected for promotion to brigadier general. He has been director of financial management and comptroller at Air Mobility Command Headquarters, Scott AFB, Ill.

Other colonels who have been nominated for promotion to brigadier general are: **Brian E. Dominguez**, who has been named mobilization assistant to the director of operational planning, policy and strategy/deputy chief of staff for operations, plans



and requirements at USAF Headquarters; **John D. Bansemer**, who is assistant vice commander of the Air Force Intelligence, Surveillance and Reconnaissance Agency, Lackland AFB, Texas; and **David B. Been**, who is commander of the 7th Bomb Wing of Air Combat Command, Dyess AFB, Texas.

#### HONORS AND ELECTIONS

**Sean O'Keefe** (see photo) has been named chairman of the *National Defense Industrial Association*, Herndon, Va. He is CEO of EADS North America and a former NASA administrator.

**Joseph Ackerman**, president of *Elbit Systems*, Haifa, Israel, has received the Brazilian Air Force Merit Medal, presented by the Brazilian ambassador to Israel, H.E. Maria Elisa Berenguer, who praised Elbit and the Brazilian air force for strengthening the ties between Brazil and Israel.

Sikorsky Chief Test Pilot **Kevin Bredenbeck** has received the Lancaster, Calif.-based *Society of Experimental Test Pilots'* Iven C. Kincheloe Award, which honors contributions to an aerospace program by a test pilot. Bredenbeck flew the X2 technology demonstrator last year to an unofficial speed record for conventional helicopters.

**John Infanger**, editorial director of *Airport Business* magazine, has been honored for 25 years of service to the aviation community by San Diego-based *Airports Council International-North America*.

**Adrian Paull**, VP-customer and product support at Honeywell Aerospace, has become a board member of New York-based *Orbis International*.

**Brad Elstad**, Republic Airways VP-safety and regulatory compliance, has been elected chairman of the Washington-based *Regional Airline Association* Safety Council. **Brad Sheehan**, Atlantic Southeast Airlines director of safety, is vice chairman.

**Thomas E. Romesser** has been selected for a three-year term on the Ottawa-based *National Research Council* Aeronautics Research and Technology Roundtable. He is VP-technology development for the Advanced Programs and Technology Div. of Northrop Grumman's Aerospace Systems Sector. ☐

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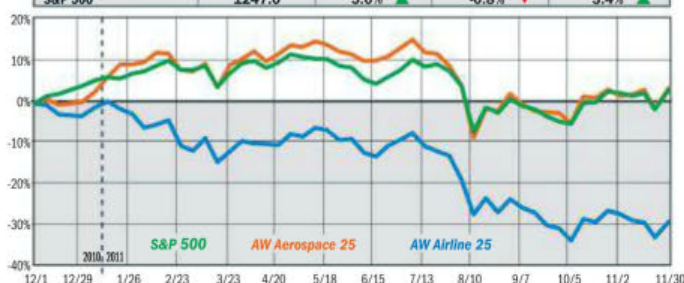


## AW&amp;ST/S&amp;P Market Indices

(as of 11/30/2011)

PERCENT CHANGE

| MARKETS         | INDEX VALUE | WEEK AGO | YEAR-TO-DATE | YEAR AGO |
|-----------------|-------------|----------|--------------|----------|
| AW Aerospace 25 | 1322.1      | 5.4% ▲   | 3.4% ▲       | 3.9% ▲   |
| AW Airline 25   | 774.6       | 6.0% ▲   | -28.2% ▼     | -29.8% ▼ |
| S&P 500         | 1247.0      | 5.0% ▲   | -0.8% ▼      | 3.4% ▲   |



## Weekly Market Performance

Closing Prices as of Nov. 30, 2011

| Company Name                      | Current Week | Previous Week | Fwd. P/E | Tot. Ret. % 3 Yr. | Tot. Ret. % 1 Yr. |
|-----------------------------------|--------------|---------------|----------|-------------------|-------------------|
| <b>AIR TRANSPORT</b>              |              |               |          |                   |                   |
| AAR Corp.                         | 18.26        | 16.21         | 8.8      | 24.2              | -26.8 ▼           |
| ACE Aviation Holdings             | 10.13        | 10.21         | -16.4    | 260.5             | -20.1 ▼           |
| AerCap Holdings N.V.              | 10.76        | 9.73          | 5.6      | 215.5             | -17.8 ▼           |
| Air Berlin                        | 3.50         | 3.51          | -2.6     | -23.5             | -33.4 ▼           |
| Air Canada                        | 1.05         | 1.04          | -2.5     | -45.1             | -71.6 ▼           |
| Air France - KLM                  | 5.79         | 4.64          | ....     | -54.1             | -69.0 ▼           |
| Alaska Air Group                  | 69.42        | 61.00         | 7.7      | 227.9             | 25.2 ▲            |
| All Nippon Airways Co Ltd.        | 2.99         | 2.93          | 22.6     | -30.0             | -20.6 ▼           |
| Allegiant Travel Co.              | 52.08        | 47.72         | 14.6     | 36.3              | 3.6 ▲             |
| AMR Corp.                         | 0.32         | 1.61          | -0.1     | -96.0             | -96.3 ▼           |
| Asiana Airlines Inc.              | 6.28         | 5.98          | 4.6      | 120.6             | -23.3 ▼           |
| Atlas Air Worldwide Holdings      | 42.25        | 35.30         | 8.1      | 247.7             | -23.4 ▼           |
| BBA Aviation plc                  | 2.77         | 2.57          | 9.6      | 199.0             | -5.1 ▼            |
| B/E Aerospace Inc.                | 38.95        | 35.33         | 15.5     | 424.9             | 6.7 ▲             |
| CAE Inc.                          | 9.99         | 8.83          | 13.8     | 74.0              | -10.4 ▼           |
| Cathay Pacific Airways            | 1.74         | 1.68          | 8.2      | 88.1              | -37.8 ▼           |
| China Southern Airlines           | 27.15        | 24.00         | ....     | 380.5             | -24.6 ▼           |
| Copa Holdings SA                  | 64.56        | 59.26         | 8.7      | 197.2             | 16.5 ▲            |
| Delta Air Lines Inc.              | 8.12         | 7.12          | 3.4      | 2.0               | -41.5 ▼           |
| Deutsche Lufthansa AG             | 12.89        | 11.40         | 11.5     | 10.9              | -41.1 ▼           |
| easyJet plc                       | 5.96         | 5.33          | 10.3     | 45.6              | -12.7 ▼           |
| FedEx Corp.                       | 83.08        | 76.56         | 12.6     | 33.6              | -11.2 ▼           |
| GOL SA                            | 7.58         | 6.74          | ....     | 110.0             | -54.3 ▼           |
| Hawaiian Holdings Inc.            | 5.95         | 5.25          | 4.4      | 37.7              | -26.0 ▼           |
| Heico Corp.                       | 59.34        | 52.96         | 32.1     | 214.2             | 37.9 ▲            |
| Jet Airways (India) Ltd.          | 4.92         | 4.71          | -6.0     | 98.2              | -69.7 ▼           |
| JetBlue Airways                   | 4.12         | 3.40          | 9.6      | -13.4             | -40.8 ▼           |
| Korean Air Lines Co. Ltd.         | 40.25        | 36.63         | 5.3      | 28.7              | -33.4 ▼           |
| Lan Airlines SA                   | 23.47        | 21.61         | 15.3     | 190.9             | -23.7 ▼           |
| Qantas Airways Ltd.               | 1.56         | 1.46          | 9.6      | -30.1             | -39.5 ▼           |
| Republic Airways Holdings Inc.    | 3.83         | 3.77          | 5.1      | -70.6             | -49.7 ▼           |
| Ryanair Holdings ADS              | 30.09        | 28.82         | 62.1     | 38.1              | -2.7 ▼            |
| Singapore Airlines Ltd.           | 8.01         | 7.89          | 18.4     | 73.5              | -19.1 ▼           |
| Skywest Inc.                      | 12.13        | 11.38         | 17.5     | -10.0             | -26.4 ▼           |
| Spirit Airlines, Inc.             | 16.13        | 16.36         | 9.9      | ....              | ....              |
| Southwest Airlines                | 8.38         | 7.40          | 11.1     | 6.3               | -37.5 ▼           |
| TAM SA                            | 19.26        | 17.79         | ....     | 211.3             | -20.4 ▼           |
| United Continental Holdings, Inc. | 17.97        | 15.53         | 3.2      | 101.0             | -36.7 ▼           |
| United Parcel Service Inc.        | 71.75        | 66.90         | 15.4     | 46.7              | 3.4 ▲             |
| US Airways Group                  | 4.72         | 4.00          | 3.7      | -7.8              | -58.1 ▼           |
| WestJet Airlines Ltd.             | 11.08        | 10.62         | 10.0     | 29.0              | -18.1 ▼           |
| Zodiac Aerospace SA               | 81.71        | 74.36         | 12.3     | 142.2             | 21.0 ▲            |

## COMMENTARY

## Pick Your Carbon Emissions Poison

In less than a month, the European Union's emissions trading system (ETS) expands to include aviation, and the chorus of opposition from airlines worldwide grows louder. Airlines claim—to some degree, accurately—the strides made in the last few decades toward a more fuel-efficient fleet show that the industry is serious about carbon emissions and the environment. But even the International Air Transport Association (IATA) and U.S. Air Transport Association (ATA), both opposed to the ETS, quietly acknowledge that there may be room for “market-based measures” such as emissions trading or carbon taxes.

But which of these two market-based measures is more effective? Economists say if the goal is limiting the amount of carbon emissions, then both systems are equivalent. A cap-and-trade system, such as the EU's ETS, regulates by setting a limit on overall emissions. Airlines can buy and bank permits for their expected carbon emissions (see related story, p. 20).

A carbon levy, on the other hand, requires policy makers to determine what level of taxation will force businesses to change their behaviors and emit less. “The challenge of a tax is setting the rate to fit the desired quantity of emissions,” says Niven Winchester, an environmental energy economist at the Massachusetts Institute of Technology's Joint Program on the Science and Policy of Global Change.

A tax offers airlines a further advantage over a cap-and-trade system by telling them in advance how much their operations will cost, says Jan Brueckner, professor of economics at the University of California, Irvine. The cost of allowances in a cap-and-trade system fluctuates, like in any secondary market. For example, allowances cost €30 per metric ton of emissions in 2009 but were less than €10 (\$13.50) last week. However, the political will to impose a tax may be lacking, and the logistics of collecting it could be difficult. In any case, airlines largely oppose any government involvement, be it a tax or not.

No one disputes that airlines emit carbon dioxide at a rate that is increasingly unpalatable to both environmental activists and a growing share of travelers, particularly in Europe. This is despite industry assertions that its emissions are negligible.

The EU says it threw a marker down to force change, in the absence of any progress from the International Civil Aviation Organization. Environmental groups have been quick to decry the glacial pace of change at ICAO, and they have a point. The court of public opinion may not wait for ICAO to create the global, sectoral system that the airline industry wants. And although airlines may have a case in objecting to the EU's unilateral imposition of the ETS, the industry likely will face either a tax or another version of the ETS in another region of the world soon. And rather than objecting, the airline industry may be better off picking the market-based measure that is least onerous. ☛

Source of financial data: Standard & Poor's and Capital IQ Inc. (a Division of Standard & Poor's) U.S. dollars and cents. Forward P/E ratio uses S&P and Capital IQ forecasts of current fiscal year.



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## AIR TRANSPORT

### Long-Haul 787

Boeing is optimistic about gaining FAA certification for the first 787 capable of flying long-haul international routes in the next few weeks, following completion of flight tests of the improved Rolls-Royce Trent 1000 "Package B" engine on Nov. 28. The upgraded engine, tested on 787 ZA004, is designed to bring performance to within 1% of Boeing's original specification and will be rated at 70,000 lb. thrust for delivery of the first long-range 787-8 version for All Nippon Airways. Originally due for delivery to Japan in early December, the slower-than-expected completion of certification work means the initial model may not be handed over until late this month or early January. The timing will be close as ANA is planning to use the initial Package B-powered 787 to fly the first long-haul international service to Frankfurt starting on Jan. 21. A spokesman for the engine maker also confirmed that Rolls won European Aviation Safety Agency Part 33 approval for the Trent 1000 Package B engine on Nov. 15. In mixed news for General Electric, the FAA has awarded 330-min. extended-range twin-engine operations (ETOPS) for the GENx-1B powered 787, while Boeing has confirmed that aircraft certification will slide into 2012. The delay, said Boeing Commercial Airplanes President and Chief Executive Jim Albaugh on Nov. 30, is tied to the late availability of a production-standard GE-powered aircraft.

### LOT Wheels-Up Report

A preliminary report by Polish authorities into the wheels-up landing of a LOT Polish Airlines Boeing 767-300 at Warsaw on Nov. 1 says investigators discovered an open circuit breaker that disabled the back-up mechanism for lowering the landing gear. The 767, on a flight from Newark (N.J.) Liberty International Airport to Warsaw with 221 passengers and 10 crew, was belly landed after several attempts to lower the gear failed. The report by the Polish State Commission for Aircraft Accident Investigation, confirms the chain of events began when the 767 suffered a hydraulic leak in the center system ("C") shortly after takeoff. Approaching Warsaw, the crew tried using the alternate

## GE-Rolls Call It Quits on F136

General Electric and Rolls-Royce are dissolving the Fighter Engine Team (FET) after deciding to discontinue self-funding the F136 alternate engine for the F-35 Joint Strike Fighter program.

The move comes after an Oct. 31 meeting between GE Aviation leadership and Deputy Secretary of Defense Ashton Carter in which "it became clear that the Defense Department would not support the FET self-funding effort," says GE. Although not unexpected given the Defense Department's termination of the F136 development effort in April, it ends a 15-year effort to mount a competitive challenge to Pratt & Whitney's incumbent F135 engine for the F-35.

With almost 80% of the development complete at the time of the Defense Department announcement, and with about \$3 billion in federal funding already spent on the effort, GE and Rolls both vowed to continue self-funding the F136 through fiscal year 2012. However, GE says Carter's position "made future progress on the F136 development program difficult. In addition, the status of the federal budget has created greater uncertainty for the overall JSF program."

Before the program was terminated, six F136 development engines had accumulated more than 1,200 hr. of testing since early 2009. GE says that throughout its development time "the FET consistently delivered on cost and on schedule, and was rewarded with high marks by the Defense Department in a successful joint venture between GE and Rolls-Royce."

The F136, though technically advanced, will now be sidelined and GE and Rolls will pursue separate competitive paths to future sixth-generation combat engines via the U.S. Air Force Research Laboratories Advent (Adaptive Versatile Engine Technology) program and other research efforts. As both GE and Rolls hold patented technology within the F136, the engine cannot be further developed for alternate uses.

The companies jointly announced that the termination decision is final and that even if a self-funded development proposal for fiscal 2012 is supported in a joint House/Senate authorization conference, the engine makers would not now pursue it. Although they "are deeply gratified by earlier House Armed Services Committee support," the former team members add that "circumstances have changed and there is not a business case for self-funding the F136 development."

gear extension and gravity extension procedures without success before making a flawless wheels-up landing.

### EU: We Are Complying

The U.S. Trade Representative is studying steps the EU says it has taken to comply with last spring's World Trade Organization (WTO) determination that certain EU subsidies to Airbus are illegal under international trade rules. The U.S., EU, Boeing and Airbus all weighed in on the matter Dec. 1, but had little substantive to say because the report detailing the steps Europe is taking had not been made public by evening. The EU's deadline for complying with the ruling was Dec. 1. "We will base our next steps on a careful evaluation of the announcement, and whether it demonstrates that the EU has in fact taken the steps necessary to bring itself into full compliance with the WTO," U.S. Trade Representative Ron Kirk said in a statement. In May, the WTO Appellate Body upheld much of a 2010 report that found that certain subsidies provided by the EU and member states Germany,

France, Spain and the U.K. were incompatible with WTO trade rules because they "caused serious prejudice" to the interests of the U.S.

### Interiors Plant Opens

Boeing South Carolina has opened a fabrication support center to serve its 787 final assembly line in North Charleston. Called the Interiors Responsibility Center South Carolina, the 300,000-sq.-ft. facility's products include stow bins, closets, partitions, overhead rests for flight attendants and flight crews and video control stations.

## DEFENSE

### Reaper Request

The French senate wants the government to buy General Atomics Reaper unmanned aircraft rather than Israel Aerospace Industries Heron-TPs for the country's interim medium-altitude, long-endurance UAV requirement, as a cost-saving measure. The senate approved an amendment calling on the government to buy the Reaper and put industrial



considerations on the back burner near-term; Dassault is fronting the Heron-TP purchase. The Reaper procurement also should free up money to be used on the long-term program, the senators suggest. They cite Defense Minister Gerard Longuet as saying the Hero-TP would be 30% more expensive and 20% less effective than the Reaper.

## Algerian Arrival

Russia's Irkut Corp. has begun deliveries of Yakovlev Yak-130 combat trainers to the Algerian air force. The first three aircraft arrived on An-124s on Nov. 29. Irkut has already assembled all 16 trainers ordered by Algeria in 2006 and plans to complete the deliveries by the end of 2016. The Algerians will use Yak-130s to train pilots for Sukhoi Su-30MKA fighters also supplied by Irkut. The trainer has a glass cockpit and a reprogrammed fly-by-wire system that can replicate the characteristics of Russian Generation 4-plus fighters.

## SPACE

### NASA Technology Efforts

Some 300 proposals submitted by more than 200 small businesses will get a chance to advance under grants awarded under NASA's space technology program that could total almost \$40 million, depending on contract negotiations. Topics selected under the ongoing Small Business Innovation Research and Small Business Technology Transfer programs reflect the agency's desire to push a wide variety of technologies that can enable future human and robotic space exploration and enhance U.S. aeronautics. Among them are research in space-navigation technology, low-cost instruments for remote sensing from space and in situ, and electronics that can handle the extreme radiation and thermal environments in space. Aeronautics proposals selected included those intended to develop better ways to avoid and mitigate engine and airframe icing.

### TDRS-M Option Exercised

Boeing will build another Tracking and Data Relay Satellite (TDRS) for NASA under a \$289 million contract option exercised by the agency and announced Nov. 29. Boeing Satellite Systems Inc. already has built TDRS-K and L under

a 2007 contract. The new option covers design, development, fabrication, testing, launch support, in-orbit checkout and sustaining engineering, with operations set to begin by 2017.

### ATK Gets Arrays Contract

ATK will provide lightweight advanced solar arrays to Orbital Sciences Corp. for its Cygnus cargo carrier under a \$20 million contract announced Nov. 30. The 11-ft. UltraFlex circular arrays will allow the Cygnus to carry more payload weight to the International Space Station under Orbital's resupply contract with NASA, ATK says.

## AEROSPACE BUSINESS

### Horizon Outlook

The European Commission has put forward its spending plan for research that suggests aerospace may fare well despite the lack of a previous dedicated funding line. Research and development funding will increase, with industry hoping it will support "downstream" efforts as much as possible without violating subsidy rules. Moreover, the funding for transport efforts is up almost 50%. The money is not dedicated to aero-

space, but industry officials believe the sector will receive a fair share.

### Tiltrotor Takeover

AgustaWestland has completed the buy-out of Bell Helicopter Textron's stake of the AB609—now AW609—civil tiltrotor after announcing in June it would take full control of the project. The company now hopes to obtain civil certification of the rotorcraft in late 2015 or early 2016. Commercial deliveries would start immediately afterward, the company says, noting it has around 40 customers with commitments for 70 tiltrotors. The third flight-test aircraft, now in production, should fly next year. It will focus on icing certification testing. The fourth prototype, also likely to fly next year, would be used mainly to validate the avionics.

### Engineering Sale-Leaseback

GKN Aerospace is selling its £20 million (\$31.5 million) aerospace engineering services business to Quest Global Engineering, but also has formalized an agreement for Quest to provide long-term engineering support to GKN, a U.K.-based defense and commercial air transport Tier 1 systems and aerostructures provider.



### Airbus Kicks Off A320 Winglet Flight Trials

An Airbus A320 with an interim upgrade between the current and new-engine-option (NEO) variants has begun flight trials with the goal of delivering the first of the aircraft to customers late next year.

The effort to finally fit winglets onto the A320 began flight trials on Nov. 30, when MSN0001, the aircraft maker's single-aisle test aircraft, completed the first flight with the lift devices, which are aimed at reducing the aircraft's fuel burn up to 3.5%. The test aircraft took off from Toulouse at 10:20 a.m. and landed at 3:03 p.m. local time, kicking off a flight-test campaign that is expected to run about 220 hr. The first A320 with the winglets, or "sharklets" in Airbus parlance, that have been installed during the production process, should fly next summer to achieve full program certification before year-end.

