

SPECIAL REPORT MRO

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AVIATION WEEK

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 Michael Bruno, Lee Ann Tegtmeier
Assistant Managing Editor Michael Stearns
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International Editor Robert Wall
Senior Editors Amy Butler, Jens Flottau, David A. Fulghum,
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DEFENSE, SPACE AND SECURITY

Editors Michael Bruno (Managing Editor), Jefferson Morris (Associate
 Managing Editor), Amy Butler, Michael Fabey, David A. Fulghum,
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CIVIL AVIATION/MAINTENANCE, REPAIR AND OVERHAUL

Editors Lee Ann Tegtmeier (Managing Editor), Frank
 Jackman (Associate Managing Editor), Andrew Compant,
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 Darren Shannon, Madhu Unnikrishnan

Chief Aircraft Evaluation Editor Fred George

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

EDITORIAL OFFICES

2 Penn Plaza, 25th Floor, New York, NY 10121
 Phone: +1 (212) 904-2000, Fax: +1 (212) 904-6068
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-I (ext.)
 New Delhi 110091, India
 Phone: +91 (98) 1154-7145
Contributing Editor Jay Menon

PARIS

40 rue Courcelles, 75008 Paris, France
 +33 (06) 72-27-05-49
Bureau Chief Amy Svitak
Contributing Editor Pierre Sparaco
pierre.sparaco@orange.fr

SAN FRANCISCO

310 Brandon 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



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Pratt & Whitney has garnered more than 2,500 orders and options for its geared turbofan series, which was launched with the PW1200G for the Mitsubishi Regional Jet. Flight testing is planned for next month.

- 26 **Boeing advancing** its 777 and 787 programs by shuffling duties for two veterans at widebody factory

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- 27 **Fears being realized** that stateless insurgents have anti-aircraft weapons that disappeared from Libya

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DEFENSE

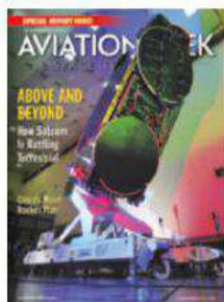
- 30 **U.K. contemplates** reversing a key modernization decision by again switching which F-35 it will buy
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- 50 **Rhetoric about** Falklands remains the same, 30 years later, but the weapons and tactics are new

- 51 **New Zealand's** air force sets sights on more advanced turboprop trainers, navy wants more helos

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- 33 **China's new** medium space launcher should fly next year, initially capable of lifting 30,000 lb. to LEO
- 34 **ESA to seek** billions for satellites for multiple Earth-observation and climate-change programs



COVER STORIES

42 *ViaSat-1 undergoes preparations for an October 2011 launch atop an ILS-Proton rocket from Baikonur Cosmodrome, Kazakhstan. Built by Space Systems/Loral, the all-Ka-band ViaSat-1 is the highest-capacity satellite in the world. It delivers 140 Gbps of bandwidth, providing 100 times the throughput of conventional Ku-band spacecraft and more capacity than all current North American satellites combined. In service since January, the 6,700-kg spacecraft is expected to sharpen satellite broadband's competitive edge over terrestrial wireless technologies, providing an alternative to DSL in some markets. By June, an order for a second satellite is expected—with even higher throughput—as detailed in a special report that begins on page 42. Space Systems/Loral photo.*



52 *The ETOPS gold standard is expected to become 330 min. now that Boeing has received FAA authority to offer a 330-min. ETOPS option on GE90-powered 777s.*

32 *China is nearing what many space engineers think is the ideal for a family of space launchers: rockets built with a few standard engines and airframe modules.*

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41 Malaysia Airlines lacks sufficient cash to pay for all of the aircraft it has on order, A380s among them

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46 Satellite operators see hope that their spacecraft eventually will host government payloads

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EARTH AS EXOPLANET

✦ **How can we tell** if exoplanets have life? Researchers at the European Southern Observatory have demonstrated one way, by looking at the Earth as though it was a distant exoplanet. Earthshine observation analyzes sunlight bouncing off Earth and reflected on the Moon for spectral signs of organic life. <http://tinyurl.com/6moxsjf>



FEDERAL BUDGET UPDATES

✦ **For comprehensive news,** analysis and data on the Obama administration's fiscal 2013 federal budget request, visit AviationWeek.com/2013—and check back throughout the budget cycle for regular updates.

BOOM OR BUST?