Airbus, in recent years, evaluated different winglet designs before settling on the 2.5-meter-tall (8-ft.) version now in trials. A retrofit option also is being investigated that Airbus COO for customers, John Leahy, says should look very similar to the current configuration and deliver similar savings. The devices will be standard elements on the A320NEO, which should enter service in 2015.

AIRBUS/A. DOUMENIOU





BY GUY NORRIS

Southern California  
Bureau Chief Guy Norris blogs  
at: [AviationWeek.com](http://AviationWeek.com)  
[guy\\_norris@aviationweek.com](mailto:guy_norris@aviationweek.com)

## COMMENTARY

# Future Factory

## Commercial composites facility sized for double-digit growth rates

Unlike most large-scale composites plants that have had to evolve organically to keep pace with demand, Alliant Techsystems' (ATK) Aircraft Commercial Center of Excellence (ACCE) in Clearfield, Utah, was designed from the outset to handle the unprecedented production rates envisioned for future widebodies such as the Airbus A350.

The site will make engine casings for the General Electric GENx-2B engine on Boeing's 747-8 and Rolls-Royce's Trent XWB on the A350, as well as all fuselage stringers and 50% of frames for the A350 family. ATK is currently installing large engine wrap machines as it completes the opening phases of an ambitious composite manufacturing expansion.

Equipped with automated tooling and fabrication systems, many of them patented, the ACCE forms the centerpiece of ATK's campaign to virtually double its civil and international aerospace structures business over the coming years. The \$100 million facility also forms the new headquarters for ATK Aerospace Structures' commercial aircraft programs and is designed with expansion in mind as additional airliner and business-jet structures work emerges in the future.

The 615,000-sq.-ft. manufacturing site incorporates 2,500 sq. ft. of freezer capacity for composite pre-preg storage and is sized to make more than 10,000 parts per month at full-rate production levels. The ACCE also assumes the work undertaken at ATK's original composites facility nearby, which will now be focused on making military components, primarily for the Lockheed Martin F-35 Joint Strike Fighter.

ATK expects the transition to be complete in March 2012. Manufacture of the first A350 fuselage parts, as well as Trent XWB flight-certification rear fan cases and production-standard GENx-2B engine containment cases, are in the process of moving into the



ACCE. With 747-8F deliveries now underway, and assembly of the -8I passenger version building up, ATK is already at the full 10-per-month rate on the GE engine.

Despite the slip in the A350 schedule announced by Airbus in November, "the activation of ACCE continues as planned and on schedule. We anticipated some delay on the A350 program," ATK says. "We have delivered more than 2,000 parts, which includes two full shipsets, plus hundreds of additional parts for follow-on aircraft," it adds. ATK does not expect any dra-

matic change to its planned long-term build-up rate.

Original plans called for the facility to be delivering three shipsets a month early in 2013, four by mid-2014, eight by early 2016 and 12 by late 2017. "We're currently anticipating going to a 13-per-month rate," says ATK Aerospace Structures operations vice president Bill Condas.

Each shipset includes almost 700 parts, of which 523 are stringers and 173 frames. "Each part is unique and tailored specifically to handle various loads," he says. Of these, 118 stringers and 95 frames are produced for the center-fuselage Section 15 panels, the late delivery of which lies at the heart of the A350 delay. Those panels are produced by Spirit AeroSystems in its Saint-Nazaire plant in France. Both stringers and frames are made from fiber-reinforced epoxy prepreg unidirectional tape, with the stringers being made in "omega" and "T" cross-section shapes, while the frames have Z-shaped sections.

Located northwest of Salt Lake City, the ACCE has four individual clean rooms covering an area of 100,000 sq. ft. The center was completed in less than nine months and contains several automated manufacturing systems capable of producing finished, standardized composite parts at virtually unprecedented rates, says ATK. These include company-developed automated stiffener formers for both stringers and frames, which will be capable of producing 40,000 meters (25 mi.) of composite structures per month.

The first automated radial frame machine (see photo) is due to be commissioned this month to support a two-shipset-per-month rate. The facility also contains the first two of five planned large-diameter autoclaves ranging in size from 13 X 80 ft. to 15 X 40 ft. Other facilities now in the process of being commissioned or installed include CNC machining stations and water jet systems capable of handling parts from 19 ft. to 70 ft. in length. A key to meeting the high-rate targets are automated ultrasonic and non-destructive inspection systems, again purpose-designed and patented by ATK. ☛





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DANIEL FACET

Airbus Military's A400M, now in flight-test phase, is set to enter service in 2013.

## COMMENTARY

# Merkel's Error

## EADS's restructuring follows same tired formula

**M**ore than two decades ago, Manfred Bischoff, then-Deutsche Aerospace's (DASA) chief financial officer, adamantly claimed that political interference in the European aerospace industry should be banned once and for all. In the 1990s, while a major cross-border consolidation initiative was envisioned by German and French leaders, Bischoff, expressing Germany's long-held conviction, claimed that state-owned Aerospatiale

should be privatized before a merger agreement with DASA could be considered. It would be an understatement to say Bischoff and high-ranking colleagues—including Chairman/CEO Juergen Schrempp—were not helpful in convincing France to adopt a straightforward free-trade strategy or a “modern” attitude toward European aerospace consolidation. When establishing EADS in 2000, they adopted a complex shareholding arrangement, a “pact” covering identical state-controlled stakes for both Germany and France. State-controlled but not state-owned, the French government retained a stake in the newly formed aerospace/defense group.

Now, more than a decade later, the Daimler automotive group and, on the French side, the Lagardere publishing group, both intend to focus on core businesses and relinquish some of the aerospace roles that no longer interest them. It was expected that EADS would bring new shareholders on board—despite the group's underwhelming performance—and that this would provide a unique opportunity to establish an all-new set-up, free from political interference. But that didn't happen. Instead, German Chancellor

Angela Merkel ratified a plan to sell Daimler's 7.5% stake in EADS to KfW, a government-controlled bank. Merkel has erred: She should have tried to convince French President Nicolas Sarkozy to opt out. Thomas Enders, Airbus's CEO, reportedly said that the KfW arrangement is “like a return to the Stone Age.”

In the next few months, as required by the company's governance, a French executive is scheduled to become EADS's chairman, replacing Bodo Uebber. Arnaud Lagardere, who heads the Lagardere media group, is expected to succeed Uebber. Given the French executive's stated plan to abandon his involvement in aerospace, this is a nonsense move that will undoubtedly exacerbate governance difficulties.

French authorities have long been involved in the aerospace sector. Airframers were nationalized in 1936 while engine manufacturers were acquired by the government shortly after the end of World War II to establish Snecma. Even when privatization prevailed, the government retained a minority stake (a “golden share”) in EADS. This is free trade the French way, despite the fact that “interfer-

ence” is never used. The government, notably the defense ministry, is regarded as much more than a regular customer. It plays a key role (although smaller than in the past) by providing program funding, including low-rate loans that have been vehemently contested by the U.S.

The French administration, after running the show for so long, is obviously not ready to step aside. For one thing, it still believes it must have a say in EADS, which is based on the pretext that the European group develops and produces the French forces' nuclear ballistic missiles. The claim that such sensitive programs should never fall into foreign hands has become meaningless over the years. Germans are no longer “foreigners.” EADS is a unified industrial group with production facilities in four neighboring countries, Germany, France, Spain and the U.K., with headquarters in the Netherlands for taxation benefits.

The restructuring of EADS presented a chance to abandon bad habits, outdated rules and byzantine politics via an all-new financial structure. Now, this is not going to happen. Merkel missed a rare opportunity.

Opting for state-owned KfW was the wrong, albeit easy, choice. Now comes the harsh reality: Who is ready to acquire Daimler's 7.5% stake in EADS? Its profitability is weak, to say the least, and maintaining a Franco-German balance of influence is certainly not a business-driven incentive. Launching the Airbus A380 mega transport—with its multiple production sites and shared responsibilities—was chaotic and costly; the A400M airlifter is over-budget and off schedule; and the A350XWB long-range commercial transport, now scheduled to fly in 2014, has already been delayed twice. In other words, Merkel could cite mitigating circumstances to defend her choice, but the potential that was lost overshadows any hasty gains. ☛



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## COMMENTARY

### LAYING IT ON

Airbus, led by its top salesman John Leahy, is making a huge push for market share, a move that threatens to put Boeing permanently on the back foot in the narrowbody market.

It is clear in Asia that Airbus is pushing hard—even harder than usual—to win over Boeing 737 customers. When Lion Air issued its request for proposals (RFP) this year for 201 new narrowbodies, one could have assumed that Airbus would refrain from trying too hard. After all, Lion is the world's largest Boeing 737-900ER operator and the airline's founder and president director, Rusdi Kirana, has a close relationship with Boeing.

But Airbus put in a very competitive bid to lure Lion away, say industry executives. If they are correct, the pressure on Boeing would have been enormous. As it turned out, Lion

ended up signing a binding agreement on Nov. 18 to order 201 737MAX aircraft and 29 737-900ERs. But industry executives say Boeing offered a big discount to retain Lion as a customer, which, if true, would put Boeing's "win" in a whole new perspective.

As the dust settles from the Lion Air competition, the battle lines are forming over India's Jet Airways, which has an RFP for narrowbody aircraft, according to industry executives. Jet is a 737 operator, too, so once again Boeing will be fighting to fend off Airbus.

Leahy and the Airbus sales team are marketing with particular vigor at the moment because "they want to get as many sales under their belt" before the 737MAX has a chance to build momentum, says one senior aircraft leasing executive. Having launched its reengineered narrowbody last year, Airbus has a window of opportunity during which

more information is available on the A320NEO and buyers have had more time to consider it. Aircraft leasing companies are big buyers of narrowbodies, but the general consensus in the leasing community is that the 737MAX is "unbuyable" right now, as there is too little information about it available.

Lessors are also watching closely to see what airlines are ordering. Airbus announced on Nov. 16 that the NEO had achieved orders and commitments totaling 1,420 aircraft. Boeing announced on Nov. 12 that it had commitments from nine customers for a total of 700 737MAX aircraft.

"Boeing talks about how they have secured a lot of orders for the 737MAX, but we only know of two airlines that have committed to the type—American Airlines and Lion Air," says the chief of one aircraft leasing company. ☺

European Union emission allowance (EUA) prices crashed to €7.71 (\$10.36) per metric ton on Nov. 25—their lowest level yet seen in the 2008-12 second phase of the cap-and-trade program.

The price of EUAs for delivery in December this year has fallen from as high as €17.00 per metric ton in May, due to concerns that Europe will enter a second recession, cutting industry's carbon dioxide emissions and demand for allowances to cover them.

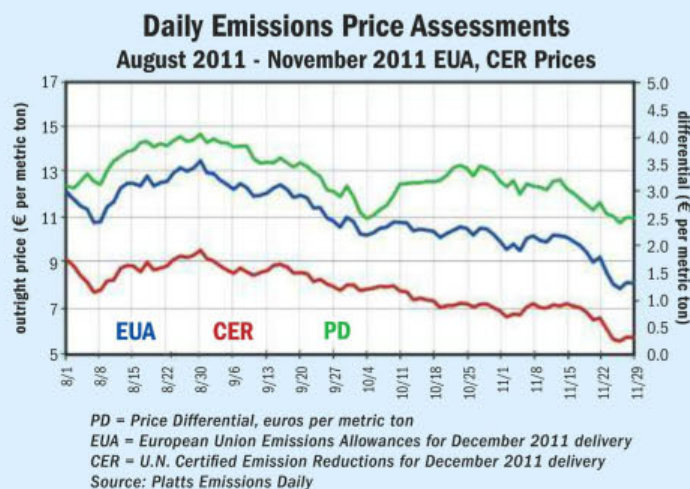
"A recession is likely. That's what the market is pricing in," one trader says. "It probably won't be as severe as last time [2007-09], but perhaps it looks like there will be a small recession in the eurozone, which is no real surprise, having seen what's been happening over the last six months."

December 2011 carbon prices have fallen €9.29 per metric ton, or 55%, from May's high of €17.00 per metric ton, as participants have recognized that the market is awash with surplus allowances as well as carbon offset credits from United Nations projects in developing countries.

The main factor preventing a price collapse to zero in the current phase is a rule allowing power plant and factory operators to hold onto surplus allowances for use in the 2013-20 Phase III period, when supply will be further constrained and a policy of free allocation of allowances will be replaced by much greater use of auctioning by the system's regulator, the European Commission.

But, as Europe's economy struggles to grow, traders are mulling the prospect that the current overhang of credits will persist for several years into the third phase, throwing Europe's flagship emissions reduction policy into limbo.

Effectively, the recession and the possibility of a second, lesser slowdown in Europe, have achieved what the Emissions Trading System (ETS) was designed to do, cutting industry's



pollution, thereby pushing down the price signal needed to reduce emissions further.

With no easy way to allow the supply side to react to demand-side changes in the EU ETS, the free market approach that was built into the system necessarily means allowing the market to run its course, the trader says.

"I don't think the regulator needs to intervene. The market's the market. The whole point of cap-and-trade is that it finds its price. I think people are more concerned that they might not have a job," he says. ☺

Frank Watson/Platts/London

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Senior Editor Frank Morring, Jr., blogs at: [AviationWeek.com/onspace](http://AviationWeek.com/onspace)  
[morring@aviationweek.com](mailto:morring@aviationweek.com)

## COMMENTARY

# Tiny Birds

## Cubesats: from teaching tool to technology

**T**he small, inexpensive spacecraft that have seduced more than one engineering student into the space arena with their hands-on appeal as teaching tools, cubesats are attracting attention beyond the academy as their capabilities grow and launch opportunities proliferate.

College undergraduates, university engineering students and even high schoolers have gotten into the act since 1999, when cubesats came into their own with publication of the Cubesat Design Specification by California Polytechnic State University and Stanford University. Use of the standardized picosats has since spread around the world, with growing capabilities as more and more young minds ponder how to use them.

"It really is a technology; it's not simply a cheap platform," says Mason Peck, director of the Space Systems Design Studio at Cornell University. "There's a lot more going on than that."

Peck has been selected to be NASA's chief technologist in January, and he stresses that until then he speaks as an engineering professor at Cornell. But in that role, he has seen the nascent cubesat industry mature to the point that commercial companies are offering cubesat components, allowing students to get as creative as they might once have been with a pile of Lego building-block toys.

"As long as you conform to the specification, you can put whatever you want in there," Peck says. "Nowadays you can buy structure, the flight computer, radios, even GPS components, essentially off the shelf."

A single "1U" cubesat (see photo) is a box measuring 10 cm (3.9 in.) per side, weighing no more than 1.33 kg (2.9 lb.). Because they are launched piggyback with spacecraft costing much, much more, a lot of the specification has to do with avoiding damage to primary payloads. That means no high-pressure vessels nor explosive or volatile chemicals. And if a component is not



CALIFORNIA POLYTECHNIC STATE UNIVERSITY

available off the shelf, it probably can be built in the campus machine shop.

The spacecraft are extensible by Us—cubesats can be 2U, 3U or a 6U "six-pack," and so on. But it is the low cost and simplicity that attracts engineering schools and organizations such as NASA and commercial companies that want to get more bang for their buck. Peck says the initial concept was to build a cubesat for \$40,000 and launch it for a like amount.

Northrop Grumman flew its Mayflower cubesat piggyback last Dec. 8 on the Space Exploration Technologies (SpaceX) Falcon 9 that launched a Dragon capsule on its historic private orbit and recovery mission. The company, which teamed with Applied Minds on the project, has since started offering cubesat services to its traditional customers, according to Wallis Laughrey, director of rapid response space at Northrop Grumman.

"That was a fully internally funded cubesat," he says. "Our reasoning for doing it was to look at ways we could take some technological capabilities that are applicable to our product lines, both from spacecraft bus or from a

payloads perspective, and find ways to get them space-qualified quickly. Now, obviously those are kind of small, [but] at first it was really just to try to get a platform that we could get out there."

The company's small investment also served an educational role for some of its junior engineers, who got a chance to build and fly a spacecraft quickly, and even to summer interns from nearby colleges.

At Cal Poly, the early work on cubesat standards has evolved into a very active program in the school of engineering and a contract worth as much as \$5 million from NASA to provide launch-dispenser services to cubesats funded by the U.S. space agency. Students at the San Luis Obispo campus developed a jack-in-the-box device dubbed the P-POD—"Poly-Picosatellite Orbital Deployer"—that uses a spring to eject cubesats in flight.

NASA-backed cubesat students got a hard look at the downside of the technology last year when a Taurus XL launch vehicle carrying the agency's Glory satellite failed to reach orbit because its fairing did not separate. Joining the Earth-observation spacecraft on the floor of the Pacific Ocean were cubesats built by Montana State University, the University of Colorado and the Kentucky Space consortium of universities in that state.

But just as Northrop Grumman flew its cubesat on a SpaceX Falcon 9, the number of launch opportunities for small secondary payloads is growing. For instance, SpaceX requested permission to include on its first mission to the International Space Station (ISS) a pair of Orbcomm smallsats, and Cal Poly is preparing cubesats for launch on a Delta II, Falcon 9 and National Reconnaissance Office mission, says Justin Foley, a Cal Poly engineering alumnus who now is the program administrator for cubesat and P-POD activities there.

New opportunities are arising all the time. Spaceflight Inc., a startup spinoff of Andrews Space, announced plans to launch four cubesats—three 1U and one 3U—on the first flight of the Taurus II launch vehicle Orbital Sciences Corp. is developing to deliver cargo to the ISS. That flight from the commercial spaceport on Wallops Island, Va., is expected early in 2012. ☐





BY MICHAEL BRUNO

Managing Editor for  
Defense and Space  
Michael Bruno blogs at:  
[AviationWeek.com/ares](http://AviationWeek.com/ares)  
[michael\\_bruno@aviationweek.com](mailto:michael_bruno@aviationweek.com)

## COMMENTARY

# Another World

## Defense denizens in the capital strive to form their own budget reality

Citizens outside of Washington often accuse those inside the Beltway of living in their own world, and the upcoming budget request for fiscal 2013 is only going to prove them right. That is because while Congress—through failure last month by the so-called Super Committee to agree to any cuts to the deficit—has set in motion \$600 billion more in reductions to defense spending over a decade, starting in January 2013. But the Pentagon is not going to acknowledge that reality in the budget request coming out in February. The reason: the Pentagon and the White House are nearly finished drafting a request that assumes those “sequestration” cuts will not happen, which was their operating assumption even as the Budget Control Act became law in August.

“I don’t know if it would be possible for us to do a budget that suddenly cut another \$50 billion out in 2013,” Pentagon Comptroller Michael McCord told the Credit Suisse-Aviation Week Aerospace & Defense Conference in New York last week. Besides, many inside his five-sided building are still banking on Congress changing its mind. Defense hawks like ranking Senate Armed Services Committee (SASC) Republican John McCain (Ariz.) and House counterpart Buck McKeon (R-Calif.) have vowed to push for a new law that rescinds the automatic cuts. And House Majority Leader Eric Cantor (R-Va.) is proposing to couple a year-end tax bill with changes to sequestration’s defense penalty. But that proposal’s prospects are unclear on Capitol Hill, and President Barack Obama has vowed personally to veto any such bill if it is



**‘We just don’t know what is going to happen.’**

PENTAGON COMPTROLLER MCCORD

not part of a broader deficit solution. “We just don’t know what is going to happen,” McCord said. Longtime SASC Republican Richard Shelby (Ala.), however, has his own idea for how to avoid the \$600 billion penalty: “The best way is to get the Republicans, next November, in control.”

### FISCAL CASTRATION

Meantime, if Pentagon planners really have not been preparing for the Budget Control Act’s sequestration scenario, they should be, says Todd Harrison, senior fellow at the Center for Strategic and Budgetary Assessments. At best, the potential impact on defense research and procurement is a 12% cut in real spending levels from fiscal 2011; at worst, it is 21%. The big variable in Harrison’s analysis is whether savings will be found in the personnel side of the Pentagon’s budget or whether it is

mostly or entirely exempted. Under sanctions imposed by sequestration, if the Defense Department does not submit a budget request meeting the act’s mandated caps, based on its own strategy and choices, Congress will have to make the cuts evenly across every Pentagon account, Harrison said during a briefing in Washington late last month. That means no distinction between Navy accounts for shipbuilding or aircraft, or Air Force missiles or ammunition. And besides hurting combat capabilities, it amounts to “fiscal castration” of the defense industrial base, Brett Lambert, the Pentagon’s industrial policy chief, told the Credit Suisse-Aviation Week conference. Industry is already fragile in some areas such as subtler suppliers that are single-source providers for specific parts, and across the base there have been overhead reductions and layoffs (see p. 38). Warns Lambert, “We will not solve this problem on the back of the Defense Department or the defense industry.”

### SUPERIOR POSITION

If the leaders of the armed services are forced to start choosing major weapons programs to keep or kill, former Air Force leaders suggest the Lockheed Martin Joint Strike Fighter will prevail, despite headline-grabbing issues in recent years. In fact, current and ex-leaders who attended an Air Force Association-sponsored seminar last week near Washington say if Budget Control Act reductions pit the family of Long-Range Strike programs against F-35 production, the JSF would without a doubt survive—although LRS also should fare well as Washington’s attention turns to the Asia-Pacific region. “The Air Force remains committed to Long-Range Strike, [but] there will have to be some tough decisions about force structure and modernization,” acknowledges Lt. Gen. Dick Newton, the Air Force’s assistant vice chief of staff. Besides LRS, an Asia-Pacific presence would require keeping alive the Boeing KC-46 tanker and, perhaps, even the sunseting C-17 airlifter production program. As for what goes, these insiders say overseas bases are prime targets, as are upgrades to legacy aircraft.



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# Time To Regroup

AMR's Chapter 11 may foreshadow both the best and worst of times ahead

DARREN SHANNON/WASHINGTON

It is hardly the first time an airline has sought protection under U.S. bankruptcy law in order to formulate—or at least fine-tune—a new business plan. Some carriers are even recidivists in bankruptcy court. But AMR Corp. had striven proudly to restructure its high cost base on its own.

Now that it has thrown in the towel and headed down the path trodden by all the other remaining U.S. legacy carriers, it is at least hoping for the smoothest trip yet through the courthouse and vowing to “kick some ass” when it comes out of Chapter 11.

There are, rightly, questions about the timing of this filing just days after the busiest travel period of the year and weeks before yet another rush of holiday travelers push load factors past 90%. Times had been bad for so long for AMR—so why would the board of directors be called to an unscheduled meeting late on a Monday evening to issue an edict that could just as easily have been delivered during one of the many recent rushes on the company's shares or held until the more sober winter months?

As with any decision of this magnitude, the answer is complicated, and only those few at the top of AMR's corporate ladder know all the reasons. But in the past weeks, it was becoming clear the voluntary reorganization hoped for by Chairman and CEO Gerard Arpey was failing and that momentum was shifting to a philosophy championing Chapter 11, led by Thomas Horton, who has assumed Arpey's responsibilities.

Stalled negotiations with the Allied Pilots Association (APA), to many observers, was the catalyst for change, and there is no doubt that the union leadership's avoidance in the past weeks of any meaningful contact with management did little to help those who favored a vol-

untary option. Staffing pressures caused by an exodus of American Airlines' senior pilots added to AMR's pains, but by Nov. 28 these had passed, as the incentive to leave (a 60-90-day retroactive share price on part of their retirement package) was all but irrelevant.

On top of this, AMR had been in that position many times before with several of its unions and, as APA points out, the monetary value of its contract talks alone was not sufficient to push a company into court protection when it already knew it had \$24.7 billion in assets and \$29.5 billion in liabilities.

No, something else was wrong and a likely contributor was AMR's forecast for the coming months. It is no secret that the airline industry is bracing for a tough 2012, and since the end of the third quarter most of the U.S. major airlines had issued revisions to their revenue, cost and capacity forecasts into next year. AMR was the one notable exception.

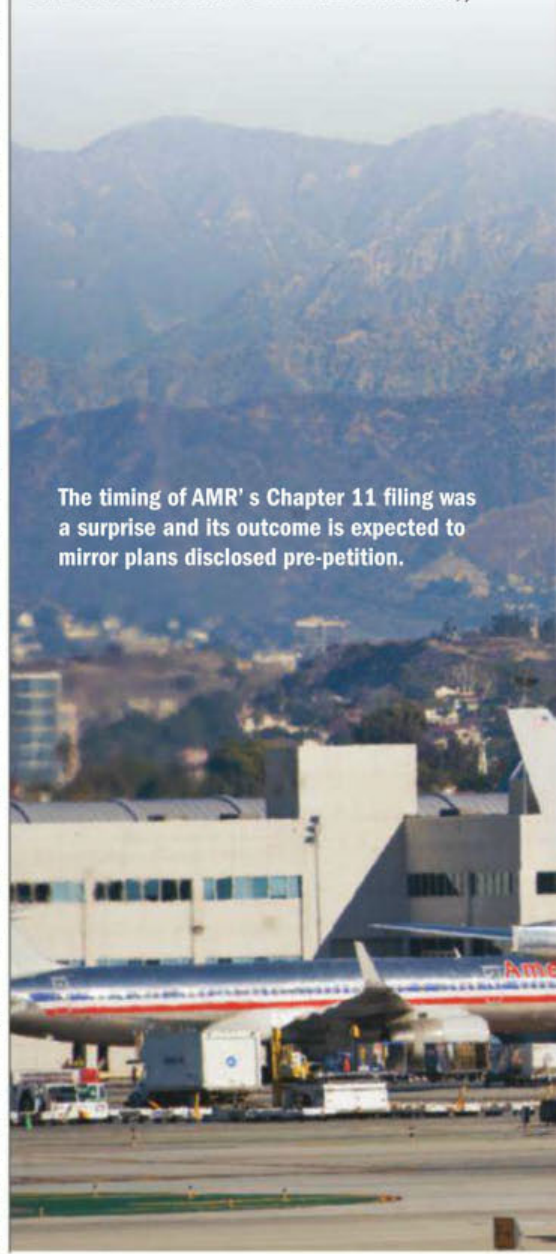
The company was already under scrutiny by investors who, while empathizing with AMR's attempts to address its labor costs, attacked it for unremarkable single-digit revenue growth while the likes of Delta Air Lines, United Continental Holdings and US Airways powered ahead with double-digit gains. Critics also questioned the so-called “cornerstone” strategy that focuses AMR's operations on five key cities, noting that the airline had no commanding hold on most of those hubs.

Time was running out for AMR. With no guidance and a continuing sense of ill-feeling toward its management, there was an inevitable dip in the company's market capitalization, even though it was trailing its peers. Eventually, the depressed stock could have fallen too far behind the airline industry's already poor standards, and in that situation the

company had little recourse but to approach the courts.

It also is now apparent that AMR wanted to avoid the limitations of debt-or-in-possession financing by funding this reorganization with the \$4.1 billion it holds in cash and (mostly) short-term investments. If the forecast was bad enough (and a few poor months can cost hundreds of million of dollars),

The timing of AMR's Chapter 11 filing was a surprise and its outcome is expected to mirror plans disclosed pre-petition.



ERIC SIMONSEN



AMR's management would have seen an already tight budget potentially depleted beyond usefulness, and yet another opportunity would have been lost.

The slickness with which AMR handled the first few hours of its Chapter 11 filing belies the surprise of the announcement. Professional, efficient and succinct, the carrier controlled its message in a way it had failed to do for months and, apart from a distinctly noncommittal public denial of possible mergers, seemed to appease most of the concerns about its immediate future.

It also appears that Horton and his team have a clear understanding of what they want from court protection; and for the most part we already know what it is.

Initial comments from Horton and Chief Financial Officer Isabella Goren reiterate the company's commitment to

## AMR Aircraft In Service

| AIRCRAFT              | OWNED      | LEASED     | TOTAL      |
|-----------------------|------------|------------|------------|
| Boeing 737-800        | 88         | 76         | 164        |
| Boeing 757-200        | 113        | 9          | 122        |
| Boeing 767-200ER      | 14         | 1          | 15         |
| Boeing 767-300ER      | 53         | 5          | 58         |
| Boeing 777-200ER      | 44         | 3          | 47         |
| MD-80                 | 122        | 85         | 207        |
| Bombardier CRJ700     | 47         | 0          | 47         |
| Embraer ERJ 135       | 21         | 0          | 21         |
| Embraer ERJ 140       | 58         | 1          | 59         |
| Embraer ERJ 145       | 118        | 0          | 118        |
| <b>TOTAL AIRCRAFT</b> | <b>678</b> | <b>180</b> | <b>858</b> |

Source: Aviation Week Intelligence Network





July's order for 460 Airbus and Boeing narrowbodies that at the time was heralded as AMR's savior. There are still doubters, especially about the pending order for Boeing 737 MAX aircraft, but the two manufacturers offered up public reassurances during the Credit Suisse-Aviation Week Aerospace and Defense Finance conference in New York last week.

This was unnecessary. The narrow-body deal was brokered by Horton, not Arpey, and the pique with which he responds to criticism of the order just illustrates his commitment, not only to Airbus and Boeing but to the strategy the order embodies. Unfortunately for American Airlines' mechanics, that also seems to include considerable outsourcing of AMR's maintenance.

So far, the company has avoided inflammatory remarks about its maintenance, repair and overhaul facilities, choosing instead to issue boilerplate statements about the need to evaluate all eventualities. But, in light of the bankruptcy, the decision to split the engine choice for the first batch of Airbus single-aisles between International Aero Engines and CFM indicates that American's maintenance strategy has changed since Arpey's reorganization plan from 2003.

The facilities were intended to become revenue centers, according to that plan, but AMR's comments at the time of the engine order noting the financial as well as operational benefits of the deals only

fueled rumors of a major change for the company's maintenance division. The unrestrained attack by the mechanics' union, the Transport Workers Union, that it "will fight like hell" does little to stop speculation that the end of in-house maintenance beckons.

While those IAE V2500 engines will power Airbus A321s set to replace at least part of the company's Boeing 757-200 operation, the new CFM56-5Bs are destined for an entirely new A319 operation that essentially will be a low-cost carrier (LCC) within the mainline operation (AW&ST Nov. 26 p. 19). This LCC was a core tenet of the AMR contract proposal that coincided with APA's withdrawal from formal talks. Given the clarity with which AMR chose to present the concept, it is certain Horton will, at least in the initial phases of his reorganization, want to keep this intact, especially as AMR proceeds with an expedited reduction of its MD-80 fleet.

This should placate many critics on Wall Street, who have openly berated AMR's leadership for failing to address shifts in North American demand as quickly, or as widely, as their competitors. The cuts in the MD-80 fleet, if deep enough, should also satisfy those who believe AMR's domestic operation is still bloated, though initial comments indicate the company is holding back from any commitment beyond "modest" reductions. Unfortunately for AMR, and its staff in particular, analysts are calling

for capacity cuts of 10%, all of which will have to come from the home market.

There are still questions about AMR's "cornerstone" strategy, which pulls most of its capacity into hubs at Dallas/Fort Worth International, Chicago O'Hare, Los Angeles International, New York's John F. Kennedy and Miami International airports, but Horton is intransigent on this: this is the future, he has regularly said, noting that once costs are addressed, the benefit of this strategy will become clear.

This should also help dismiss rumors of a pending merger, especially with US Airways, which would dilute benefits of the cornerstone approach. Despite AMR's incessant inability to deny merger speculation, it has pointedly avoided the influence of outsiders by funding the bankruptcy itself. Horton himself rallied the troops at headquarters Nov. 29 with calls to "kick some ass" when the airline emerges from Chapter 11.

That is not to say a merger is not planned, but both Delta and United waited to restructure their operations through bankruptcy courts before approaching their respective targets. It should also be noted that AMR has approached both US Airways and JetBlue Airways to place its designator code on a U.S. East Coast shuttle; code-sharing could negate many of the problems associated with mergers.

All of this comes at a cost, and while creditors will take a hit, AMR's labor groups should expect some pain. Job losses are inevitable, and the defined benefit pension plans Arpey so jealously guarded are also likely to be terminated. In fact, the Pension Benefit Guaranty Corp. is preparing the ground work by warning AMR workers they should expect to lose \$1 billion, should responsibility for the massively underfunded pensions be transferred to the already stretched U.S. government agency.

Workers at American Eagle Airlines should also prepare for a shock. The reorganization suspends a divestiture plan that proposed drastic cuts to Eagle's fleet, but even with new concessions it may be unable to be competitive with third-party operators such as SkyWest and Trans State Airlines.

The coming months will be tiresome for all involved, and the outcome will ultimately be disappointing for some. But for now, AMR has taken a major step to stem the flow of red ink from its balance sheet. Only time will tell if it can achieve profitability. ☼

## AMR's Bespoke New Leader

**T**homas Horton's background is almost tailor-made for the role he now serves as AMR Corp.'s chairman, president and CEO. His nearly life-long career at the company was punctuated only by four years at AT&T where, as chief financial officer and vice chairman, he restructured the struggling telecommunication company's debt and then organized a merger with local provider SBC. Since his return to AMR in 2006, Horton has been instrumental in overhauling its strategy, from a restructuring of the operator's relationship with its Oneworld alliance partners to its



**Thomas Horton**

"cornerstone" hub policy and, notably, a record narrowbody order that should revitalize the carrier's mainline fleet over the next five years. His management team includes Executive Vice President Daniel Garton, who led the divestiture of regional affiliate American Eagle Airlines (until Chapter 11 suspended that), Robert Reding as head of operations, Chief

Financial Officer Isabella Goren, Jeffrey Brundage as chief labor negotiator and senior vice president for human resources, and Gary Kennedy, who has served as general counsel and chief compliance officer since 2003. ☼



# Omnibus Deal

## Boeing's surprise IAM contract offer

MICHAEL MECHAM/SAN FRANCISCO

In early October, Boeing surprised the International Association of Machinists and Aerospace Workers District 751 by proposing talks on a new four-year contract months ahead of schedule. What has emerged from those meetings is a contract that preserves the union's health and benefit goals and guarantees that its newest project, the 737 MAX, will remain on the IAM's home turf in Renton, Wash., and not drift away to a non-union locale.

Although District 751 was surprised at the timing of Boeing's initiative, President Tom Wroblewski says, "it became clear to us" that Boeing's offer was serious. Now Wroblewski will lead the effort to convince the union's 34,200 members that what emerged from a late-night Nov. 29 bargaining session is generous in terms of traditional union concerns about pay, pension and medical benefits and carries with it unusual assurances

**Renton, Wash., has two Boeing 737 commercial assembly lines and one for the P-8, a derivative. How the factory will be configured for the 737 MAX has not been revealed.**

from Boeing about future job stability.

The agreement promises "a new era of prosperity," Wroblewski says. But the devil will be in the details for machinists. They are scheduled to vote Dec. 7 in Seattle's Puget Sound factories; Portland, Ore.; and Wichita.

Like Wroblewski, Boeing Commercial Airplanes President and Chief Executive Jim Albaugh is selling the deal, with an emphasis on 737 MAX production. Ratification "will secure a long and prosperous future," he says.

The terms of Boeing's proposal are making some suppliers nervous. "Sooner or later, Boeing will come after us to pay for their labor costs," Triumph Group CEO Richard Ill told investors at the Credit Suisse-Aviation Week Finance Conference in New York last week. When Triumph enters negotiations with the IAM next year, it expects the union to use the generous terms it won from Boeing as a starting point.

Still, the deal is being widely praised on Wall Street and in Washington. Jeffries

& Co. analyst Howard A. Rubel borrows from a Boeing marketing line in declaring it was evidence that company management and labor are "working together." Wedbush analyst Kenneth Herbert calls it a net positive for eliminating the fear of a potential strike in 2012 and, most likely, ending a National Labor Relations Board (NLRB) case. Washington state's Democratic Sen. Maria Cantwell, who chairs the Senate aviation subcommittee, declared it a "tsunami-sized deal" that "is a transformation of the relationship be-

ton line is part of the new Boeing deal. Given ratification, "we believe all our grievances with Boeing will be resolved," he says.

Boeing's factories are in the midst of an unprecedented production ramp-up into 2014. The last thing it needs is a repeat of the IAM strike in 2008, which the company reckons cost it \$1.8 billion in earnings. The IAM has struck three times in the past 15 years. Its current contract expires next September. If it ratifies the new agreement, the contract will run into September 2016.

The biggest production increase is for the 737 Next Generation series, 35 of which are built per month now, with the schedule planned to reach 42 per month in 2013. Counting weekends, that equates to more than two airplanes rolling out every day from Renton. In ad-



MICHAEL MECHAM/ANWST

tween the company and workers to focus on quality, performance and incentives."

In addition to settling an important contract ahead of schedule, the deal offers another sweetener for Boeing. Ratification is to bring an IAM sign-off on its long-running dispute over the decision to establish a second Boeing 787 final assembly line in a 447,000-sq.-ft. factory in North Charleston, S.C., where the work is non-union. That bitter divide has ended up before the NLRB, which began hearings in June on a staff proposal that Boeing shift the work back to its widebody headquarters in Everett, north of Seattle.

While insisting that the deal's production stipulations are focused on the 737 MAX and other Washington-based programs, Wroblewski accepts that clearing the air over the North Charles-

ton, the company has to prepare the factory for 737 MAX production with an eye toward a first delivery in 2017. The MAX is still in the design phase.

But Boeing's productivity pressures extend beyond the single-aisle 737 to its larger widebodies at Everett. The 787, which is just making its way into the market after nearly four years of development and production delays, is to see build rates skyrocket. Currently moving past a rate of two per month, the airplane is to hit 10 per month in 2013 from combined production in Everett and North Charleston. Increases are set for the Boeing 747-8 and Boeing 777, as well.

Not all the pressure comes from higher assembly rates. Boeing needs to integrate production of the U.S. Air Force's KC-46A tanker into its 767 commercial



assembly line and the U.S. Navy is slowly building up low-rate initial production rates on the P-8A maritime patrol aircraft, which is assembled in Renton and finished out with its military gear on a new special line in Seattle.

IAM machinists are essential for all these programs. "The Puget Sound area is the aerospace capital of the world because of its concentration of a skilled workforce and educational institutions," says analyst Tom Captain, a principal with Deloitte LLP. Those advantages trump the higher costs Puget Sound carries when compared to South Carolina and other labor-friendly states, he says.

Concern that Boeing might move the 737 MAX away from Puget Sound stirred state and local officials, including Gov. Christine Gregoire, and the IAM to create Project Pegasus in an attempt to convince Boeing that its best choice was to stay. Part of the strategy was a cost-and-benefit study by Accenture, a consultancy, to which the IAM contributed \$100,000. Accenture concluded that Renton posed the least risk, in part because of the established skills of its workforce.

Having to rally to convince Boeing that Washington represents the best location for aircraft production is not new to the state. It got its first shock that Boeing did not necessarily hold hometown loyalties when the company shifted its corporate headquarters to Chicago after its 1997 merger with McDonnell Douglas. A second jolt came in 2004, when Boeing began looking for an alternate site to assemble the 787.

The state responded with a series of tax breaks and regulatory relief that kept the 787 in Everett. As that program struggled, Alenia and Vought Aircraft sought bailouts and Boeing found itself with two new factories in labor-friendly South Carolina. The bitterness of the 2008 IAM strike prompted CEO James McNerney to insist it was time for Boeing to diversify its production base. A year later, North Charleston, not Everett, got the nod for a second 787 final assembly line.

The IAM called that move a retaliation for a "lawful" strike and sought relief from the NLRB. The dispute has grown political; Republicans in Congress charge that the NLRB is exceeding its authority by telling manufacturers where to locate work. In fact, as Wroblewski was praising Boeing's proposal, the House of Representatives was trying to overrule NLRB proposals on union organizing rights.

With that background, it is understandable that Boeing and the IAM kept their negotiations secret. Boeing's team was headed by Vice President Rick Stevens, head of human resources at company headquarters in Chicago, and Vice President Ray Conner of Boeing Commercial Airplanes, who now directs airplane sales but was previously the company's manufacturing supply chain leader. This Chicago/Seattle negotiating mix helped convince Wroblewski how serious Boeing was in seeking a deal.

The proposed contract boosts defined pension payouts for existing machinists and new hires—a key point for the IAM—while offering a pay increase of 2% per year. Besides a 401(k) retirement fund match, the contract contains the possibility of 2-4% annual bonus payments, provided quality, safety and productivity gains are met. This provision is an incentive for workers to consider the company's profitability and is becoming more common in the industry. The IAM already has agreed to a similar provision in its contract at Boeing's St. Louis defense plant, as has the United Auto Workers at Boeing's Philadelphia helicopter facility. Machinists also are to receive a \$5,000 signing bonus.

Boeing has long sought greater contributions from its employees toward the rising costs of company-provided health care coverage. In the new deal, machinists will contribute more, although union leaders say their benefits are still "far superior to those earned by most workers in our industry."

Production assurances for the 737 MAX include parts manufacturing, assembly and work at supporting plants, such as wire and interior shops in Everett. In addition, Boeing is offering the IAM "firm commitment" pledges to production of other widebody jets in Everett and the KC-46A and P-8 programs in Puget Sound.

Boeing has not suggested that work on those programs might go elsewhere, although its military facility in Wichita is in need of new work. While the proposal's language is silent on whether Boeing might add capacity at other locations, as it did with the 787, an IAM official says the commitment itself is regarded as a victory because Boeing has not offered such language in the past. ☛

*With Jen DiMascio in Washington and Joseph C. Anselmo in New York.*

## Long Recovery

MICHAEL MECHAM/SAN FRANCISCO

**J**ust how many new employees Boeing Commercial Airplanes will need when it begins production of the 737 MAX is unclear, but efficiencies gained in its regular 737 Next Generation series production suggest the number will be relatively low.