💬 **An article in our sister publication, *Defense Technology International*,** sparked an online debate on our **Ares** blog about why major acquisition programs fail. What is the best way to de-

LOCKHEED MARTIN



fine program failure? Should F-35 cost and time overruns earn it the label "failure?" Read the article and comments and join the conversation. <http://tinyurl.com/8a3r6j9>

QATAR 787 DEBUT

📷 **Qatar Airways** has announced it will bring one of its Boeing 787 jets to the Farnborough air show in July. The airline has unveiled photos of its business-class cabin in a 1-2-1 configuration. See the photos on our **Things With Wings** blog. AviationWeek.com/wings

IT GETS STRANGER

💬 **Our Things With Wings** blog rounds up more strange goings-on from the world of commercial aviation. It's strange—but true—aviation news. AviationWeek.com/wings



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FROM THE WEB

Comments from readers
on AviationWeek.com

International Editor Robert Wall's "Close Encounter: Typhoon and Rafale"—on the Ares defense technology blog—deals with a cementing of ties between U.K. and French military forces. Comments are informative about the evolution of the aircraft, with involved exchanges. Portions of these include:

TangoViking noting:

The RAF also visited Bodo, Norway, with two Typhoons recently. Perhaps it was Cold-Response related.

Pappy musing:

Makes me wonder why the U.S. is apparently uninterested in this design style. Stealth limitations?



A. JUELAND/FRENCH AIR FORCE

Yodeling cyclist responding:

Yes. The canard design was very popular, and a lot of the early advanced tactical fighter designs incorporated it. The advantage lies in the fact that, at high Mach numbers (i.e. transonic, not hypersonic) the center of pressure on the wing moves back. Having the surfaces which govern pitch in front of the wing provides maximum torque under these conditions, and allows for a high turn rate for a given surface area/deflection.

Sferrin adds:

However, once stealth became a factor, all the canard designs went away. Of the seven submissions—Lockheed, Northrop, General Dynamics, Boeing, McDonnell Douglas, Rockwell and Grumman, only the latter's design might have had a canard. I say "might" because the official Grumman submission still seems to be a bit of a mystery, but the one generally shown had a canard.

 **Join the discussion at:**
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FEEDBACK

STRETCHING REALITY

A recent cover story touts "Cabins, Connectivity and Comfort" (AW&ST Feb. 27, p. 44). Really? For whom? Certainly not for the occasional traveler. The illustrative photo of a passenger is insulting to those of us who are not "business travelers." They have priority boarding, pack the overhead bins with oversized luggage and recline seats recklessly. Two things could better improve comfort: restrict/eliminate seat recline except for extremely long flights and actually enforce size limits for carry-on luggage.

The article states that Southwest Airlines is making spacing even smaller. Weight savings are good, but I do not buy the airline's statement that bodies will actually have more room.

Thomas W. Sheehan

HOUSTON, TEXAS

CHECK YOUR APPROACH

Gunjan Bagla's admirable "How to Win Indian Business" (AW&ST Feb. 13, p. 58) could be applied to almost any country. I grew up in South America in the 1960s and experienced first-hand the culture of the arrogant U.S. business professional. Most never bothered to learn Spanish. Their children went to American-run schools, and consequently never learned the native language. The Americans had their own compounds, clubs and local culture. My parents chose to send me to local schools and we helped the Peace Corps volunteers build homes for the locals, who were treated with dignity. As a result, my own international business has flourished because of learning to treat all people equally. U.S. businessmen should extend themselves beyond the big hotels and expensive living areas in the nations with which they are doing business. Tour the countryside, mingle, offer help when appropriate. Do something other than take profits and worry about the bottom line. Business will come, and you will feel more satisfied for it.

Charles Sands

ORMOND BEACH, FLA.

EVER-EVOLVING THREATS

I was relieved to see the Chinese cyberthreat finally receiving the serious analysis it deserves in "Budget Cyber Threat" (AW&ST Feb. 6, p. 30), until I read the penultimate paragraph. Someone actually thinks UAVs are the future? Consider the following:

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

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.

Chinese hacking deeply penetrated major defense corporations and the Pentagon. The rogue drone that headed toward Washington exhibited a classic capture/flight pattern to analyze efforts to regain control and release without traceback. And the X-47B is being tested over Chesapeake Bay!

Our entire UAV program is compromised and will remain vulnerable far into the future.