As it heads toward a 38-per-month production rate for NGs in 2013, BCA already has added an additional 600 workers across all job categories, says company representative Liz Verdier. But whether it will need to add another 600 to achieve its next production step of 42/month in 2014 has not been determined.

Boeing has made no projections on hiring rates for the 737 MAX.

After the 9/11 terrorist attacks led to a slump in air travel, BCA responded by laying off a third of its 93,000 workers, including 16,300 members of the International Association of Machinists and Aerospace Workers (IAM), taking their employment from 38,800 down to 22,500. The pink slips were spread over three years; total employment bottomed out at 50,577 in September 2004.

With demand increasing again, total employment at BCA had climbed to 71,528 by September 2007. Any laid off IAM employee who wanted to return was back at work by then.

The recession of 2008-2009 took another toll but at the end of this October total BCA headcount stood at 78,450, making it the company's largest business unit in terms of employment. In the Puget Sound region, BCA has hired more than 4,000 since the first of this year. Most are production workers.

It is not possible to compare employment levels at BCA exactly since 2001 because Boeing sold its fuselage, nacelle and wing components production facility in Wichita 2005, transferring some 5,500 jobs to the new owners, with the largest segment represented by the IAM. Reorganizations have spread responsibilities for some activities to new units, such as Shared Services, and greater use of information technology has brought production efficiencies which have reduced employment requirements. ☛



# Less is More

## Process changes cutting emissions in Boeing's delivery prep process

MICHAEL MECHAM/SAN FRANCISCO



**P**rocess improvements that cut fuel burn and emissions during Boeing's aircraft delivery preparation process are under consideration across the company's product line after an especially "green" rollout in November of a 777-300ER for Air New Zealand.

"You have to be relentless about it," Air New Zealand (AirNZ) technical manager Duncan Mairs says of the implementation of environmental impact policies. "No one's going to change the environment overnight. But you've got to look at everything and you've got to keep at it to [make it] a way of life."

Boeing's 777s go through a 20-day paint and delivery process once they leave the factory in Everett, Wash. The company is not saying its environmental initiatives will reduce that time appreciably, only that by cutting duplicative efforts or using alternative preparation methods they can cut greenhouse gas emissions.

The two biggest savings come in aircraft painting and pre-delivery engine testing. Boeing realized it was duplicating a significant amount of pre-delivery testing that General Electric already performs for 777 powerplants at its Peebles, Ohio, before it ships GE90-115Bs to Everett. By not duplicating GE's tests, Boeing reduced its fuel burn by 800 gal. on AirNZ's -300ER.

Next year it expects 777 fuel savings to reduce CO<sub>2</sub> emissions by 1.4 million lb., says Vice President Jeff Klemann, head of the Everett Delivery Center.

Boeing says it is further reducing fuel burn with better pre-planning of acceptance flight testing. Add to that a tighter grip on fuel loads needed for testing, which cuts aircraft weight, and the company expects to cut fuel used for testing by 193,155 gal. annually.

The company has used chromate-free decorative paint for more than a decade. Hexavalent chrome in the paint is considered a carcinogen and, as such, requires special health and safety monitoring during striping, painting and cleanup.

Boeing was not able to offer the equivalent in a primer until last year when PPG Aerospace introduced one. First to use the new primer were Brazil's GOL on a 737-800 and KLM on a 777-300ER (AW&ST Mar. 22, 2010, p. 14). While Boeing is automatically extending its other environmental initiatives across its model lines, chromate-free primer will remain an airline option.

**Boeing counts a 40% reduction in GE90 test times in customer acceptance preparations by eliminating work GE had already performed.**

Other initiatives include reducing the number of times potable water and hydraulic filters are changed during testing. In the case of potable water, the company used to flush a 777's storage tanks every three days. But it found no degradation in microbial counts when it flushed only twice in seven days. As a result, it saves 1,600 gal. of water during delivery preparations.

"The potable water improvements have already been implemented on other programs," a Boeing official reports. "Other programs are considering future engine run functional test improvements. As our development programs mature these ideas will be implemented as applicable." ☐



**Air New Zealand specified chrome-free primer paint for its 777-300ER. Boeing now offers this environmentally friendly option on all its models.**



# Precision Landing

Future exploration engineers likely to learn from Mars Science Laboratory targeting techniques

FRANK MORRING, JR./WASHINGTON

**D**elivery of NASA's large Curiosity rover to a Martian crater next Aug. 6 will be a do-or-die test, not just of its "sky crane" landing system, but of an equally new approach to targeting distant bodies with unprecedented precision.

Curiosity will be lowered on high-tech cables from a hovering spacecraft—that looks a little like something out of a Star Wars movie—to the smallest landing zone ever. Whether it works or not, getting the rover into position for the touchdown also is stretching planetary entry and descent techniques in ways that will shape space exploration for decades.

"Overall we're fairly confident in this system, but going through the process we have recognized that there are limits to how far we can go with the mass of the landed system with this, and we have ways that we think we could develop improvements to allow even more landed mass," says Steven W. Lee of the Jet Propulsion Laboratory, who is guidance, navigation and control manager on the MSL project. "It's the same with the precision landing."

Targeted in the \$2.5 billion Mars Science Laboratory (MSL) mission is a 20 X 25-km ellipse adjacent to a 5-km-tall (3-mi.) mound inside Gale Crater. Just south of the planet's equator, the crater measures 154 km across—smaller than the landing zones of the Mars Exploration Rovers launched in 2003.

On Dec. 10 controllers at the Jet Propulsion Laboratory will oversee the first in a series of trajectory correction maneuvers spread over the probe's 255-day cruise to Mars designed to deliver it to the proper entry corridor at the outer edge of the planet's thin atmosphere. The MSL lifted off from Cape Canaveral AFS, Fla., at 10:02 a.m. EST Nov. 26 atop a United Launch Alliance Atlas V-541, with four solid-fuel boosters and a Centaur upper stage. The Centaur's second burn, lasting almost 8 min., sent the spacecraft out of Earth orbit toward Mars.

"The launch vehicle has given us a great injection into our



BEN COOPER/AMAST

**Launch of NASA's newest Mars probe sets up a 255-day test of advanced entry, descent and landing techniques designed to hit the smallest target ever (lower left).**

trajectory, and we're on our way to Mars," states MSL Project Manager Peter Theisinger. "The spacecraft is in communication, thermally stable and power-positive."

Initially the probe was targeted away from Mars slightly to keep the Centaur stage from following it to the planet's surface and perhaps contaminating it with terrestrial microbes. With the precise launch, the first correction maneuver could come even later than Dec. 10, Lee says, because it will only need a small 3-meter/sec. "nudge" to turn it back on course.

From there on, the cruise phase of the mission will look a lot like other Mars-landing transits—checking out the suite of instruments and making additional trajectory adjustments as the spacecraft approaches its targeted entry corridor. The differences will come at the end of the trip, when the spin-stabilized cylindrical cruise stage feeds a final position fix from its Sun sensor and star trackers to the entry capsule and then separates before reaching the atmosphere.

JPL engineers drew on expertise at Johnson Space Center and elsewhere dating back to the Apollo era to devise what will come next. After the cruise stage jettisons, springs will kick two 73-kg (161-lb.) tungsten weights away from the entry element to shift its center of mass off the aeroshell's centerline. That will allow the spacecraft's entry, descent and landing (EDL) algorithms literally to fly the capsule toward the floor of the crater.

"The airflow goes faster over the top of the aeroshell relative to the bottom of the aeroshell; that gives you a lift vector," Lee says. "We can use that lift vector not only to keep ourselves a little higher in the atmosphere, but we can maneuver that lift vector to control the energy of entry to try to control our down range relative to the center of the landing ellipse, and also use it to control cross-track."

NASA JET PROPULSION LABORATORY





# CONGRATULATIONS

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A Honeywell inertial measurement unit keeps track of the capsule's position and velocity as it hurtles through the Martian atmosphere, flying "S" turns like a reentering space shuttle to bleed velocity and home in on the landing ellipse. When the capsule has slowed almost to Mach 2, the vehicle will jettison more tungsten ballast, broken into six 28-kg spring-ejected pieces for a gentler shift of the center of mass back to the center of the vehicle. That way it will be falling straight ahead when it pops its 16-meter-dia. parachute at Mach 2.

After the chute opens 11 km above the surface, plus or minus 2 km depending on landing-day conditions, the heat shield falls away, exposing the Curiosity rover and its eight-engine descent stage. A six-beam K<sub>a</sub>-band radar—the "terminal descent sensor"—is activated at 8 km, again plus or minus 2 km, giving the EDL algorithm the information it needs on distance to the ground and rate of descent.

"The terminal descent sensor has been another lynchpin in enabling this kind of a mission, mainly because we're such a large vehicle and we need to commit to our maneuvers using the radar data relatively early in the timeline," Lee says. "As a result, we need to have a radar that can work at higher altitudes than past radars."

When the parachute and backshell are released at 1,800 meters above the surface, the descent stage engines begin firing to slow the descent further. Firing asymmetrically at first, they maneuver the stage away from the chute and start the final trip to the surface. The 899-kg rover is lowered toward the surface on three cables and a data umbilical in the sky crane technique (AW&ST Aug. 1, p. 38).

If all goes as planned, Curiosity sets down on its six wheels—sparing the need for more landing gear—to begin exploring the crater's sedimentary mound for evidence of past habitability.

The site has been characterized by the Mars Reconnaissance Orbiter's High-Resolution Imaging Science Experiment (HiRISE), which gives mission managers confidence that the spacecraft won't come down on a large boulder or teetering on a low cliff. That is necessary, because while the final landing sequence is complex, it does not involve active hazard avoidance to maneuver the descending spacecraft away from danger.

"Our landing site experts here could actually show you the landing ellipse and point to a little scarp there, a little mesa here," says Lee. "I don't think there's a scarp or mesa that we don't know about, or worry that we haven't characterized the site. It's a very small—less than 1 percent, certainly, and probably much less than 1 percent—chance that we just happen to come down right in that bad spot. Those are risks that, when you're going to Mars, you just have to accept."

Humans-in-the-loop have been actively avoiding terrain hazards while landing since Neil Armstrong piloted the Eagle to its touchdown in the Sea of Tranquility on Apollo 11. Lee says JPL is already researching active hazard avoidance all the way down for robotic missions in rougher terrain than the relatively flat target ellipse in Gale Crater.

In developing the MSL mission, Lee and his colleagues used extensive simulation and "millions" of Monte Carlo risk-reduction runs of the approach and landing, raising confidence. And despite the complexity of the EDL sequence, driven by the size of the rover and the tight landing site, there was an ongoing effort to keep it as simple as possible.

"Part of our culture has been, when we think through a problem and think through options, we always want to be able to go back to a whiteboard and start with first principles," Lee says. ☼

## Problem Resolved

**H**e told controllers "Houston, we have a problem" only 2 hr. before banking on it to save his crew's lives on the aborted Moon landing flight, but decades later, James Lovell has cashed in literally with an Apollo 13 checklist.

The checklist, with handwritten calculations by the mission commander, sold at Heritage Auctions in Dallas last week for \$388,375—a record for memorabilia from the U.S. manned lunar program and the second most expensive space item ever. A navigation chart used on Apollo 11 sold for \$218,000 in 2009. A Vostok 3KA spacecraft sold for \$2.9 million this April.

Shown here are pages Lovell used to upload command service module guidance data to Apollo 13's lunar module (LM) at 58 hr. 8 min. 6 sec. into the 1970 flight. The three-man crew then used the LM as a "life boat" on the trip to and around the Moon before switching back to the command module for a safe return to Earth in what lead flight director Gene Krantz famously called "a successful failure." ☼

The image shows a handwritten checklist from the Apollo 13 mission, titled "DOCKED LM COARSE ALIGN" and "SUIT FAN/H2O SEP CHECK". The checklist includes various tasks such as "Verify CSM in Min DEADBAND ATT HOLD", "Calculate LM Gimbal Angles", and "V41 N20E COARSE ALIGN IMU". Handwritten calculations and notes are visible throughout the document, including a note about "this problem was anticipated" and a signature "Jim Lovell".

**DOCKED LM COARSE ALIGN**

1 Verify CSM in Min DEADBAND ATT HOLD

2 Calculate LM Gimbal Angles

3 V41 N20E COARSE ALIGN IMU

**SUIT FAN/H2O SEP CHECK**

1 CB(16) ECS: SUIT FAN 2 - Open

2 CB(11) ECS: SUIT FAN 1 - Close

3 SUIT FAN - 1 (SUIT/FAN Warning, FAN Comp Lts-Off, ECS Caution, H2O SEP Comp Lts -Off In 2 min)

4 CB(16) ECS: SUIT FAN 2 - Close

5 V41 N20E COARSE ALIGN IMU

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# Display of Discipline

Switzerland's Gripen NG decision assures fighter's long-term development

ROBERT WALL/LONDON

**I**s "good enough" the new defense procurement decision-making mantra?

Swiss Defense Minister Ueli Maurer is unabashed in acknowledging that the government did not opt for the most capable aircraft when it decided on the Saab Gripen NG over the Dassault Rafale and Eurofighter Typhoon. Instead, it went with the aircraft that met its objectives—and at a cost that leaves money on the table for other defense needs. It would be simplistic to write this off as a Swiss banker's mentality at work. Actually, the choice is not far off the U.S. KC-X tanker decision in which price topped overall capability in the Pentagon's process when it opted for the Boeing 767 tanker over the EADS A330 offering.

If this mindset catches on, it could prove to be good news for the Gripen more broadly. With a new round of fighter competitions in the offing—many associated with countries without the high-end threat concerns underpinning the competitive landscape in places such as Japan and South Korea—price considerations could be on the rise. Denmark and Bulgaria, for instance, are looking at fighter procurements, and the Czech Republic and Hungary, where Gripen is the incumbent, also have to solidify their long-term fighter plans as their existing leases are coming to an end.

For Saab, the Swiss decision to buy 22 JAS 39E/F Gripen NGs to replace its F-5 Tiger force has the additional benefit of putting the next-generation version of

the single-engine fighter on a firm footing. While Sweden had said all along it would buy the aircraft, receiving an export commitment early formalizes the schedule.

Sweden, which was planning to field the aircraft around 2017, had committed to accelerating its schedule to match that of any export customer. Switzerland is expecting to field its first aircraft in 2015, with deliveries spanning 2-3 years, so now Stockholm is looking to place an initial order for around 10 aircraft ahead of its original plans. A day after the Swiss announcement, the Swedish parliament's defense committee confirmed the early purchase of 10 JAS 39E/Fs. The full government is set to sign off on the specifics of the deal next year.

That could be important news for the competition also in Brazil, where Gripen is facing the Boeing F/A-18E/F and Rafale. A type selection is expected in the first quarter, with Brazilian air force officials saying the new aircraft should be fielded in 2017.

For Dassault, the Swiss decision is only the latest in a series of stunning setbacks for Rafale in the export realm. The development is particularly painful coming only days after the United Arab Emirates put its long-anticipated Rafale purchase into doubt, blaming the company for not matching the French government's willingness to cut a deal. But it is also a setback for French President Nicolas Sarkozy, who has been crusading on behalf of Rafale.

The French government/industrial team was optimistic it could sway Swit-



The Gripen that Switzerland will field is likely to be different from the test aircraft, although the exact configuration has not been set.

zerland to buy Rafale, in part by promising to provide easy access to training ranges in France and by helping the Swiss air force to overcome the problem of the tight airspace restrictions it faces in its own country.

Dassault argues that Switzerland could have met its requirements with fewer aircraft—at an equivalent or lower cost—if it had simply opted for Rafale. Maurer retorts that the government examined buying fewer aircraft, but wanted to have enough on hand to field two operational squadrons and meet training needs (the program had already been curtailed from fielding three squadrons).

The decision also marks a setback for the other contender, Typhoon. The consortium was hoping Switzerland would be enticed by the fact that three of its direct neighbors—Germany, Italy and Austria—already operate the aircraft.

For Typhoon, but even more so for Rafale, the Swiss choice intensified the pressure on securing India's Medium Multirole Combat Aircraft program—where the two are the sole remaining contestants now that Gripen and others have





SWISS AIR FORCE

been eliminated. It is the largest fighter program currently in competition and a decision could come before year-end.

Both can perhaps derive some benefit from the Swiss decision, since Maurer suggests each of the losing contestants provided higher performance, something India may prize more than Switzerland did. What is more, the Swiss defense minister says the offers from all three contestants met the government's requirements in terms performance, industrial participation and 100% contract offsets.

Nevertheless, he left little doubt that the Gripen was a clear choice. The procurement costs were considerably lower—they are expected to come in below 3 billion Swiss francs (\$3.2 billion)—and it also held the edge in terms of life-cycle cost over 30 years.

Moreover, Switzerland was pleased with the potential for industrial cooperation on offer from Saab. With the NG development still to be completed, there is an opportunity for higher value technical work. Although a number of Swiss companies should benefit from the deal—they would have, no matter who won—Ruag is likely the biggest ben-

eficiary. A company official notes that it was important that it serve as the maintenance, repair and overhaul center for the aircraft, no matter which candidate was chosen.

Switzerland and Sweden will now begin refining the program. In the next several months, they will decide how pilot training may be set up, including potential training in Sweden. Also still under review is the site of the final assembly plant.

Along with location, the specific aircraft configuration is still under discussion, and that continues to be a contentious point. Switzerland had indicated it would buy an off-the-shelf aircraft, and the developmental nature of elements of the NG is raising more than eyebrows. "The 'Swiss-tailored' Gripen only exists on paper," complain Dassault officials, adding that "Its technical development and production risk significantly increases the financial efforts required of the Swiss authorities to accomplish the country's fighter aircraft program."

Once the program is finalized, it will still need endorsements from several political entities, including a submis-

sion to parliament around mid-2012, with the goal of completing the deal by the end of the year for inclusion in the 2013 procurement plan. A fighter purchase in Switzerland is always fraught with discord, but the deal is likely to pass because a majority in parliament is eager to make it happen. In fact, the executive branch was ready to hold off, but parliament decided to push the issue in part to take advantage of the strong Swiss franc, which provides a relative price advantage for the fighter.

Maurer says decisions are still pending about the Gripen serving as the eventual replacement of Switzerland's existing fleet of older F/A-18s. It certainly would be a contender, but so would other aircraft, both manned and unmanned, he suggests.

For Saab, there is one more upside; Uncertainty over its Gripen production line has been eased considerably. Of the existing Western competitors in the market for fighter exports, Gripen had the smallest backlog. The Swiss deal, coupled with the Swedish plans, effectively leave Saab in a secure spot until at least the end of the decade. ☐



# Refining Tactics



## Pentagon says contractors can earn healthy profits despite cost reductions in defense

AMY BUTLER/NEW YORK

**B**usiness as usual—including record profits and high overhead and labor rates—could shift in the defense industry as it adjusts to new buying practices taking root at the Pentagon.

Contractors can expect a growing emphasis on using competition to secure and maintain work and government overseers are honing their negotiation tactics

for the lean times ahead. If this initiative works as planned, the Pentagon intends to reduce its own costs while maintaining “reasonable” profit for industry, says Brett Lambert, the department’s industrial policy chief.

Company cost structures are already morphing as a result of the so-called better-buying power push, according

to Vice Adm. Mark Skinner, military deputy to the Navy acquisition chief. But more change is needed, especially with overhead and support costs.

Some company executives claim the Pentagon is engaging in a war on profit. Not so, says Shay Assad, director of defense pricing and acquisition policy. The Pentagon is “using profitability to

**The Navy’s F/A-18E/F is often cited as an example of smart contracting.**

motivate contractors to reduce their cost structures,” he told a group of investors last week at the Credit Suisse/Aviation Week 2011 Aerospace and Defense Conference here.

To better track contractor cost structures, the Defense Contract Management Agency (DCMA) is undergoing a “revolutionary change,” including the addition of more than 350 cost-estimating experts, Assad

says. For about a year, officials have been creating a defense pricing database under the purview of DCMA that will provide program managers insight into the cost structures of companies doing business with the department. Today, this data is not tracked and program managers are often negotiating without the benefit of contract data

# Do Over

## U.K. SAR program intends phase-out of military Sea King helicopters

ROBERT WALL/LONDON

**“K**ee it simple stupid.” That, at least, is the philosophy the U.K. appears to have embraced as it revives its effort to replace its search-and-rescue helicopter force after a previous effort went spectacularly off course.

The new bidding is in lieu of the complex, £6-billion (\$9.4 trillion) publicly financed SAR-H initiative that was canceled in February on the eve of program award, after more than two years of discussions with industry. Irregularities in the deliberations with the final bidder, a consortium that included CHC Helicopters, Thales, the Royal Bank of Scotland and Sikorsky offering the S-92, led to the program being scrapped.

The new effort comes at an important time for helicopter makers in the European market. With government budgets in decline, the U.K.’s search-and-rescue effort is one of the few new programs on the horizon. It seems destined to involve teaming between helicopter operators and manufacturers, with potentially two rotorcraft types.