Thomas J. Rath

PASADENA, CALIF.

(No complete solutions to cyber or electronic warfare exist, just seemingly endless morphing by all sides. But note that links to the penetrated UAVs were not encrypted, nor is the entire UAV program compromised. The RQ-170's role in the bin Laden raid should dispel that notion—Ed.)

IT'S NOT THAT SIMPLE

Two statements on the Feedback page (AW&ST Feb. 13, p. 10) reflect a surprising lack of understanding of U.S. national institutions and the laws of economics.

Reader James Campbell would want "Brazil's economy" to pay part of the price of the Super Tucanos destined for the Afghan air force, because Brazil's economy "is doing well." The purchase of the aircraft is a straightforward commercial transaction. If you want something, you pay for it. If you can't afford it, don't buy it. Just who in the Brazilian economy should contribute anyway?

Blogger Alexandre suggests that the U.S. Federal Reserve "transfer some dollars . . . to NASA programs" to finance flights to the Moon and beyond. Expenditures by the federal government, including NASA, are met via funds present in the annual budget available in prescribed amounts to government agencies and departments. The Fed isn't some kind of vault where can you walk in, grab a fistful of dollar bills and pass them on to an agency of your choice.

Giovanni Manfredi

GENEVA, SWITZERLAND



24th Annual Greater Washington Aviation Open

MAY 14, 2012

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Timothy Stull (see photo) has been named managing director of Chicago-based *Landrum & Brown*. He was managing director of air traffic strategy and programs at United Airlines.

Karsten Benz has been appointed to succeed **Andreas Bierwirth** as chief commercial officer for *Austrian Airlines*. Benz has been European VP-sales and services at the Lufthansa Group.

Ryan O'Toole has become a director in the Aerospace-Defense-Government Group of Los Angeles-based *Houlihan Lokey*. He was a director at Lazard Freres & Co.

USAF Brig. Gen. (ret.) **Harold B. Adams** and **James L. Armitage** have been named senior fellows of the *Potomac Institute for Policy Studies*, Arlington, Va. Adams was VP-engineering and operations at GTE Spacenet, and Armitage was VP and sector chief technology officer for Northrop Grumman Electronic Systems.

Steve Dunn has become director of sales for Europe and Africa at *XipLink* in Montreal. He comes from CET Teleport in Germany.

Lisa Donnan has been appointed VP and customer executive for strategic capabilities and technology at *TASC*, Chantilly, Va. She is an advisory board member of the Volgenau School of Engineering at George Mason University, Fairfax, Va.

Craig Lowe has joined Washington-based *Airlines For America* (A4A) as director of security. He was A4A project manager for the Known Crewmember program and president/founder of Lion's Gate Services.

Neil Gibson (see photo) has been named to the senior management team of the London-based *Gama Group*. He was director of PremiAir's Charter & Management Div.

David Louzado has been appointed sales director for the Risk and Asset Management Div. of *Airclaims*, London Heathrow Airport. He was VP-fleet services at Falko Regional Aircraft, formerly BAE Systems Asset Management.

James Melville has joined *SenarioTek*, Santa Rosa, Calif., as U.S. sales manager. He was national account manager for SymTx/AAI for Lockheed

Martin and Northeast U.S. sales manager.

Nelson Ford has become chairman of the *Center for Strategic and Budgetary Assessments*, West Sacramento, Calif. He is president and CEO of consulting firm LMI and had been undersecretary of the U.S. Army.

USAF Brig. Gen. **David W. Allvin** has been nominated for appointment to major general. He is vice commander of the 618th Air and Space Operations Center of Air Mobility Command, Scott AFB, Ill. Other nominees for major general are: Brig. Gens. **Howard B. Baker**, commander of the Air Force Global Logistics Support Center of Air Force Materiel Command, Scott AFB, Ill.; **Thomas W. Bergeson**, senior defense official and defense attache in the U.K. for the U.S. Defense Intelligence Agency in London; **Charles Q. Brown, Jr.**, deputy director of operations at Headquarters U.S. Central Command, MacDill AFB, Fla.; **Darryl W. Burke**, commander of the 82nd Training Wing of Air Education and Training Command, Sheppard AFB, Texas; **Richard M. Clark**, commandant of cadets at the U.S. Air Force Academy in Colorado Springs; **Dwyer L. Dennis**, director of intelligence, surveillance, reconnaissance and requirements at Headquarters Air Force Materiel Command, Wright-Patterson AFB, Ohio; **Mark C. Dillon**, director of regional affairs, in the Office of the Deputy Undersecretary of the Air Force for International Affairs at the Pentagon; **Carlton D. Everhart, 2nd**, commander of the 618th Air and Space Operations Center of Air Mobility Command, Scott AFB, Ill.; **Samuel A. Greaves**, director of plans, programs and analyses at Headquarters Air Force Space Command, Peterson AFB, Colo.; and **Morris E. Haase**, deputy commander of Joint Task



Timothy Stull



Neil Gibson



Christopher Jones



Yolanda Murphy



Diona Chenier



Hugh Butler



Willie Simmons

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Force-Horn of Africa, U.S. Africa Command, Camp Lemonnier, Djibouti.

HONORS AND ELECTIONS

Christopher Jones (see photo) was honored with *Northrop Grumman's* Career Achievement in Industry Award for engineering at the company's Black Engineer of the Year Award (BEYA) Global Competitiveness Conference. Jones is senior VP and general manager of the Integrated Logistics and Modernization Div. **Yolanda Murphy** (see photo), media relations manager in the Electronics Systems Sector, won the Corporate Promotion of Education Award. **Diona Chenier** (see photo), a multidiscipline engineer in Electronics Systems, received the Outstanding Young Alumnus Award. **Hugh Butler** and **Willie Simmons** (see photos) won special awards for distinguished career achievement. Butler is a division director of business management for the Navigation Systems Div., and Simmons is the AWACS engineering manager in the ISR Div. of Electronics Systems. **Sri Achary, Kelvin Franklin, John Illgen, Enoch Long, Michael Nessor, Corey Jones, Terrence Neal** and **ShuRhonda Bradly** were named BEYA Modern Day Technology Leaders.

Keith Buckley, president and CEO of ASC Signal Corp., has been appointed chairman of the New York-based *Society of Satellite Professionals*, succeeding **Clayton Mowry**, president of Ariane-space. **Michael Aloisi**, VP-technology, satellite and affiliate services for Viacom, is the new president. ☛



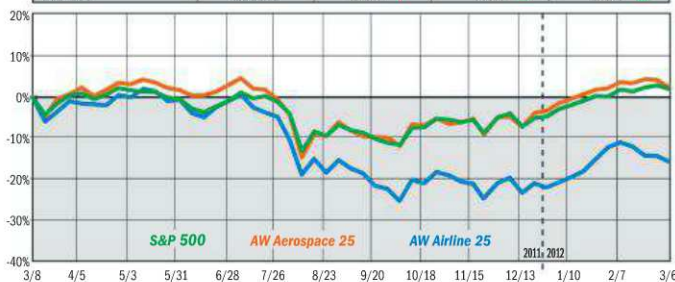
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AW&ST/S&P Market Indices

(as of 3/7/2012)

PERCENT CHANGE

MARKETS	INDEX VALUE	WEEK AGO	YEAR-TO-DATE	YEAR AGO
AW Aerospace 25	1440.3	-2.0% ▼	5.7% ▲	2.9% ▲
AW Airline 25	839.3	-1.8% ▼	9.3% ▲	-16.6% ▼
S&P 500	1352.6	-1.0% ▼	7.6% ▲	2.5% ▲