The Department for Transport, which is managing the

program, says “This service will require an all-weather SAR helicopter service able to operate throughout the U.K. and in the maritime environment. [It] must be responsive, able to search a wide area of interest, locate and recover personnel and stabilize casualties from all risk areas.”

But the Royal United Services Institute’s view is that the program is not ambitious enough. The think tank believes the program “should be seen as an opportunity to harmonize the U.K.’s helicopter emergency services and set up a National Air Service.” It would pool police, air ambulances and SAR helicopters. Such an effort would “require a strategic vision that is currently lacking due to the fragmentation of the emergency services sector and the lack of a single responsible owner at central government level,” the report’s author, Jennifer Cole, says.

The initiative the government is offering is far more straightforward. It proposes a simple 10-year fee-for-service arrangement. The contract or contracts under the program, which could cost up to £3.1 billion, are likely to be awarded in 2013, with the service provision to start in 2015. The entire program would fall under the aegis of the Maritime and Coastguard Agency.

The initial focus will be on replacing Sea King SAR operations now conducted by the Royal Air Force and Royal Navy. The defense ministry is keen to phase out the Sea Kings by March 2016.

The number of bases for SAR operations will also be trimmed to 10 from 12; currently eight military bases and four Maritime and Coastguard Agency sites are used. Operations



from the sister services and agencies.

Integrated Contractor Analysis Teams are also being established to focus on oversight of particular company divisions with which the Pentagon does the most business.

Assad acknowledges that these efforts are "Business 101," but notes that these skills have atrophied over time. The Pentagon is doing the kind of ground work any corporation does to prepare for negotiations, he says.

One investor notes that following the post-Cold War budget cuts, companies achieved high profits via consolidations. In the past decade, the unprecedented defense spending on the wars in Iraq and Afghanistan provided a safety net despite an economic downturn that has hit the U.S. manufacturing sector hard. Now that defense spending is drying up, these companies must accept that the boom times are over, the investor says.

This does not translate, however, to significant reductions in profit. "Profits are the smallest part of our cost," Lambert says. "We'd love to pay more profits." Assad's hope is to motivate companies to reduce overhead, improve labor rates and better allocate engineering support. This would translate to a lower cost to the Pentagon while providing attractive profit margins to companies.

Meanwhile, the Pentagon is under pressure to cut at least \$450 billion from its budget over the next 10 years, and this could escalate depending on debt-reduction measures enacted by the Senate.

Pentagon leaders are putting in place plans and requirements geared to arm their program managers for contract negotiations. Chief among them is the advent of the "should-cost" review, which is designed to provide insight on what the cost of a program should be based on an in-depth review into its supply chain and the company's cost structure. This figure will be much lower than the actual budgeted cost of a program.

"You need to be ahead of schedule and under cost in this environment," Skinner says "If not, you are in trouble."

Skinner acknowledges that more work needs to be done to educate Pentagon program overseers on how to motivate industry via contracting. Navy program managers are now required to take a short course about energizing contractors. "Our program managers will have to raise their game . . . or we will not do well in this environment," he says.

The Center for Strategic and International Studies found that 80% of defense programs overran funding targets since 1972, despite resourcing them at a 50% confidence that the estimates were solid.

The Pentagon is also injecting more competition into procurements. "We have a big hammer, which is competition, and then we have a teeny-weeny screwdriver, which is award fees," Skinner says.

The Navy is hoping to shift 10-15% of its sole-source work into a competitive environment in the coming years, he says.

In cases where a competition at the prime level is not possible or where the service is locked into a long-term deal, program managers are encouraged to "break out" capabilities from the prime and manage them directly under the Navy's own purview. Thus, "we don't pay the pass-through cost," Skinner says.

"If a company is actively managing the supply chain, we are OK with that," says Assad. The Pentagon's issue is with contractors who are adding cost to contracts for easily procured items.

Additionally, the Pentagon is keen to buy more data rights to weapon systems upfront to avoid being locked into a single original equipment manufacturer to support that system. This would also allow for competitions throughout the life of a program, Skinner says.

Today, the shift from design to build is often managed by a single contractor unless an egregious misstep takes place. ☐



The search-and-rescue program will first focus on replacing Royal Air Force and Royal Navy Sea King helicopters.

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around Boulmer and Portland will be phased out—in 2015 and 2017, respectively—but would continue at or near Sumburgh, Stornoway, Culdrose, Wattisham, Valley, Lee on the Solent, Chivenor, Leconfield, Lossiemouth and Prestwick.

Bidders have until mid January to opt in, and can chase either the entire program or elements.

One option would be the SAR operations at four sites (Sumburgh, Culdrose, Leconfield and Valley) with a helicopter providing at least a 200-nm radius, with the rotorcraft at Stornoway offering at least a 250-nm radius. All would have to be

able to recover at least eight people. The £1.2-1.8 billion contract runs up to 13 years (including a 10-year operational phase and options for extensions).

The second portion, to cover operations at Lee on the Solent, Chivenor, Prestwick, Lossiemouth and Wattisham, would require a rotorcraft with at least a 170-nm radius and the ability to recover four people. This £800 million-1.3 billion portion includes an 11-year contract that covers eight years of operational service with options for extensions.

Up to five bidders will begin the process; 2-3 will receive a final invitation to bid. ☐



# Sticking Point

Malaysia is adding AEW&C aircraft to protect its interests in the South China Sea

LEITHEN FRANCIS/KUALA LUMPUR, MALAYSIA



NORTHROP GRUMMAN

Former U.S. President Theodore Roosevelt once said that when it comes to international relations, it is best to “speak softly and carry a big stick.”

Malaysia, in its relations with China, has to deal with the thorny issue of conflicting claims over the South China Sea. The Southeast Asian nation needs Chinese trade and investment, but cannot afford to be at the losing end of the stick when it comes to its sovereignty.

Prime Minister Najib Abdul Razak alluded to the dilemma on Nov. 12 in a China Central Television interview. “The level of economic relations between Malaysia and Asean [Association of Southeast Asian Nations] and China is huge and it is increasing on

**Malaysia is considering the purchase of two Northrop Grumman E-2Ds to help it monitor the South China Sea.**

a very strong trajectory, but of course there are other issues we have to contend with [when it comes to China]. But we are positive about our engagement and relationship with China,” he added. Najib can speak softly, but to be taken seriously Malaysia needs to be able to identify incursions in the South China Sea.

The country does have land-based

# Indigenous Alert

India's EMB-145 early-warning platform to be tested soon

ASIA-PACIFIC STAFF/NEW DELHI

India's home-grown airborne early warning and control (AEW&C) effort enters a crucial phase this month with the Embraer EMB-145-based platform making its first flight in coming days, according to defense officials.

The project has been in development for eight years at the Indian Defense Research and Development Organization (DRDO) Center for Airborne Systems (CABS). With a pronounced need for greater air surveillance and electronic intelligence-gathering, the Indian air force has asked the program team to speed up tests and offered more personnel to start platform flight trials more quickly.

The \$415 million program will initially supply India with four EMB-145I aircraft, though at least 15 more are almost certain to be ordered once the platform is operational and certified in India. The DRDO hopes to begin deliveries in 2014.

A team from the Indian air force Aircraft & Systems Test-

ing Establishment will conduct the initial flight tests with Embraer pilots in Brazil. Test procedures in that country will be governed by Brazil's civil aviation and India's Cemilac agency.

An Indian air force officer familiar with the program says the development has progressed satisfactorily and that the service is working with DRDO to see how test schedules can be compressed. “The [defense ministry] has agreed to let us explore ways to ensure deliveries sooner than was earlier planned,” he continued. “These are assets critical to our infrastructure expansion plans, especially in the north and west.”

With both China and Pakistan fielding new surveillance aircraft, the Indian air force is prioritizing acquisitions of aerostat sensors and radars of virtually every kind.

In February, Embraer handed over the first of three aircraft to a DRDO team following integration of the dorsal unit with dummy electronics, auxiliary power units, environmental control system, inflight refueling probe, internal fuel tanks, satellite communications (satcom) gear and all necessary antennas.

The CABS lab supplied the dorsal unit, including its dummy electronics and the Ku-band satcom dome. Two other DRDO labs—the Defense Avionics Research Establishment and the Defense Electronics Research Laboratory—supplied the antennas for electronic and communication support measures and UHF/VHF. The primary sensor is a fully Indian extended-range active, electronically scanned radar, comprising three back-to-back arrays, with one for friend-or-foe identification.



radar. For maritime surveillance, it relies on Beechcraft KingAir aircraft fitted with Thales radar, but these have a limited range.

Realizing the South China Sea is a blind spot in Malaysia's rearview mirror, its air force is intensifying its efforts to procure airborne early warning and control (AEW&C) aircraft. Chief of the Malaysian air force, General Rodzali bin Daud, says the service has been trying since the late 1990s to obtain this equipment.

The procurement has been put on hold several times as other defense purchases—deemed by politicians here to be more important—have taken precedence. A key to securing the AEW&C aircraft involves swaying the prime minister. Successful big-ticket defense items tend to be those that he approves.

Rodzali's strategy is to highlight the multi-role capabilities of the aircraft, emphasizing that this a national asset that would also be useful to government agencies and all branches of the military. At the TangleLink Airborne Early Warning & Control conference here last month, Rodzali said AEW&C aircraft can support "national responsibilities including search and rescue, [anti]piracy, counter-drug operations and border security."

A sizable budget is crucial if the air force is to get its first choice. Rodzali alluded to this in his speech when he said: "The air force hopes the financial situation improves and the AEW plan will be [realized]."

Some of the conference delegates, speaking on the sidelines of the event, questioned whether the air force has the budget for the more expensive platforms and systems on offer. Sensing this may be an issue, some players—such as Lockheed Martin U.K.—are trying to convince the air force to go for a cheaper solution, namely using an existing platform in the air force's fleet, such as the Lockheed Martin C-130, and converting it to an AEW&C aircraft using the company's roll-on, roll-off AEW&C mission systems.

The Malaysian air force, however, is adamant that it wants new aircraft.

This is why Saab is proposing its Erieye radar mounted on a new Embraer EMB-145 regional jet.

Airbus Military is pitching the Airbus Military C295 AEW, a completely new C295 variant, which is still in development. If the company is successful with its pitch, the air force would be its launch customer.

Northrop Grumman originally suggested selling ex-U.S. Navy E-2C Hawkeye aircraft to Malaysia, but now it is

promoting the new model of Hawkeye, the E-2D. If Malaysia orders the E-2D it will most likely be a foreign military sale and the air force will negotiate with the U.S. Navy for early delivery slots.

It is understood that Malaysia will buy two aircraft initially and will likely base both in the same place.

East and West Malaysia, however, are separated by 600 km (373 mi.) of water, a point that Rodzali raised in his speech. If the aircraft are stationed in West Malaysia, they will have to be flown for several hours to reach East Malaysia. Then they will need sufficient fuel in reserve to perform missions in and around the area and return to base.

Rodzali emphasized that Malaysia's land-based radar is insufficient, particularly when it comes to monitoring the seas. "Land-based radar's lack of mobility puts it second to airborne systems," he said. Malaysia also needs to ensure that its AEW&C aircraft has low-level detection capability, he added.

"It is important to maintain a high degree of situational awareness and central to this is AEW," Rodzali said.

If Malaysia can achieve this capability—its proverbial big stick—this could make China think twice about encroaching into the tinier nation's territory. ☛

The platform also features indigenous data links developed specifically for the program.

EADS has worked with the program for more than a year, consulting on system architecture, certification and mission equipment optimization.

The brief flight-test schedule in Brazil will specifically gauge flying qualities and basic handling. Testing of the aircraft's on-board systems will begin mid-2012 after the first aircraft is ferried to Bengaluru.

By August, the program team hopes to begin the platform's first technical trials. The aircraft will be fitted with its real sensors and electronics, including avionics racks, seating, cabling

and operator workstations. Tests will be conducted in Bengaluru, in the desert sector of western India and at northern bases.

Progress on the Indian AEW&C program comes as the Indian government is studying a solicited proposal from Israel Aerospace Industries to supply two more Phalcon airborne warning and control system aircraft in a deal pegged at \$800 million. India's Air Chief Marshal Norman Browne said in October that the proposal had been accepted and was now being processed before contract signature. Last month, Israel's air force Chief, Maj. Gen. Ido Nehushtan, made a quiet visit to New Delhi, where the Phalcon proposal is believed to have been discussed. ☛



India's homegrown airborne early-warning and control effort hits a critical milestone this month with first flight of the Embraer-145-based platform.





# Defensive Offense

Persian Gulf carriers push for increased access to Europe, dialog on state support

JENS FLOTTAU/ABU DHABI, UNITED ARAB EMIRATES

**M**iddle Eastern airlines have long been accused of receiving unfair government support, but they are arguing that their model should serve as an example for the world.

"Yes, we have governments support us, in the same way as Europeans did before their privatization," Qatar Airways CEO Akbar al Baker told delegates at the Arab Air Carrier Organization (AACO) annual general meeting here last week. He argues that once airlines in the region "are properly mature," they will launch initial public offerings (IPO) and privatize to fully stand on their own feet.

The themes of alleged unfair subsidies for the region's airlines—particularly the big three, Emirates, Etihad Airways and Qatar Airways—and the slow opening of European markets dominated the AACO meeting. In fact, the themes were deliberately put on the agenda in order to air them with critics. Persian Gulf airline representatives stuck to the argument that their companies are in a much earlier stage of corporate development compared to their European rivals, stressing that when the major European carriers were in a comparable phase, they were heavily dependent on state aid, too.

"Air France, British Airways, Iberia, Lufthansa—all of them were fully government-owned," Al Baker says. "When the civil servants bankrupted these airlines, they went public by writing off the old debt."

His European guests had little to say in response, but the uneven playing field nevertheless persists. The big three in Europe—Air France-KLM, British Airways and Lufthansa—no longer have access to direct support (with exceptions such as a €500 million [\$675 million] debt assumption by the Austrian government as part of Lufthansa's takeover of Austrian Airlines). But they have to deal with the big three Persian Gulf carriers, two of which do not publish audited reports yet and openly admit that they could not have made it to their present state without continuing government help.

Weakening the European carriers' argument, though, is the fact that state aid is hardly limited to the Persian Gulf. Many of Europe's smaller carriers such as LOT Polish Airlines, CSA Czech Airlines or Malev Hungarian would likely not be around if they were not government-owned. Tiny Slovenian carrier Adria Airways just received a €50 million capital injection from the state to stay afloat. India is about to decide on a multibillion bailout for Air India in spite of sharp protests by the country's ailing private carriers such as Jet Airways and Kingfisher Airlines. And in Latin America, the Argentinian government not only continues to prop up Aerolineas Argentinas but protects its home market against stronger, more efficient rivals from the region and abroad.

Eventually, airlines in Europe and North America will likely have reason to

**Qatar Airways, Emirates and Etihad Airways, want considerably more access to European destinations.**

complain about the state's role in Chinese airlines, but so far their long-haul presence is not warranting such concern.

The biggest strategic threat to European airlines now—aside from fuel prices, emissions-trading and new taxes—is seen as the Persian Gulf carriers' growth. The European majors have learned to cope with low-cost carriers, but their Middle Eastern rivals threaten European airlines' most profitable business segment: long-haul routes, particularly to the Asia-Pacific region.

John McCulloch, former CEO of the Oneworld alliance and now a senior principal at the Seabury consultancy, points out the irony that many Middle East airlines were actually set up to serve European interests and were even sometimes managed by foreign airlines. For a long time, European airlines were happy to take feed from their Arab partners, "but now the table has turned," he says.

And the prospects are worrying: The big three Persian Gulf carriers have ordered three times as many aircraft as the big three in Europe—Emirates alone has more aircraft on firm order than its European competitors. The Persian Gulf carrier orderbook is even larger than the entire installed base of long-haul aircraft of U.S. majors. And as many Middle Eastern carriers have ordered the Boeing 787, they will be able to exploit even more secondary markets, provided they have the necessary traffic rights. "No wonder Europe feels threatened," McCulloch says.

Seabury also reports that Persian Gulf airlines have a 35% cost advantage vis-a-vis their international competitors, mainly because of lower labor and ground-handling costs.

"You can compete with airlines, but you cannot compete with governments," says Ulrich Schulte-Strathaus, secretary general of the Association of European Airlines, with a view to airport handling fees. He says they are 85% lower in the Persian Gulf region than in Europe. But his AACO



counterpart, Abdul Wahhab Teffaha, says European airports are 85% too expensive. Teffaha also asks why debate focuses on Etihad and Qatar Airways, when the biggest carrier of the three, Emirates, is publishing audited reports and “is 100% in accordance with best practices for transparency.” Even Schulte-Strathaus admits that the Middle Eastern countries “have done the right thing and invested in infrastructure.”

In spite of government backing for Persian Gulf airlines, Al Baker says, “we are disadvantaged and should be the ones talking about fair treatment.” The primary disadvantage in his view is the lack of sufficient access to Europe, based on current bilateral agreements and due to their European competitors’ heavily lobbying not to open up more.

“There is huge demand; let us all prosper together,” Al Baker proposes. “We are placing all these huge orders [with Airbus], creating European jobs, but we don’t get anything back.”

Khalid al Molhem, director general of Saudi Arabian Airlines, supports opening of the European market too, a path that his once-protective country is slowly following now. “For an airline [that has previously benefitted from restrictions to its competitors], it is painful, but as a Saudi citizen I think opening up is a good thing,” he says. “You have to look at it from a broader perspective.”

Of course, there are open-skies agreements in place between the European Union and some countries in the Middle East and North Africa, such as Morocco and Lebanon, and negotiations are under way for some others. Carriers such as Royal Air Maroc, though, Al Baker notes, are hardly a threat to any European airline. Open-skies deals are also in place between individual European countries, such as the U.K., and important countries in the region, such as the United Arab Emirates, but not with the European Union as a whole.

Given the constant conflicts and complaints about unfair treatment, AACO is proposing initiatives to foster better understanding and solutions. It wants to see negotiated a “framework of principles that guarantees a balanced relationship between the two regions and secures a parallel framework to that of the Euro-Mediterranean that would include all Arab countries willing to join.”

Such a combined Arab aviation area is unlikely soon, however; partly because of restrictive bilateral agreements in place between Arab countries. ☛

# One-way Street

## Protests of EU emissions trading system by Arab and other countries make little progress

JENS FLOTTAU/ABU DHABI

**A**rab countries are part of a global group of states trying to fend off inclusion of their airlines in the European Union’s emissions trading system (ETS) in its current form. But, as they and representatives of their airlines witnessed at the Arab Air Carriers Organization (AACO) general meeting here last week, the European Commission still shows no sign of relenting.

“Arab airlines want to shoulder their environmental responsibilities, but as part of a global solution,” the AACO Abdul Wahhab Teffaha told delegates. “Unilateral initiatives ignoring the boundaries of jurisdiction are not succeeding,” he said, noting that any global deal would have to be handled by the International Civil Aviation Organization.

At the meeting, the AACO drew up a resolution calling on the Arab Civil Aviation Commission (ACAC) to find a common Arab position “with regards to the illegitimacy of applying the European Union scheme on non-EU airlines.” However, countries are taking differing approaches to negotiating the “equivalent measures” that they could theoretically use to keep their airlines from paying for carbon certificates. Also, according to industry executives, Qatar was initially prepared to spearhead a joint ICAO initiative but appears to have pulled back on that.

The EU ETS is scheduled to be introduced in January, in spite of global opposition. The group of 26 countries opposing it—including the U.S., China, India, the United Arab Emirates and Qatar—say the EU violates their national

sovereignty by charging for emissions that occur in non-European airspace, too. An aircraft flying from Johannesburg to Rome will spend 90% of its flight time outside of European borders, but the airline will still be charged for the entire length of the trip.

Industry officials say they expect foreign ministers from the Middle East region to address the European Commission soon to lay out their concerns on a higher political level in an effort to increase pressure on the EC. One potential outcome could be that countries opposing the ETS formally mandate ICAO to negotiate a compromise on their behalf. This would make it much more difficult for the EC to push through its initial plans, though it could then still opt for an intra-European scheme that does not involve traffic in and over third countries.

The EC, meanwhile, is trying to engage its opponents in negotiations over equivalent measures that would lead to exclusions from the ETS based on local environmental projects. At the AACO meeting here, IATA CEO Tony Tyler said following that path “would be a nightmare for the industry,” because it would open the way for various regional schemes that would be expensive and difficult for international airlines to handle.

Philip Good, policy adviser at the EC’s climate action directorate general,

**Arab airlines such as Etihad are at the forefront of opposition against including airlines in the EU emissions trading system.**





argues that limiting the ETS to the portion of flights within European airspace was deemed impractical by ICAO itself in 2006, which sparked fierce opposition from Tyler. Charging just within European airspace is, in Tyler's view, "no problem," as all the necessary navigational data would be easily available. Instead, he

asked Good, "what gives you the right to charge for flights over third countries?"

Good also rejects demands to limit the ETS to intra-European flights, basically because these are only responsible for one-third of the emissions. "You are then only looking at part of the problem," he asserts.

With a view to proposed U.S. legislation that would make it illegal for U.S. carriers to participate in the ETS, Good says, "it would be a great shame if the U.S. passed such legislation." He says a "contest between two conflicting rules" would be a "very difficult position to be in for airlines." **G**

## From Bad to Worse

### European airlines face a nightmarish 2012

ROBERT WALL/LONDON

**E**conomic turmoil in Europe and high fuel prices have made 2011 a difficult year for the region's carriers. The problem is, the outlook for 2012 is already far worse, with economic and regulatory headwinds only getting stronger.

New data from the Organization for Economic Cooperation and Development (OECD) and the International Air Transport Association (IATA) provide further signals airlines, particularly in Europe, are heading for an increasingly difficult economic situation in 2012. In its latest economic outlook, the OECD projects a mere 0.2% growth in gross domestic product for the eurozone, down from 1.6%. Even in 2013, the recovery will be a merely modest 1.4%.

Overall, the OECD sees GDP for all member states contracting next year to 1.6%, from 1.9% this year and 3.1% the year before. A downside scenario could see the U.S., Europe and Japan in negative territory next year, the OECD warns.

There is traditionally a direct link be-

tween GDP growth and air transport's revenue passenger kilometers. Also, world trade growth should slow to 4.8% next year, the Paris-based organization says, from 6.7% this year.

The OECD projection comes as IATA notes that cargo demand in October was 4.7% below the level of last year. "Since mid-year, the [air cargo] market has shrunk almost 5% and this is far greater than the 1% fall in world trade," notes Tony Tyler, IATA's director general and CEO. Freight traffic for 2011 has now dipped into negative territory with the October figures.

IATA notes that the loss of confidence among purchasing managers appears to be driving a shift to slower, but lower-cost freight options, with the OECD noting that both business and consumer confidence is weakening.

Although cargo traffic has been contracting for some time—and is viewed as a harbinger of what happens with passenger traffic—so far revenue passenger kilometers are still growing. IATA reports 3.6% year-on-year growth for October and year-to-date growth of 6% compared with the first ten months of 2010.

As if that were not enough to concern carriers, the U.K. government has rejected repeated industry calls to halt increases in its Air Passenger Duty levy. The tax is rising faster than the pace of inflation, carriers bemoan.

The European Commission is also proposing tighter rules on slot utilization, requiring the usage of a slot to increase to 85% from 80% to retain the position. The package would also clear the way for slot trading. The deal also includes a few positive elements for airlines, such as a push to increase ground-handling competition, which could drive some costs down. The EC's proposal would still require member-state approval.

Add to all of this the inclusion of airlines in the European emissions trading system, creating additional costs that airlines are not sure can be fully passed on to customers.

In September, IATA projected European airlines would deliver a modest collective profit of \$300 million next year, but that outlook is likely to be worse now.

Furthermore, the few efforts to make things easier for airlines in Europe are flagging. The European Commission warns that its uphill struggle to get member states to move forward on implementing the Single European Sky legislation—facilitating air transport across the member states—is stalling. "2012 is a make-or-break year for the Single European Sky and there is

**British Airlines is among the U.K. carriers unhappy with London's decision to further increase the Air Passenger Duty.**





a lot at stake. Despite efforts that have been made, the commission's "traffic light" assessment shows a large majority of member states in the orange or red zones and at risk of not meeting critical targets for 2012," says European Transport Commissioner Siim Kallas.

One example is the creation of functional airspace blocks, which are supposed to reduce air traffic management complexity within the EU. But except for

the Danish/Swedish functional airspace block, the EU notes that all efforts "are in the orange or red zone and give serious cause for concern." Efforts to curb delays by establishing performance targets also are behind. "Existing plans by member states would fail to meet the EU-wide capacity target of a 0.5-minute delay per flight in 2014. If this target were achieved, some €920 million (\$1.24 billion) would be saved over 2012-14 due to fewer and

shorter delays," the commission notes.

"The current economic climate should be an added incentive, but member states are now using this as an excuse to stall the project," says John Hanlon, secretary general of the European Low-Fare Airlines Association in a joint statement with other airline lobbying groups. "Member states need to go back to the drawing board and work together with the commission to revise their performance plans." ☐

# Advancing Biofuels

## FAA funds research to develop new jet blends

GRAHAM WARWICK/WASHINGTON

**W**ith commercial aviation facing stiff competition from road transport for biofuels derived from vegetable oils and animal fats, the FAA is funding research into advanced alternatives to conventional jet fuel.

The agency has awarded contracts totaling \$8 million to develop drop-in jet fuel from new sources, evaluate how biofuels affect engine durability and develop guidelines for quality control and sustainability.

The FAA believes the research will help move aviation biofuels toward commercial-scale production by making a wider range of feedstocks and jet-fuel pathways available.

The research will improve a variety of fuels from different feedstock sources such as sugar cane, woodchips, switchgrass and pyrolysis oils, said FAA Administrator Randy Babbitt, addressing the Commercial Aviation Alternative Fuels Initiative (Caafi) general meeting in Washington last week.

"We are also partnering with the U.S. Air Force Research Laboratory [AFRL] to test the fuels," he said. "We will also conduct research on guidelines for quality control and tests simulating the long-term use of biofuels on engine life."

The bulk of the funding goes to four companies to develop advanced drop-in biofuels. Each will provide 100 gal. of jet fuel to AFRL for testing.

LanzaTech received \$3 million. The company has developed a process to turn carbon monoxide in waste gases from steel, oil and chemical plants into

alcohols, and has teamed with Swedish BioFuels to convert those into jet fuel.

Virent Energy Systems received \$1.5 million. The company has developed a catalytic process to convert plant sugars into liquid fuels and is working under a \$13.4 million Energy Department contract to convert corn stover into jet fuel.

Velocys also received \$1.5 million. The company is developing a pyrolysis process using microchannel reactors. Pyrolysis uses rapid heating to thermally decompose organic matter into hydrocarbons from which jet fuel can be produced.

UOP received \$1.1 million to develop an alcohol-to-jet process, using renewable isobutanol produced by Gevo from cellulosic feedstocks utilizing a ferment-

tation process. UOP played a leading role in developing the first biofuel approved for use in aircraft, a 50% blend of so-called HEFA jet fuel derived from vegetable oils and animal fats.

Honeywell Aerospace, meanwhile, received \$280,000 to conduct a 500-cycle, 2,000-hr. endurance test of a 50% HEFA blend in its Tech7000 demonstrator engine. The company already is working under the FAA's Continuous Lower Energy, Emissions and Noise (Cleen) research program to test a 100% HEFA biofuel with synthetic aromatics in the Tech7000, with flight tests on its Boeing 757 engine testbed planned for 2014.

Metron Aviation received \$250,000 to develop guidelines for quality control aimed mainly at new players entering the aviation fuel market. Completing the list, Futurepast received \$50,000 and Life Cycle Associates \$25,000 to conduct sustainability studies.

Babbitt says the research will help the FAA meet its Destination 2025 vision, which includes transitioning 1 billion gal. a year of jet fuel consumption by U.S. airlines to sustainable biofuels by 2018. ☐



ALASKA AIRLINES



# Troubled Times

## Taxes, government restrictions add to Indian carriers' difficulties

JAY MENON/NEW DELHI

**A**lthough spiraling jet fuel costs, plummeting profits and high debt levels are threatening the survival of its domestic carriers, India's burgeoning demand is expected to pull the beleaguered aviation sector through the current turbulence.

Among the country's six major airlines—Jet Airways, Kingfisher Airlines, SpiceJet, Indigo Airlines, GoAir and national carrier Air India—only discount carrier Indigo is making a profit. Kingfisher Airlines, which calls itself “King of Good Times,” lost its scepter and throne to high fuel costs and the price war among airlines. Its shortage of cash hinders its ability to buy fuel and pay salaries, airport charges and interest to its lenders.

In November, Kingfisher was forced to cut several unprofitable flights from its network in an attempt to reduce losses, given high fuel costs. The airline, owned by billionaire liquor baron Vijay Mallya, has been talking with lenders to raise capital and trim \$1.2 billion in debt. It posted a second-quarter net loss of 4.69 billion rupees (\$90 million), compared with a net loss of \$44.5 million a year earlier.

The airline's debt hit rock bottom in October and state-run oil refiner Hindustan Petroleum Corp. Ltd. temporarily suspended fuel deliveries to Kingfisher Airlines for the second time in four months. To add to its woes, the New Delhi and Hyderabad airports threatened to deny the airline credit and demand upfront cash payments for using their facilities.

The heavy losses also forced Kingfisher to shut its no-frills segment, Kingfisher Red, in September.

Similar problems have befallen other Indian carriers. Jet Airways, India's top airline by market share, posted a net loss of \$138 million for the quarter ended Sept. 30, compared with \$2.4 million a year ago. Budget airline SpiceJet also reported

a net loss of \$46 million. State-run Air India, which has a cumulative debt of \$7.7 billion from aircraft acquisitions and short-term loans to maintain its operations, has been asking for a total of \$3.2 billion.

The Center for Asia Pacific Aviation (CAPA) predicts a \$2.5-3 billion loss for Indian airlines in the fiscal year ending in March. According to CAPA estimates, the cumulative debt burden of the three big Indian carriers—Kingfisher, Air India and Jet Airways—was a whopping \$16 billion. “Indian banks have an exposure of \$6 billion related to working capital and term loans. They will have an additional exposure on the aircraft-related financing,” says Kapil Kaul, South Asia chief executive of CAPA.

There are several reasons why India's aviation industry, once the symbol of economic growth, is in turmoil. While India is among the countries with the fastest-growing passenger traffic, high fuel costs and the inability to raise fares have resulted in huge losses over the past three quarters. The steep increase in global oil prices hits Indian carriers particularly hard because they must pay government fuel taxes at rates up to 30%. Airlines complain that fuel prices are almost double global rates and account for 40-45% of operational expenses, compared to 18-20% abroad.

The increasing sales tax on air tickets also negatively affects the country's civil aviation industry. Despite campaigns stating that the tax flouts International Civil Aviation Organization (ICAO) policies, the Indian finance ministry extended the sales tax to all classes of domestic and international airline tickets. Previously, the tax was only levied on international premium-class tickets.

High salaries for pilots and crewmembers also drive up carriers' costs, even though there was no rapid hike in salaries after the recession in 2009.

While costs have increased, revenue has decreased for many of the Indian airlines. They boosted capacity by leasing more aircraft and opening new routes, which caused per-seat profits to nose-dive. The carriers also added expensive aircraft to their fleets too quickly without putting their balance sheets in order for tough times.

On top of this, the depreciation of the Indian rupee has resulted in bulging costs.

To stay afloat, Kingfisher Airlines and Jet Airways both

JOEPRESNATION.NET PHOTOS



### AIR INDIA

In the last week of November, the airline and 26 banks forged a plan to restructure Air India's \$3.2 billion debt.



### GOAIR

India's smallest budget airline plans to raise \$150 million through a public offering to fund operating expenses.



### INDIGO AIRLINES

The only Indian carrier making money plans to increase its fleet to 100 aircraft by next March from the current 43.



need infusions of capital, according to their respective auditors. B.K. Ramadhyani & Co., which audits Kingfisher, says the carrier's ability to meet its financial obligations is "dependent on the company's ability to infuse the requisite funds." Similarly, auditors Deloitte Haskins & Sells and Chaturvedi & Shah say raising funds is essential if Jet Airways' accounts are to be prepared on a "going-concern" basis in the future.

Jet Airways plans to give \$9.6 million of interest-free loans to its JetLite unit by the end of March as an immediate measure to enable the unprofitable subsidiary to continue operating.

Even Kingfisher tried to stem worries about its future by listing a few options that could help it through the turbulent times. Mallya says the airline's net worth has eroded, but it has not asked for a bailout from either the government or banks. Rather, it wants lenders to inject working capital of \$154 million as short-term relief. The airline restructured its debt earlier this year by converting one-third of its loans into shares and issuing them to lenders and founder companies.

Mallya says the airline has initiated a large-scale aircraft reconfiguration and transition to a full-service model, along with network rationalization, to reduce interest costs and streamline existing fleet orders.

Rationalizing their operations is something the airlines can control, but another major challenge—outdated infrastructure including shoddy runways and air traffic management systems that desperately need upgrading—is beyond their control.

India's government could provide relief for its domestic airlines if it reduced the high jet fuel tax and opened the aviation sector to investment by foreign airlines, which could not only bring in funds but also help improve management practices.

There is hope of government support for the struggling carriers. "The private-sector airlines have to be managed efficiently but if they do get into difficulties, we have to find ways to help them," Prime Minister Manmohan Singh says.

India's commerce and industry minister, Anand Sharma, says a civil aviation ministry proposal to assist the strapped airlines is "receiving government's active consideration." Some analysts think it is highly likely to approve it soon.

"The Indian government will have to eventually open up the sector, but to what extent is not yet clear," Dhiraj Mathur, aerospace executive director at PricewaterhouseCoopers, tells Aviation Week.

Currently, Indian law permits up to 49% foreign investment in airlines and more in airport infrastructure. However, foreign airlines are not allowed to invest in the sector, something Kingfisher's Mallya is calling for the government to change.

Not everyone agrees with Singh's support of the carriers, though. Among them is Ajay Lele, a former Indian air force wing commander who works with the New Delhi-based Institute for Defense Studies and Analyses. "The airlines are responsible for their own mismanagement and need to deal with it themselves," Lele tells Aviation Week.

He says Indigo is generating profit and growing rapidly because of efficient management and prudent fund-raising.

"The private industry cannot have an extravagant life and rely on the government to take care of their losses. It already has Air India to take care of," Lele says.

The government is considering a variety of plans to restructure Air India—a relic of state ownership that is threatened by losses, bloated costs and severe competition from the private domestic airlines. India's central bank is expected to submit a report this month recommending a fresh turnaround plan for the national carrier, which incurs monthly losses of more than \$115 million in addition to its deep debt from aircraft acquisitions and short-term loans to maintain operations.

In the past two years, the government has pumped \$482 million into Air India, and the ministerial panel is looking at injecting another \$1.2 billion over the next 10 years.

The silver lining if the dark cloud hanging over India's civil aviation sector is that government figures show an increase in domestic air passengers to 51.6 million in 2010 from 11.7 million in 2003. The Airport Authority of India (AAI) estimates that India will become the third-largest aviation market in the world after the U.S. and China, rising from its current ranking as ninth.

According to the AAI, India will have 150 airports and a fleet of 2,000 aircraft by 2030. The country's fleet now stands at 735 aircraft owned and leased by public and private aviation companies.

And, with the International Air Transport Association also forecasting that the Indian civil aviation market will record a compound annual growth rate of more than 16% in 2010-13, it is clear that the once booming industry is not crash-landing. ☉



## JET AIRWAYS

India's largest private airline is looking to raise \$300 million to repay \$285 million of debt.



## KINGFISHER AIRLINES

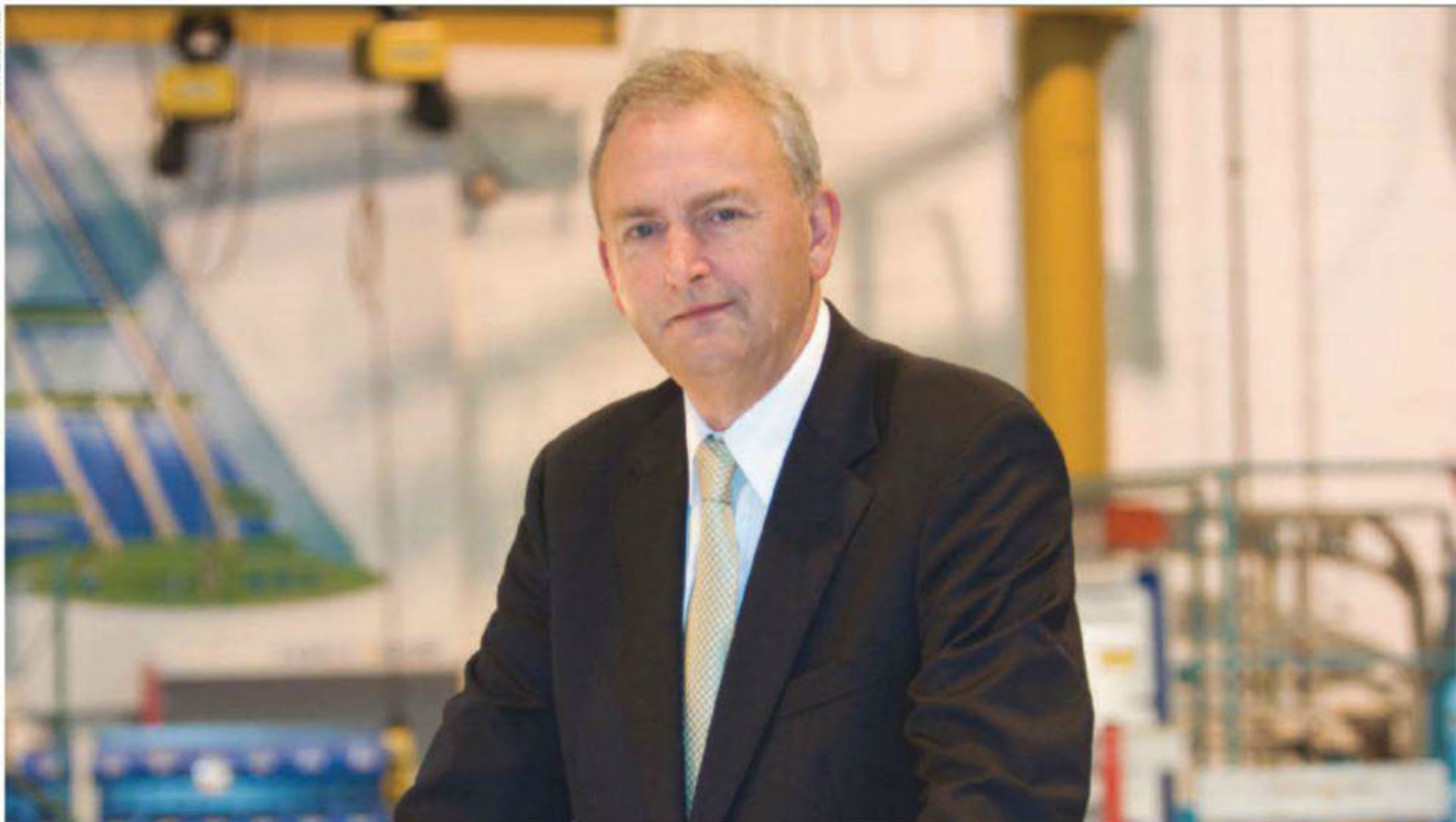
Owned by billionaire liquor tycoon Vijay Mallya, it is trying to raise capital to reduce its debt of \$1.2 billion.



## SPICEJET

This budget carrier is trying to manage a loss of \$46 million in the three months ended Sept. 30.





## Balancing Act

**T**he outlook for the commercial airliner supply chain should be rosy, but heightened demand and increased production rates have coincided with a near-global sustained economic turmoil—creating epic uncertainties for every link in the chain. GKN Aerospace and Land Systems CEO Marcus Bryson met in London with Aviation Week International Editor Robert Wall to discuss

this matter, including concerns about suppliers' access to capital and their ability to sustain quality as production rates spike. Also discussed was how defense spending cuts are affecting the business, and GKN's—a Tier 1 aerostructures and systems provider to the commercial and military aerospace industry—perceived absence from the mergers and acquisitions market.

### **AW&ST: Narrowbody output is growing rapidly. Will you be able to cope with the demand?**

Bryson: There are two different issues. Our exposure to the Boeing narrowbody is quite small because of history. We were not around for the sourcing decisions. But on the Airbus A320, with the advent of our purchase of Filton, our content is quite considerable. If I look at the build volumes they are projecting, we are probably OK in terms of the facilitization.

### **How about your supply base?**

I am concerned about two aspects of the subtler. One is the ability to keep up with the build rates. Their access to finance is an issue. It is not just the money for plants and equipment, but also the working capital to support the ramp-up. My other concern is about quality. There have been instances where quality drops

off. That is something we are paying particular attention to at GKN.

### **You said you can handle the current ramp-rate increase Airbus is talking about—with output on narrowbodies potentially reaching 44 aircraft a month—but on NEO, they are talking about building 50 aircraft a month. Is that a bridge too far for you?**

It is going to be quite interesting to see what they do. They have talked about 'Rate 50'; if they do that, great. The question we would have is how long that peak is going to last. I would not want to peak for just one year and then go down again.