Weekly Market Performance

Closing Prices as of March 7, 2012

Company Name	Current Week	Previous Week	Fwd. P/E	Tot. Ret. % 3 Yr.	Tot. Ret. % 1 Yr.
AEROSPACE & DEFENSE					
AeroVironment Inc.	25.99	28.48	17.1	-18.2	-9.2 ▼
Allegheny Technologies Inc.	40.20	43.87	14.1	142.4	-36.3 ▼
Alliant Techsystems Inc.	56.71	60.00	8.3	-9.1	-17.8 ▼
BAE Systems plc	4.88	4.98	7.4	8.2	0.4 ▲
Boeing Co.	73.52	74.95	16.1	165.3	4.6 ▲
Bombardier Inc. 'B'	4.08	4.81	8.8	78.1	-33.2 ▼
Cobham plc	3.30	2.99	10.2	24.2	-8.2 ▼
Curtiss-Wright Corp.	36.36	37.15	12.0	61.2	-3.9 ▼
DigitalGlobe Inc.	11.90	15.38	20.5	-60.5 ▼
EADS NV	35.29	36.41	15.3	172.4	36.6 ▲
Eaton Corp.	48.75	52.19	11.0	243.8	-6.6 ▼
Elbit Systems Ltd.	36.16	36.70	6.9	-14.5	-22.5 ▼
Embraer-Empresa Brasil ADR	28.60	30.06	11.7	209.3	-13.2 ▼
Esterline Technologies Corp.	65.95	64.95	11.2	215.7	-8.4 ▼
Exelis, Inc.	11.64	10.51	6.4
Fimmeccanica SpA.	4.61	5.07	-7.7	-59.2	-58.9 ▼
FLIR Systems Inc.	25.92	26.17	15.5	33.8	-19.1 ▼
General Dynamics Corp.	71.25	73.23	9.7	111.3	-4.3 ▼
General Electric Co.	18.77	19.05	12.2	191.3	-5.7 ▼
GKN plc	3.25	3.49	8.2	428.3	2.0 ▲
Harris Corp.	42.64	43.63	7.9	45.8	-4.9 ▼
Hexcel Corp.	23.98	25.27	17.1	403.8	29.5 ▲
Honeywell International Inc.	57.74	59.57	13.0	166.5	3.4 ▲
Huntington Ingalls Industries Inc.	36.14	35.88	11.5
L-3 Communications Hldgs. Inc.	67.73	70.25	8.1	23.2	-13.3 ▼
Lockheed Martin Corp.	87.96	88.41	11.2	67.2	14.5 ▲
Moog 'A'	40.99	43.91	12.2	121.4	-9.3 ▼
Northrop Grumman Corp.	59.96	59.81	9.1	111.2	2.3 ▲
Orbital Sciences Corp.	13.67	14.05	13.4	12.2	-23.9 ▼
Parker-Hannifin Corp.	86.19	89.81	11.9	217.5	2.1 ▲
Precision Castparts Corp.	164.99	167.43	17.2	237.4	18.3 ▲
QinetiQ Group plc	2.36	2.41	9.9	20.2	22.9 ▲
Raytheon Co.	50.71	50.52	9.9	59.8	0.7 ▲
Rockwell Collins Inc.	58.01	59.29	12.3	116.0	-8.5 ▼
Rolls-Royce Group plc	12.79	12.97	14.7	212.1	35.4 ▲
Safran SA	32.60	33.59	12.5	273.0	-0.7 ▼
SAIC Inc.	12.28	12.22	8.9	-30.0	-27.3 ▼
SIFCO Industries Inc.	19.18	19.39	287.2	15.3 ▲
Singapore Technologies Eng.	2.43	2.55	16.9	58.2	-0.4 ▼
Spirit Aerosystems Holdings	23.76	23.96	10.9	185.6	-9.2 ▼
Textron Inc.	26.13	27.51	13.7	608.7	-3.9 ▼
Thales	35.61	36.18	10.2	0.1	2.1 ▲
Triumph Group Inc.	60.62	63.80	11.7	275.9	38.0 ▲
United Technologies Corp.	82.57	83.87	14.4	130.4	1.6 ▲

COMMENTARY

Emissions Row Muddies Airbus's China Strategy

When Chinese President Hu Jintao visited Washington last year, he unveiled with great fanfare \$19 billion worth of purchases for Boeing 737 and 777 jets. There was only one catch: The aircraft had actually been ordered between 2007 and 2009. The central government in Beijing has long used its requisite sign-off on orders by Chinese airlines as a tool to further its political agenda, doling out—or withholding—big-ticket purchases at opportune moments. That strategy is on display again in the increasingly bitter battle over the EU's unilateral move to charge airlines for emissions, which is opposed by China, the U.S., India, Russia and 19 other nations.

Louis Gallois, the CEO of Airbus parent EADS, says China's government is holding up approval of orders for 30 A330 wide-body jets. He complains that Airbus is being taken hostage in the dispute over the emissions trading system, which requires airlines to buy credits to pay for CO₂ emissions during the entire lengths of flights, even if just small portions are over the EU. Airbus says it will be forced to scuttle plans to increase A330 production rates in 2013 if the Chinese orders are lost.