### **You have had a lot of money tied up in the Boeing 787. It must be a relief that the manufacturer is finally delivering hardware.**

We are of course really pleased that Boeing has made their first deliveries

to ANA [All Nippon Airways]. For us, it is an important platform. We have—depending on engine variant—\$2 to 2.5 million in content per airframe. So we have been sitting here eager for Boeing to get their production ramp up started. We'll see the benefit of that come through on the top and bottom lines.

### **Are you fully ramped up again after purposely slowing production when the program ran into trouble?**

It is a little bit stop-start, stop-start. I think Boeing is trying to get their supply chain all in line. I am always interested in exit rates. When they exit 2011, what is the build rate going to be? And what is their exit rate in 2012? I think at the moment their exit rate is between four and five [aircraft per month] for 2012. So when I project to 2013, the exit rate will be seven or eight. We have invested quite a bit in plant and equipment to



## Marcus Bryson

Age: 57

**Career:** At GKN—On Oct. 1, 2011, Bryson became CEO of Aerospace and Land Systems. Appointed to the Executive Committee as chief executive-Aerospace in January 2006. Prior to that, he was chief executive of Propulsion Systems and Special Products in 2004 and chief executive of Aerospace Services—Europe in 2000.

Bryson became part of GKN with the acquisition of the Westland Group in 1994. He joined Westland in 1984 and held a number of finance and commercial roles within the business.

**Awards and Recognition:** Vice president of ADS—the U.K. aerospace, defense and security industry lobby group.

cope with the ramp up, which has sort of sat there suboptimal in terms of utilization. We are very keen for them to get going on that. Like everyone involved in the supply chain, we have invested heavily in the program.

**Boeing will amortize its massive development bill over 1,100 787s. What payback period are you looking at?**

Because of the way we account for this, we either make money when the product goes out the door at the time we deliver the part or we don't make money. So from our perspective, we are at the top end of the learning curve coming down. And we will probably reach a break-even or small profit point in 2012-13. As we proceed down the learning curve, we will start to get into cost-recovery territory.

**So what worries you about the commercial market situation right now.**

Mostly global macro-economics and financing. If the banks stop lending to airlines, that is the biggest risk.

**You have a key role on the A350. Airbus says the program has no margin left. How is the situation at GKN?**

These are incredibly technologically challenging programs done on tight timelines. Everybody gets hung up with

6-12-month delays. They are painful, but these are challenging for the primes and the Tier 1 suppliers. We are a bit behind where we would like to be and are working hard to reach a position where we want to be. One of the challenges on the A350 is the concurrency.

**The story in the defense market is almost the reverse. How badly are you affected?**

Ninety-five percent of our military revenue comes out of the U.S. and 80% of that is covered by multi-year contracts that run to 2015, 2016 and 2018. So when I look at our military portfolio, we are in as good a place as most. But I would not say we will be immune from cuts. [In Europe], we are heavily exposed to the A400M and that should really ramp up in 2013.

**You have a decent position on JSF [F-35 Joint Strike Fighter]. How comfortable are you with how things are going?**

JSF is very important to us. It is moving forward more slowly than we'd like, but it is starting to build up a bit. We would like to do more on JSF and are trying to win additional work on the engines and structure. Future production work is also up for grabs.

**About 18 months ago, you said you'd like to double the business by 2015. Is that still the plan?**

That was including acquisitions. From the organic perspective, we are pretty much on track. We have not done [a deal] for three years. I've not seen anything come across my desk that strategically looked attractive to us, [but] we have had discussions.

**When you look at United Technologies' planned purchase of Goodrich, do you feel you also need to bolster your position?**

I am sure the next two to three years will see a big shift in the supply chain. I don't feel pressure, but it does change some dynamics. The Goodrich acquisition repositions the nacelles business. Now you have Pratt & Whitney linked with Goodrich. And with GE and Snecma on Aircelle, that sector is segmented. Is there room for a third player?

**At one point you spoke of increasing your work on engines. Is that still a viable idea?**

We are still looking at that. It is one focus for us on the acquisition question. It is also one area that we are looking at to increase our JSF workshare.

**Do you see other growth opportunities?**

I'd like to get in more content on rotorcraft. Also, on business jets we are historically not that invested; they represent around 7% of revenue. But the high end of that market has proven to be pretty resilient and there are new programs coming through. We are doing some work for Dassault [on the yet to be formally launched SMS small, mid-size business jet] and we do some work for others.

**Where do you stand on the composites versus metals debate?**

Fifty percent of our business still includes metallics. And we are involved in some really interesting technology developments. There is still a view [at GKN] that composites are not the be-all-and-end-all. Airbus and Boeing are also nervous about whether you can industrialize for production of 50 composite narrowbodies per month. The metals story is not over.

**In composites, there is a growing field of competitors. How big a risk is that?**

We have tried to position ourselves at the top end of technology. Other than the prime contractors, there are maybe four or five companies that can do that. I don't see any of the low-cost players catching up quickly. But the danger, as I see it, is that with the A320NEO and the 737MAX, you are not looking at a new narrowbody until 2023 or 2025, and that allows some of the more recent entrants time to catch up. So we have to maintain our research and technology expenditure. Now is not the time to take our foot off the gas. Those that do will regret it.

**Is that a message you are also taking to the government and, more important, is anyone listening?**

We at ADS [the U.K. aerospace, defense and security industry lobby group] are putting a long-term strategy together. If you look at the Chinese, they have a 25-year plan, so it is essential we maintain our research and technology investment. The government is picking up the message loud and clear. They understand the value of aerospace to the U.K. economy, and we are the second-largest aerospace industry in the world. When decisions are taken on the next-generation single-aisle aircraft, it is essential that we in the U.K. have the right technology and the right economics in place. ☺



# Image Upgrade

Florida testbed facility provides uplift for NextGen

JEN DIMASCIO/DAYTONA BEACH, FLA.



**F**or a big-budget program that's behind schedule and over budget, two ingredients are helpful for keeping it on track—vision and image.

The FAA's Next-Generation Air Transportation System recently got a boost from both, with the opening of a new testbed managed by Embry-Riddle Aeronautical University at the Daytona Beach (Fla.) International Airport. VIPs at the recent rollout were swooning over everything from the room-sized video monitor showing each phase of a simulated flight departure to a room full of the coolest conference chairs on the planet.

The testbed—one of three for the NextGen program—links the FAA with experts from the top-rated aerospace engineering university and industry partners including Boeing, Lockheed Martin, General Electric, Jeppesen, Saab, Harris and others.

So far, the testbed has executed demonstrations to integrate weather effects with flight automation tools as part of two NextGen weather programs. A recent Boeing demo at the testbed looked at a product called NEO Spiral II, in which an unmanned aircraft exchanged information about the UAV's status us-

ing NextGen's System-Wide Information Management system.

"In the coming years, we expect to see even more exciting developments here in Daytona Beach as we implement planned activities which will provide live [national airspace] data to support demonstrations and will enable information-sharing with other testbed sites and remote NextGen partners," said FAA Administrator Randy Babbitt during a Nov. 7 field hearing at Embry-Riddle.

Embry-Riddle has a \$55 million contract with the FAA to manage the facility through the end of 2014, and university officials believe that contract will be extended. Now that the facility exists, other government agencies—including NASA or the Defense Department—could also use it.

The kind of technical development and demonstrations done at the facility is one plus for the program. The testbed also provides a way to increase its visibility and credibility.

Both are critical, according to Gerald Dillingham, director of physical infrastructure issues at the Government Accountability Office. Dillingham says many technology transfer efforts depend on how well the private sector

buys into the idea. "FAA has had difficulty advancing technologies that cut across programs and offices at FAA, when there is no clear 'home' or 'champion' within the FAA technology."

The testbed, Dillingham says, "is a positive step that should help address some of these issues."

Babbitt readily acknowledges that one of the chief problems with the program is maintaining the support of the players involved. Asked how confident he was about a NextGen rollout in 2018, Babbitt said the ground infrastructure would be in place years before that, but that the business case would depend on the returns that participants see. Early on, there was a high level of involvement, but some users dropped out. "We want to get to the bottom of it," Babbitt said. "The more people that use it, the more savings will be there."

Stakeholder peel-off has spelled doom for other colossal government programs, and the FAA and its partners want to make sure that doesn't happen. That's especially important because NextGen is poised to create enormous savings for the industry in terms of dollars and carbon emissions, Babbitt and others say.

Rep. John Mica (R-Fla.), the chairman of the House Transportation and Infrastructure Committee whose congressional district includes some of Daytona Beach, notes that by 2018 NextGen could reduce delays by about 35% and have a dramatic impact on fuel costs.

To gain buy-in from private companies and the government to get NextGen off the drawing board, stakeholders in funding and in modernizing the national airspace need to see that these concepts really work, officials say.

It's hard to get someone to spend \$1 billion when people say, 'Has anyone ever tested that,' and 'Show me,'" says Christina Frederick-Recascino, vice president for academics and research at Embry-Riddle. "What we do here is a lot of initial testing of concepts and prototyping for the near- and mid-term. Once we do something here, we'll show it to our partners at the test center," she says. "They refine the concept, and then they bring that up to their bosses at the FAA who are on the procedural side who say, 'Yeah, this is something we could really test.'"

And so the testbed becomes a system to push new systems forward into what the national airspace actually uses.

"We can show the technical center and folks at the FAA what works and what doesn't," she says. ☺



# Looking for Lift

## Southeast Asia's newest country explores airlift and airport expansion options

LEITHEN FRANCIS/SINGAPORE

**T**he tiny resource-rich Southeast Asian nation of Timor-Leste wants to buy military transport and maritime surveillance aircraft, and the country is aiming separately to build a new international airport for the capital, Dili.

Timor-Leste gained full independence from Indonesia in 2002 and its government has been relying for airlift on a United Nations peacekeeping mission stationed in the country.

"We have use of helicopters from the U.N. and they have always been very generous; whenever we need use of a helicopter, it's there," Timor-Leste's president, Jose Ramos-Horta, tells Aviation Week. He notes, though, that "at the end of 2012 they will leave, so we will be left" with no helicopters. Timor-Leste has largely been making use of Australian Army Sikorsky S-70A-9 Black Hawks, as the Australians are part of the U.N. mission.

"We are looking at purchasing helicopters and having a fleet of helicopters," says Ramos-Horta. These are needed for several missions, with medical evacuation the most pressing—the country's road network is so underdeveloped, he says, that when there is a serious accident, injured persons need to be airlifted to a hospital. But outside organizations may be better at maintaining the helicopters on Timor-Leste's behalf.

"In my humble opinion, if we don't even have the capability to maintain a fleet of bicycles, how are we going to maintain a fleet of helicopters?" asks Ramos-Horta. "To address that issue, I would suggest that rather than purchase the helicopters, we lease them. We could pay for the helicopters on a flight-hour" or monthly basis, he says. As president, Ramos-Horta has no power to form legislation—that role sits with the government, headed by the prime minister—but he can veto some types of legislation, and he is a democratically elected official with influence.

Timor-Leste also has a requirement for maritime patrol aircraft to monitor its exclusive economic zone out at sea, Ramos-Horta says. Indonesia's defense minister, Purnomo Yusgiantoro, told Aviation Week in early June, prior to a visit to Dili in August, that Indonesia hopes to sell Indonesian Aerospace CN235 maritime patrol aircraft to its former province.

AUSTRALIAN DEFENSE DEPARTMENT



Timor-Leste is relying for airlift on Australian Army S-70A-9 Black Hawk helicopters such as these flying past the monument to the Virgin Mary on Mount Ramelau.

But rather than buying the CN235, it seems Timor-Leste is leaning toward the smaller and cheaper Indonesian Aerospace C212 maritime patrol aircraft. The aircraft-maker's aero-structure director, Andi Alisjahbana, told the *Jakarta Post* in early October that Timor-Leste is going to order the C212-400 in the near future. The country has the money and need for such aircraft because much of the Timor Sea is its territory, under which lie huge oil and gas deposits.

While Ramos-Horta recognizes the

importance of maritime patrol aircraft, he says the government has higher priorities. He also questions whether Timor-Leste could operate the aircraft effectively, given its vast sea territory.

"I see how the Australians do it," he says. Despite all the Australians' equipment and aircraft, he notes that they continue to have problems intercepting illegal fishermen and smugglers entering their waters. "You can spend the money, but how much capability do you really get? I have my doubts. The Australians have an impressive navy, but the illegal fishermen laugh at them."

This concern aside, Ramos-Horta says Timor-Leste will continue to invest in developing its maritime enforcement capability. It recently received two new

Shanghai-class patrol vessels that it bought from China for \$28 million, including training, he says. South Korea donated three second-hand, but refitted, patrol boats to Timor-Leste this year, and the country also has two older patrol vessels that Portugal gave it, adds Ramos-Horta. "These patrol boats are still not enough," he says, as Timor-Leste requires larger vessels that can cope with the 4-meter-high (13-ft.) waves prevalent on the island's south coast.

Timor-Leste only has two airports with paved runways: Dili Airport, the main international gateway close to the capital; and Baucau Airport, 122 km (76 mi.) east of the capital, built in the 1960s when Timor-Leste was still a Portuguese colony. Baucau is hardly used, but it has a runway built to handle large military transports that is much longer, and some say better maintained, than Dili's.

Ramos-Horta says the government is likely to opt to upgrade Dili's existing airport rather than build one on a greenfield site. The work would involve building a new passenger terminal and widening and lengthening the runway, he notes. "Realistically, construction of the airport is not likely to occur before 2013," says Ramos-Horta.

Dili Airport can handle aircraft no larger than an Airbus A320. The only scheduled international passenger services to Timor-Leste are Dili to Denpasar, Indonesia; Darwin, Australia; and Singapore. ☐



# New Horizons

## Search for new light military transporter could herald paradigm shift for India

ASIA-PACIFIC STAFF/NEW DELHI

**P**rivate industry in India is being handed an opportunity to do something it has only dreamed of—building large-scale military hardware for a market dominated by a handful of state-owned corporations. The most significant effort yet to establish a private foothold will come as the Indian air force (IAF) calls on the private sector to build a replacement for its vintage Avro HS-748 military transports.

The move marks the first time in India's contracting history that a contract for a new aircraft has not, by default, been awarded to Hindustan Aeronautics Ltd. (HAL).

The IAF says it wants to replace 56 Avros, although official sources indicate that the air force likely will order at least 70 aircraft. The service began inducting the British HS-748 in 1964, making some of the aircraft in service almost a half-century old. The 56 aircraft currently in service perform light-freight hauling and troop transport duties. Their former tactical role has been largely taken over by the IAF's Antonov An-32s, themselves old and in the middle of an upgrade program in the Ukraine.

Early indications suggest that the Tata Group, one of India's largest private companies, could lead the effort in partnership with a consortium of several specialized contractors, including Ma-

hindra. Both have had decades of experience supplying equipment to the Indian military, but neither has come anywhere close to a deal as big or as ambitious as a new aircraft-building effort. The companies have chosen not to comment on the program at this time.

The Indian defense ministry is working on the program's plan, and specifically, how private industry will build the replacement transporter. What seems certain is that the aircraft will be put together using large bits of technology from abroad—perhaps even a largely license-built version of a foreign aircraft. The key difference in this case is that the principal integrator will be a consortium from Indian private industry.

Foreign suppliers understood to be in talks with Indian companies to formulate a proposal for the new aircraft include Russia's Rosoboronexport (Antonov), EADS, Finmeccanica's Alenia and Embraer. A defense acquisitions official said the consortium would also explore opportunities with U.S. companies such as Lockheed Martin.

According to an IAF officer familiar with the proposal, "The private sector has proven that it has the skill and capacity to undertake a major aircraft-building program. The IAF believes this is an avenue that needs to be explored now. Talks with industry have proved extremely fruitful. The compa-

nies we have been in touch with have asked us to rest assured that they can and will build us a replacement for the venerable Avro."

While the IAF chief, Air Chief Marshal Norman Browne, appeared to suggest recently that looking to the private sector was an initiative toward self-reliance, the reality is more nuanced. The fact is that HAL, so far the only true military aircraft builder in India, is saddled with orders and development programs of its own. The company simply does not have the factory space and manpower to develop and build another new aircraft for at least the next 10 years.

In addition to the 126—or more—Medium Multi-Role Combat Aircraft's license-built jet, the twin-seat variant of the Indo-Russian fifth-generation fighter, the Light Combat Aircraft full-rate production line and a slew of new helicopters, HAL is developing a 20-ton transport jet with Russia. Moreover, the IAF has frowned on delays in deliveries by HAL and the company's inability to compress delivery schedules beyond a certain point. Industry-watchers suggest that it is this unprecedented—and somewhat unusual—situation that has forced the IAF to look outside state-directed industry and to seek out the barely touched private sector.

"The air force has always wanted a counter, an alternative to HAL, but the private sector always had its own dilemmas and problems," says a former HAL chairman, who now consults for foreign companies. "The game has changed now. The IAF has recognized that there is sufficient capacity outside HAL to take on even full-scale work. It is a positive step. HAL is not used to competition. Such a move will force it to become leaner and more competitive." ☛

The need to replace HS-748 transports, like this one, could finally drive India's air force directly to private-sector suppliers.





# Sub Sensor

MICHAEL FABEY/PATUXENT RIVER, MD.

The upgraded Seahawk's formidable data-gathering capabilities make it effective against submarines but can overwhelm its crew, too.

a forward-looking infrared sensor with laser designator, and an advanced mission data-processing system. It also employs torpedoes, Hellfire air-to-surface missiles and crew-served mounted machine guns.

Besides ASW, the Pentagon's director of operational test and evaluation (DOT&E) reports that the MH-60Rs also are used for surface and undersea warfare, area surveillance, combat iden-

tification and naval surface fire-support missions previously provided by two helicopters—the SH-60B and SH-60F.

Recent improvements to the helicopter, however, lead to other concerns. For instance, the addition of Link 16 data-link functionality allows the MH-60R to share sensor data directly with other battle group participants and provides increased situational awareness for all units in the network, the DOT&E says. Yet during some surface warfare missions, testers say, "the enormous amount of track information and sensor data presented to the three-man crew oversaturated the sensory and cognitive skills of the operators, decreasing their ability to discern critical information from within all the information presented."

In turn, "this required the use of numerous workarounds that ultimately led to frequent loss of situational awareness as crews were forced to filter out critical sensor data to maintain a sustainable task load," the DOT&E says.

Program contractor Lockheed Martin says improvements were made to address the large volume of data Link 16 introduces. More Navy and DOT&E examination is expected. ☐

**A**n old maxim says the best way to fight a submarine is with another submarine, but the MH-60R Seahawk helicopter has U.S. Navy officials rethinking antisubmarine warfare (ASW) strategies.

The development comes as officials scrutinize budgets and look to maintain core military capabilities such as ASW, while considering major acquisition changes such as revising ship-building plans. Still, kinks remain in the Seahawk's utilization, as recent testing results indicate.

What makes the upgraded Seahawk effective against submarines, according to Robert Kimble, the Navy H-60 deputy program manager, is its enhanced sonar—the AN/AQS-22 airborne low-frequency sonar, which serves as its primary undersea warfare sensor. "The MH-60R shifts the advantage from the submarine to the helicopter," he says.

With the sonar, the Seahawk has demonstrated a three-to-sevenfold increase in the detection range compared to other current Navy dipping sonar systems, Kimble notes. And with other enhanced sensors, the helicopter is proving to be a valuable asset for gathering intelligence, surveillance and reconnaissance, as well as extending the range of cruisers, destroyers, frigates, Littoral Combat Ships and aircraft carriers from which it is designed to operate.

In fact, Kimble says, more of the helos likely will be based on carriers and then assigned to smaller ships. The majority of Seahawks are now assigned to destroyers, cruisers and other smaller vessels.

The aircraft incorporates dipping sonar and sonobuoy acoustic sensors, multimode radar, electronic warfare sensors,

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# DECK WORK

Cats and traps lie ahead for unmanned X-47B as work-up to 2013 carrier demonstration begins

GRAHAM WARWICK/WASHINGTON

**S**pring 2012 at NAS Patuxent River, Md., and an unusual shape joins the F-35 Joint Strike Fighters flying the pattern at the U.S. Navy's test center. The tailless flying wing is Northrop Grumman's X-47B unmanned combat air system demonstrator (UCAS-D), being prepared for autonomous landings on an aircraft carrier in 2013.

The Navy may be late to the unmanned-aircraft game, but it is pushing the technology in terms of both capability and autonomy. In addition to UCAS-D, the service is launching the Autonomous Aerial Cargo/Utility System (Aacus) program to prototype advanced capabilities for vertical-takeoff-and-landing (VTOL) unmanned aircraft systems (UAS).

Just as Aacus is expected to feed technology into the Navy's program to deploy the shipborne VTOL Medium-Range Multi-Role UAS by 2019, UCAS will inform its plans to field the Unmanned Carrier-Launched Airborne Surveillance and Strike System (Uclass) by 2018, and develop a sixth-generation F/A-XX to replace the Boeing F/A-18E/F after 2030.