The emissions spat is threatening to disrupt Airbus's vigorous drive to expand its share of China's fast-growing aviation market. While Chinese airlines still have more Boeing jets in service—869 at the end of 2011, versus 757 for Airbus and 218 for all other airframers—Airbus has steadily gained ground, thanks in part to its move to build an A320 final assembly plant in Tianjin, southeast of Beijing. The Teal Group calculates that the value of Airbus's backlog in China now stands at \$27.6 billion, versus \$24.5 billion for Boeing (Teal estimates actual prices paid, which are lower than the list prices published by airframers).

Airbus's lead could easily evaporate if Beijing directs its airlines to buy more jets from Boeing to retaliate for the emissions system. But it may not come to that. Opposition has grown so fierce that it is hard to see how the EU will not back down before the first bills for 2012 emissions come due in April 2013. Russia is threatening to prohibit EU airlines from overflying its territory. China has already banned its airlines from buying emissions credits. And even the Obama administration—no slouch on environmental issues—is considering retaliatory actions. U.S. Transportation Secretary Ray LaHood has angrily denounced the European decision to act unilaterally. "It's a very, very bad law that they have passed," he said in a March 8 speech.

Back in Paris, Gallois had similar sentiments, though he was more diplomatic. "We don't think that a European-only solution is appropriate," he says. Given Airbus's position as a European employment and export juggernaut, those words should carry a lot of weight. ☺

With Robert Wall in Paris and Madhu Unnikrishnan in Washington.

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.

DEFENSE

Upgraded Herc

The U.S. Air Force has funded flight tests of upgraded Rolls-Royce T56 engines on a Lockheed Martin C-130H. They are aimed at increasing reliability and service life as well as cutting fuel consumption by around 8%. The T56-15 Series 3.5 "enhancement" kit is expected to undergo tests at Edwards AFB, Calif., around mid-year and is expected to help USAF meet its target of reducing aviation fuel usage by 10% by 2015. The turbine upgrade is designed to increase component life by around 30%, and according to an Air Force analysis, could contribute to long-term savings of \$3.5 billion over the lifetime of the fleet.

Helo Help

The European Commission has given the green light for France and Italy to financially support the Eurocopter X-4 and AgustaWestland AW169 development programs. EU anti-trust authori-

ties determined there was no risk to competition from the move. France sought EU approval for a €143 million (\$189 million) loan. Eurocopter needs to repay the loan once it reaches a sales target for X-4s and then pay royalties for additional sales. The loan mechanism mirrors those Airbus partner countries have provided to the large aircraft maker and which the U.S. has been challenging in the World Trade Organization. Rome, for its part, is looking to provide €272 million in zero-interest loans over 19 years for the AW169.

Ta Ta, Talarion

EADS appears to be rethinking its push of the Talarion unmanned aircraft, after a prolonged period of unsuccessfully trying to get Germany and other European countries to back its development. EADS continues to fly its Barracuda unmanned aircraft demonstrator and, this year, plans another flight-test campaign in Canada. But that does not mean EADS has made its peace with

the decision in France and the U.K. to back the BAE Systems/Dassault Aviation Telemos unmanned aircraft for their future medium-extended long-endurance system. The Anglo-French system is due to be fielded around 2020.

AIR TRANSPORT

Concorde Saga Continues

The saga over the crash of an Air France Concorde in 2000 that killed 113 people continues, with a French appeals court last week kicking off a proceeding. The appeals process is expected to last around nine months. It will reexamine issues such as whether there was a design flaw in the Concorde and whether a component of a Continental Airlines DC-10, which preceded the supersonic airliner on the runway, left debris that caused damage to the following aircraft.

Bigger ETOPS

The FAA has granted 330-min. extended-range, twin-engine operations

Boeing To Triple its Widebody Delivery Site

Final site clearing is under way for construction of a 180,000-sq.-ft. delivery center for Boeing's widebody aircraft factory in Everett, Wash.

Expected to open early next year, the new Everett Delivery Center north of Seattle is replacing a 60,000-sq.-ft. facility that dates to the late 1960s when Boeing was developing its first widebody jets, the 747-100/-200s. The new center will be built on the same site south of the widebody factory.

Demolition of the old building has been under way since last December; ground was broken for the new site last week even as the old site was still in the final stages of being cleared.

Since the original center opened, Boeing has used it to deliver more than 3,500 747s, 767s, 777s and

787s. The company uses a separate delivery center for its 737 narrowbody family from its Renton factory south of Seattle.

The new building's design, by DLR Group of Seattle, offers clear views from any location of any of the aircraft being delivered. Up to three airplanes—two on the west side; one on the east—can be pulled up to the center at any time. Skybridges will allow customers to board regardless of weather conditions.

While it awaits opening of the new center, Boeing is using other facilities for individual deliveries, including its Future of

Flight conference center and museum, which is opposite the factory across Paine Field.

Boeing delivered 105 widebody jets last year: 73 777s, 20 767s, nine 747-8s and three 787s. With allowances for weekends, that averages to one delivery every 2.5 days. The 777 program is the current record-holder for widebody production rates at seven per month.

By the end of 2013, Boeing expects the Everett factory to be producing 19 aircraft per month, or 228 per year. The 777 program will lead that charge early in the year, rising to 8.3 per month, followed by the 787 by year-end at seven per month. Both the 747-8 and 767 lines will operate at two aircraft per month.

While production rates do not equate exactly with monthly deliveries, they do indi-

cate how Boeing's pace is to pick up to one delivery every 1.2 days.

The aircraft are towed from the factory to the delivery center over a bridge that spans a state road.

The delivery center will be home for all final preparation work, including painting, fueling and engine run tests. It will house offices for flight testing and customers and a lounge for aircraft acceptance ceremonies. More than 150 customer representatives are expected to use it, 30-45 at any one time. Airlines with larger fleets will have permanent offices.



BOEING CONCEPT



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(ETOPS) approval for the Boeing 787's upgraded General Electric GENx-1B Performance Improvement Program (PIP) engine (see related story, p. 52). Confirmation, which follows last year's 330-min. ETOPS clearance of the baseline GENx-1B last year, comes as Boeing completes certification flight-testing of the GE-powered 787. The FAA is expected to confirm certification of the aircraft by the end of March.

SPACE

ISS Refueling Tests Begin

U.S. and Canadian ground control teams have started the first robotic refueling demonstration outside the International Space Station, which they hope will lead to the robotic removal of a satellite gas cap by mid-summer and eventual in-space refueling. The Canadian Space Agency's Special Purpose Dexterous Manipulator wielded the tools in the two-armed robot's first technology demonstration assignment beginning March 7. The two-year, \$22.6 million multi-phase Robotic Refueling Mission demonstration aims to underpin commercial initiatives to extend the operating life of satellites. It may also advance efforts to develop space-based refueling depots for deep-space human exploration.

Bigger Bandwidth

Boeing confirmed an agreement with mobile satellite service Artel to distribute Inmarsat-3, -4 and -5 bandwidth to potential U.S. government users. The Boeing Commercial Satellite Services and Artel deal is focused initially on providing K_a bandwidth on Inmarsat-3 and -4 satellites. Inmarsat-5 global satellite communications will be available starting in late 2013. The agreement includes provisions for users to be able to conduct compatibility testing on Inmarsat-5 terminals starting in the middle of 2013.

PROPULSION

Engine Change

The consortium trying to revive the fate of the Fokker 100 has decided to change its engine choice, opting for the Pratt & Whitney PW1000 geared turbofan. The engine will be effectively the same 56-in.-dia.-fan configuration Pratt & Whitney is providing in the PW1200G for the Mitsubishi Regional Jet. The engine will replace the Rolls-Royce BR725

Boeing-Comac Deal Deepens Ties with Beijing

An agreement to cooperate on energy conservation and emissions technology research deepens Boeing's ties with China's commercial aviation establishment.

The accord was signed March 6 in Beijing with Commercial Aircraft Corp. of China (Comac), builders of the C919 and ARJ21. It extends a series of agreements the U.S. manufacturer already has in materials research, air traffic management, nanotechnology and biofuels (AW&ST April 25/May 2, 2011, p. 48). Boeing's strategy in China emphasizes cooperative research that does not expose any of the company's intellectual property and allows it and the Chinese to benefit from new work the two cooperatively produce.

However, in its earlier "good partner" agreements, Boeing was tied with Chinese research institutions; this one is directly with the state-owned manufacturer that wants to wiggle into the U.S. company's biggest market—single-aisle jets.

Other U.S. and European manufacturers are assisting directly in development of the C919 by providing engines, components and systems, as they do for Airbus, Boeing and other aircraft makers. The new agreement does not provide technology for the manufacturer of either of Comac's two aircraft development programs, the 70-105-seat ARJ21 or the C919, first in a series that Comac is building to challenge Airbus and Boeing in 168-190-seat single-aisle jets.