Operational studies under the UCAS program have shown

that a long-endurance, aerial-refueled unmanned combat aircraft could significantly extend the surveillance and strike reach of a carrier battle group. But first the Navy must get comfortable with bringing an unmanned aircraft on to the flightdeck.

Though UCAS-D is a demonstration, and not a prototype for Uclass, the system architecture and operating concepts developed to enable the 44,000-lb. X-47B to land safely on a carrier—and particularly changes to the ship's command-and-control system—could carry over.

The first of two X-47Bs completed Block 1 envelope-expansion flight tests at Edwards AFB, Calif., on Nov. 17, and air vehicle 1 (AV-1) is to be shipped to Pax River by year-end to begin Block 2 carrier-suitability testing, including land-based catapult launches and arrested landings. The second X-47B, AV-2, made its first flight at Edwards on Nov. 22.

In 16 sorties since its initial flight on Feb. 4, AV-1 has expanded the envelope to 220 kt. airspeed and 15,000 ft. altitude—a task that was originally expected to take a year and require 49 flights. “AV-2 will continue to expand the envelope, and when it ships [to Pax River] all the necessary corners to go to the

Both X-47B unmanned combat air system demonstrators, Air Vehicles 1 and 2, pose on the runway as AV-2 takes over the flight-test task at Edwards AFB, Calif., from AV-1.





carrier will have been cleared,” says Carl Johnson, Northrop Grumman vice president and UCAS-D program manager.

While gathering flying-qualities data, AV-1 has flown simulated carrier approaches at altitude. “All X-47B flight-test data look very good and will support our carrier demonstration objectives,” says Capt. Jaime Engdahl, Navy UCAS program manager. “We found no technical issues during any of the flights and it took considerably less flight time than predicted to execute all of our planned test points.” As a result, AV-2 could be moved to NAS Pax early, in spring 2012.

The speed of envelope expansion is due in part to the accuracy and predictability with which the 62.1-ft.-wingspan X-47B executes the preprogrammed test points. But it is also due to Northrop’s familiarity with its signature cranked-kite planform, and to extensive modeling and simulation. Engdahl says the aircraft simulation model accounts for about a third of the 3.4 million lines of software code for the UCAS-D program.

“The modeling and simulation is correlating so well with flight-test data that we can use it to add confidence and reduce on-aircraft testing. It significantly reduced the number of flights required to expand the envelope,” says Johnson. “The future for UAS with robust modeling and simulation is we will not have to fly the platform as much as manned systems, which are less predictable.”

“The aircraft is flying exactly the way the model said,” says Engdahl, adding no flight-control changes have been required. “Control-law development has been very robust,” agrees Johnson. “We’ve had no issues, but then our developers have quite a bit of experience with this planform design.”

Confidence in the aircraft’s behavior will be crucial at Pax, where the Lockheed Martin F-35B and C are being flight-tested and where disruption to normal operations when the X-47B is flying must be minimized. “When we begin flying there, operating an unmanned aircraft from an active naval air station, it will be a significant step forward,” says Johnson.

The Navy has experience operating the unmanned Global Hawk Maritime Demonstrator from Pax. “They started conservatively, keeping all other traffic away. As they became



**AV-1 completed flight-envelope expansion testing at Edwards AFB in 16 flights compared with the expected 49, largely due to advances in modeling and simulation.**

comfortable with the system, they gradually integrated it into the airspace,” he says, predicting “It won’t be too long before it will be hard to tell the X-47B from other flights.”

While the X-47B is conducting cats and traps at Pax, additional tests of two manned surrogates—a King Air and F/A-18D equipped with UCAS-D avionics—will certify the software and systems for the 2013 demonstration. “We will install the system on the ship and take the King Air and F/A-18





## UNMANNED AIRCRAFT



An unheated Pratt & Whitney F100 engine powers the 44,000-lb, 62.1-ft.-wingspan X-47B.

Surrogate trials also validated the distributed control concept, in which a UCAS mission operator on the ship always has positive control of the aircraft, but the carrier air traffic control (ATC) center, primary flight control (Pri-Fly) or "air boss" in the tower, and landing signals officer (LSO) on the flightdeck can send commands to the unmanned vehicle as they would to a manned aircraft.

"Over the last 10 years the Navy has been digitizing its carriers. ISIS—the integrated ship information system—has automated and digitized the information flow around the ship, so ATC and Pri-Fly can share a picture of who's flying, how much gas they have, etc.," says Engdahl. For UCAS-D, a ship interface processor is installed to act as gateway between the X-47B mission control element and the carrier network. This allows ATC to pull in data such as fuel state and send commands to the vehicle, while the UCAS mission operator has access to all ATC and deck information.

When the aircraft is inside the 50-nm-radius carrier control area, but outside 10 nm from the ship, ATC sends digital commands to the mission operator. The aircraft checks in with its position, airspeed and altitude, and ATC sends a message back with marshal position and push time. Inside visual range, control passes to the Pri-Fly, and the mission operator monitors as the tower sends messages to the aircraft and it automatically responds. On final approach, control passes to the LSO, who can hit the pickle switch and wave off the aircraft at any time without having to go through the tower, ATC or mission operator.

Key to the control philosophy is a level of air-vehicle autonomy beyond that in today's unmanned aircraft. "UCAS-D represents a new generation of UAS due to the level of autonomy developed to do a carrier landing or automated aerial refueling," says Johnson. "Other systems are remotely piloted, and only do what they are told from the ground. All the decisions are on the ground, and the system architecture makes it hard to move to a higher level of autonomy.

"With UCAS-D we start with a fundamentally different architecture that puts capability on the aircraft. We won't release it all for flight test, but the architecture is designed for higher levels of autonomy we can use as we expand capability," he says.

"The vehicle knows it needs to refuel and in a machine-to-machine process talks to the tanker and gets permission to move to the tanking position. It develops a relative-navigation coordinate system so it knows where the tanker is and uses that frame of reference to move itself to where it needs to be."

**AV-1 (foreground) will be heading eastward to NAS Patuxent River, Md., for carrier suitability testing. Completion of expansion could allow AV-2 to follow earlier than anticipated.**

out to certify the carrier, so when we plug in the X-47B it will be relatively seamless," says Engdahl.

The F/A-18D surrogate conducted the first autonomous arrested landings on a carrier in July. During the at-sea tests, the aircraft made 36 approaches to the USS Eisenhower, 16 touch-and-go landings and six coupled approaches to arrested landings. All were conducted "hands off," and in the same way the X-47B will land, but with a pilot onboard for safety and redundancy.

"We've exercised all the functionality with the surrogates," says Engdahl. The Eisenhower tests included straight-in, or Case 1, instrument approaches where the unmanned system took over control 8 nm behind the ship; and visual, or Case 3, approaches where the system took over as the F/A-18 passed the carrier on the downwind leg and then turned the aircraft on to its final approach.

The autonomous landings demonstrated the precision-GPS ship-relative navigation technology at the heart of UCAS-D. The carrier sends its GPS position to the aircraft via a low-latency, high-integrity Tactical Targeting Network Technology data link. The aircraft, which has triple-redundant GPS/inertial navigation systems, calculates its position relative to the moving ship and guides itself to a touchdown on the flightdeck.

"Surrogate testing with the F/A-18 using prototype software validated the algorithms. Now we are turning it into production software to do all the rigorous qualification and certification testing required by Navair [Naval Air Systems Command], to ensure we have thought of every contingency," says Johnson. "Over the next year we will go through the work-up to validate the software in the lab, on the vehicle and in flight."

NORTHROP GRUMMAN PHOTOS







**AV-1 conducted simulated carrier approaches and landings at altitude over Edwards AFB, including lowering its tailhook.**

# Plug to Play

## Automated aerial refueling is next on X-47B test agenda

**GRAHAM WARWICK/WASHINGTON**

If aircraft carriers enable the U.S. to project force, keeping those forces over the battle falls to its aerial-refueling tanker fleet. Automated tanking will be critical to the persistent surveillance and deep-strike capabilities envisioned for unmanned combat aircraft.

So it makes sense that, once it has shown it can operate from a carrier, the Northrop Grumman X-47B unmanned combat air system (UCAS) demonstrator should be tasked with proving autonomous aircraft can refuel in flight from the same tankers, and using the same methods, as manned aircraft.

To that end, the program plans in 2014 to demonstrate that the X-47B can refuel autonomously in flight via U.S. Navy probe-and-drogue and Air Force boom-and-receptacle systems, transferring 3,000 lb. of fuel to the UCAS by each method.

The flight demo will build on work under way, led by the Air Force Research Laboratory (AFRL), to develop technologies and operating concepts (conops) for automated aerial refueling (AAR). Key to the effort is proving that precision-GPS relative navigation (relnav) can enable unmanned aircraft to rendezvous with and connect to essentially unmodified aerial tankers.

Increasing levels of autonomy will be demonstrated as the X-47B moves from land-based testing to the carrier and eventually automated aerial refueling. "In land-based testing, it flies a validated mission plan in a fixed frame of reference. When we move to the ship it introduces additional variables the system must react to," he says. "Ultimately we will look at inflight re-planning permission. We will tell the vehicle where the tanker should be and it will adapt its mission to find the true position."

As with envelope expansion, clearing the X-47B to land on a carrier is expected to benefit from the vehicle's predictability. "A pilot can get off-nominal but, because of the digital interface with the ship and real-time updates to the vehicle, an unmanned aircraft is not going to get very far off track," says Johnson. But as it will be the first tailless aircraft to land on a carrier, tests are focused on ensuring the X-47B has good flying qualities, says Engdahl.

At-sea testing will evaluate handling qualities in crosswinds and headwinds, control power as the vehicle passes through the airflow "burble" behind the carrier, touchdown dispersion on the deck and lateral dispersion on "bolter" touch-and-goes. More than one carrier is to be outfitted to work with the X-47B for the 2013 demo. "We will work with the carrier schedule to get as much test time as we can. That's when it will get interesting," Engdahl says. ☼

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AV-2, seen on its Nov. 17 first flight at Edwards AFB, will be equipped for the 2014 automated aerial refueling demonstration, set to follow the carrier demo in 2013.



In the common architecture being developed by the Air Force and Navy, the unmanned receiver and manned tanker exchange position information from onboard global-positioning/inertial-navigation systems (GPS/INS) via a high-integrity data link. The receiver calculates its location relative to the tanker and flies itself into formation, from where it is directed, by its ground control station (GCS) or the tanker itself, to move through the standard refueling positions used by manned aircraft.

Developing a draft conops enabling tankers to refuel both manned and unmanned aircraft is a key goal, says AFRL's Daniel Schreiter, AAR program manager. Producing an architecture to which the government has data rights, so it can maintain a common refueling system across industry primes to ensure integration of the tanker fleet with future unmanned aircraft is another key goal, he says.

The demonstration system developed by AFRL is based on the Northrop Grumman LN-251 GPS/INS and Rockwell Collins TTNT (tactical targeting network technology) data link. "Our goal is to get an AAR variant of the LN-251 [to] a production-standard unit that can be bought off the shelf," Schreiter says.

Phase 1 of the AAR program included four rounds of flight testing: first to test GPS operation in formation flight; then to test performance of the TTNT data link, followed by closed-loop automated station-keeping: first following the tanker, then allowing the GCS to direct the aircraft between refueling positions.

These flights used a manned surrogate for the unmanned aircraft, a Learjet operated by Calspan and equipped with a single-channel version of the precision-GPS retnav system. The first of two rounds of flights under Phase 2 have been completed, again using the Learjet but this time with a "production-like" multi-channel retnav system.

Phase 2 flights are addressing the safety and reliability of the system. "We fly with two LN-251s on the tanker and three on the receiver," says Schreiter. "We are not yet doing voting, just data

collection. We are looking at voting schemes on the ground, and at the impact of candidate architectures on reliability."

Naval Air Systems Command and AFRL "have been working together since early 2000, and in December/January the Navy will take the reins," says Capt. Jaime Engdahl, Navy UCAS program manager. Work-ups for the AAR flight demo will begin in the fall of 2012, initially using that same Boeing F/A-18D equipped with X-47B avionics that is being used as a surrogate in the work-up to the carrier demonstration.

"We will go back through the whole work-up for the [AAR] software, beginning with surrogate testing," says Carl Johnson, Northrop Grumman vice president and UCAS program manager. The flight demonstration will use the second X-47B, air vehicle 2, which will be equipped for both probe-and-drogue refueling from a 707 tanker and boom refueling from a KC-135. "One aircraft is fully provisioned, but the full-up system is not in place yet," he says.

"We will take the exact boxes and data link out of the carrier and put them into a rack on the tanker, port the software from the carrier air traffic control center into the tanker operator's station, and do retnav to the tanker with the same hardware," Engdahl says. The Navy will use the same dual-redundant TTNT data link as AFRL, but Honeywell's H-764G embedded GPS/INS instead of the LN-251.

While the two services are developing a common approach to automated refueling, the Navy version requires an additional step. In the Air Force system, the unmanned aircraft navigates itself to the center of the boom envelope, where the refueling operator on the tanker takes over and steers the boom into contact with the receiver.

In the Navy probe-and-drogue system version, the unmanned aircraft will navigate itself to where the drogue is expected to be, where an onboard sensor will guide the probe into contact with the refueling basket. ☐



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(610) 373-2099; [casey\\_carlson@aviationweek.com](mailto:casey_carlson@aviationweek.com)

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# Penny Wise, Pound Foolish



*Streit is Distinguished Professor of Engineering and Applied Science at the University of California, Los Angeles.*

**T**he U.S. avoided one catastrophe this summer when Congress raised the debt ceiling and averted default. But another calamity is waiting in the wings. If Congress does not intercede following the failure of its “Super Committee,” nearly \$1 trillion in cuts will fall on the military—most of them mindless across-the-board automatic reductions that Defense Secretary Leon Panetta says will “devastate” national security.

Reining in the budget while preserving battlefield supremacy will not be an easy circle to square. But it is something America has done before. After the Vietnam War, Washington was similarly looking to cut spending during a weak economy. But even as they cut spending overall, Pentagon planners were careful to preserve the research and innovation funding that has been the foundation of U.S. national security strength for decades.

“Research into unmanned aircraft continued in the 1990s despite the procurement holiday. Because of that, Predator was ready after 9/11.”

That is why, even as the budget shrank, the nation remained a step ahead of its enemies. It was during these years, for example, that stealth technology was invented. And when Iraq invaded Kuwait, the F-117A stealth attack aircraft was ready to slip past enemy radar and devastate Saddam Hussein’s military within weeks.

The pattern was repeated after the Cold War. Research into unmanned aircraft continued despite the 1990s procurement holiday. Because of that sustained effort, the Predator was ready after 9/11. A decade later, unmanned systems have redefined modern combat and enabled the U.S. to take on enemies wherever they operate, as terrorist leaders from Pakistan to the Horn of Africa have learned.

But the terms of the debt-ceiling agreement make it very difficult to repeat this wise approach. The law requires deep cuts beginning in the next fiscal year, while the savings from activities such as winding down combat deployments and rooting out waste take time to realize. That means R&D and investment funding will be squarely in the crosshairs.

Research and procurement funding is already low—just a quarter of defense spending, which itself is only 16% of the federal budget, compared to 40% in the 1970s and well below the post-World War II average of 21%. At just over 1% of GDP, this is an area that cannot absorb more cuts without putting our long-term battlefield edge at risk. We have just seen the benefit of having the world’s most advanced military as U.S. airpower led the campaign that drove Moammar Gadhafi from power in Libya without a single U.S. casualty—and at a cost of just \$1 billion.

Other countries understand the value of aggressive research and innovation. China graduates 10 times the number of engineers that America does and, due to restrictive U.S. immigration policies, is keeping more and more of this talent at home; applications to U.S. engineering schools from China have plummeted almost 50% in recent years. It is no surprise that China just rolled out 25 new drone systems, launched the core of its first space station and plans to sail its first home-built aircraft carrier by 2015.

In the last two years, more than half of all U.S. patents have been awarded to foreign companies. This spring, U.S. bidders lost to Europe in a competition to supply new fighters to India. That means jobs and manufacturing work exported to Europe and a weakening of what is left of the U.S. defense-industrial base. That will only accelerate the brain-drain problem as design work follows commercial manufacturing overseas. Exports add billions to our national bottom line each year, but American companies cannot win foreign sales if they do not have the best products and the most advanced technology.

The state of aerospace and defense is already fragile. We are losing too many experienced engineers as the Apollo generation retires, and our schools are not producing enough qualified engineers to replenish the ranks. Attracting talented young people to science and engineering careers grows more difficult as marquee programs like the space shuttle are mothballed and inspiring new ventures like the James Webb Space Telescope face a constant threat of cancellation.

Now, the Defense Department is warning that the automatic spending cuts will add another full percentage point to the unemployment rate, costing more than a million jobs. That will only accelerate the erosion of the aerospace industry, a national crown jewel that drives both our military and economic strength. Cuts to R&D that erode our long-term military strength and put hundreds of thousands of Americans out of work simply do not add up. Congress needs to find a better way. ☐





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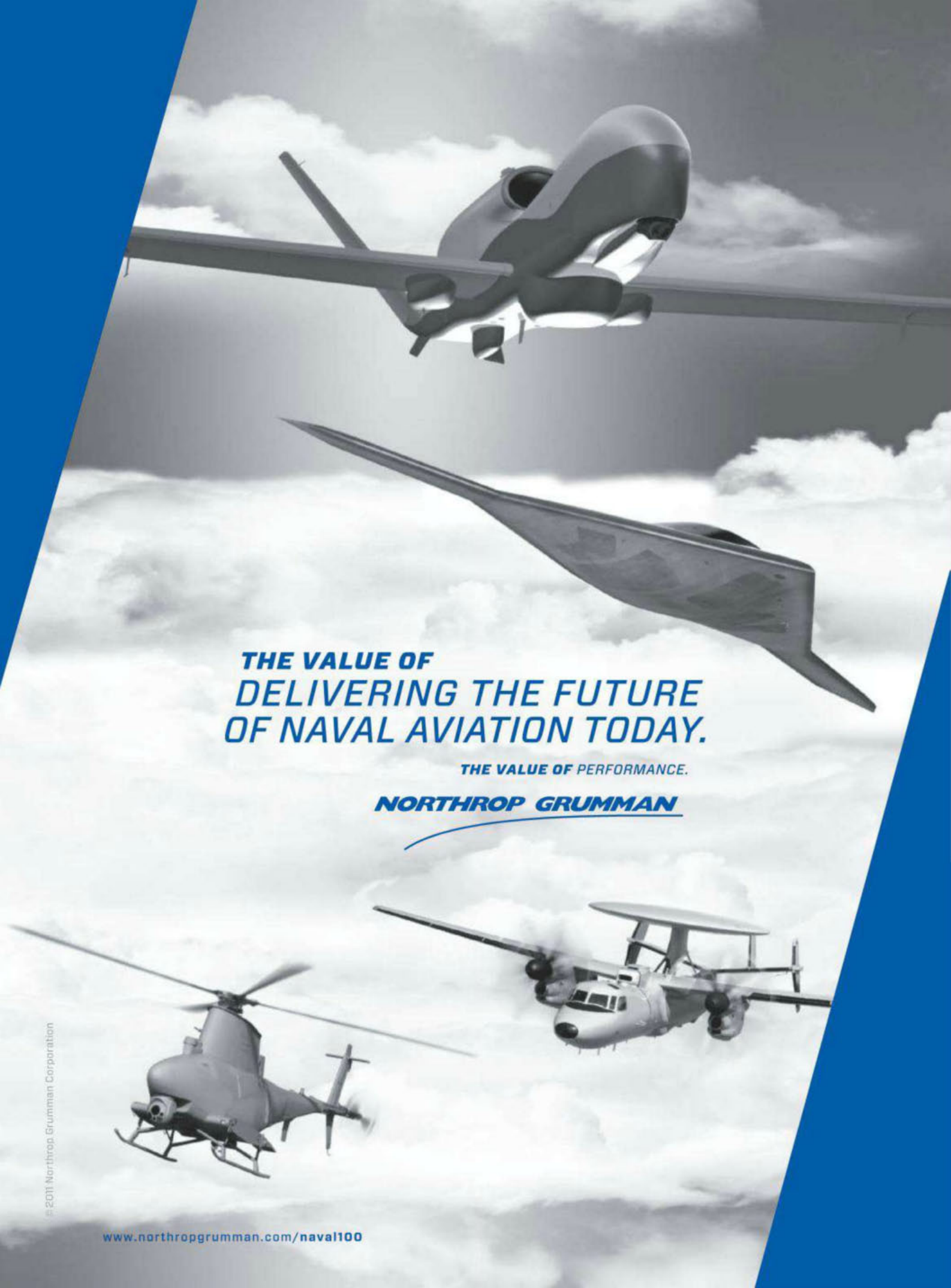


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