Instead, the two companies are forming the Boeing-Comac Aviation Energy Conservation and Emissions Reductions Technology Center in Beijing to support research to increase fuel efficiency and reduce greenhouse-gas emissions. Until now, Comac's main effort in that area has come through the engines it selects for its products, notably the CFM International Leap for the C919. Both Boeing and Airbus are tapping Leap for reengining of their 737 and A320 families, respectively.

"Our new technology center shows that two companies in a competitive industry can partner to make progress on important challenges that cannot be solved by one company alone," Boeing Commercial Airplanes President and CEO James Albaugh commented during the signing ceremony with Comac Chairman Jin Zhuanglong and President He Dongfeng.

which Rekkof Aircraft, the company behind the Fokker 70/100NG, identified as its preferred offering.

Leap, Leap

Avio and Snecma have finalized a deal to cooperate on the CFM International Leap-X engine, expanding their relationship on the CFM56. The deal comes as Avio's private equity owner is considering the sale of its share in the business. Snecma-parent Safran is seen as a potential buyer, although industry officials say the sides remain apart on a price.

MAINTENANCE

Repairing Afriqiyah A330s

Sabena Technics' maintenance facility in Bordeaux, France, is performing heavy check and repair work on two Afriqiyah Airways Airbus A330s. Several aircraft in the Libyan operator's fleet suffered damage during recent conflicts. Philippe Rochet, Sabena Technics' executive vice president of airframe services, says the MRO sent a maintenance task force of 10 engineers to Libya to prepare the aircraft for ferry flights to Bordeaux. The engineers performed non-destructive test-

ing, engineering and initial structural repairs on the A330s before they flew to France for the heavy maintenance.

LOT 767s To Shanghai

Shanghai Aviation Services Co. signed a two-year maintenance agreement with LOT Polish Airlines for Boeing 767-300 heavy maintenance. This is the first agreement between the two companies.

AEROSPACE BUSINESS

Heir Apparent

General Dynamics has named Phebe Novakovic president and COO, positioning the 54-year-old as the front-runner to succeed Chairman and CEO Jay Johnson. Novakovic has been a senior executive at the company since 2002 and last headed the Marine Systems group.

Correction: A table listing stored passenger aircraft in the March 5 edition (p. 24) contained an error regarding Boeing 747-400s. Last week, Aviation Week Intelligence Network data showed 58 of the 747 variant were parked. An industry source indicated several of those would return to revenue service soon.

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BY GRAHAM WARWICK

Senior Editor-Technology
Graham Warwick blogs at:
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warwick@aviationweek.com

COMMENTARY

Cold Comfort

Nanotech promises energy-efficient anti-icing

Icing has been a threat to aviation since the dawn of the aeronautic age, and as manufacturers pursue efficiency improvements measured in fractions of a percent, the power demanded to protect aircraft—whether by bleed air or electrical heating—is coming under attack.

At the same time, unmanned-aircraft developers see the need to operate in all weather conditions, but cannot afford the power and weight penalties associated with traditional anti-icing systems. Nanotechnology may hold the answer, at both ends of the spectrum.

U.S. research and development organization Battelle is mixing conductive carbon nanotubes (CNT) into aircraft paint to produce a lightweight, low-power, anti-icing coating that is easy to apply and repair. General Electric Global Research is developing nanostructured surfaces that delay the formation of ice and reduce its adhesion.

Columbus, Ohio-based Battelle has dispersed nanotubes into a coating solution to make it conductive, so it heats up like a resistor when power is applied to a wing's surface, says John Ontiveros, operations manager for the program. The coating has been tested in an icing tunnel using a scrap wing from a UAV.

The trick is to suspend the right amount of CNTs in the solution to achieve the resistivity needed in a coating that can be applied by a spray gun like regular paint, he says. The coating "stack-up" consists of primer over the bare metal, the nanotube heater coating, a soy-based protective layer and then the normal top coat of paint.

The coating is only 0.020-0.030-in. thick and four times more power-efficient (in watts/area) than other electrothermal anti-icing systems, Ontiveros says. The lower the resistance, the more efficient the heat generation.

"We are down to low single digits, which is pretty awesome."

Because the heating is on the wing's surface, not under its skin, there is no thermal lag, according to Ontiveros. The coating heats up rapidly, and

power can be cycled quickly between different sections of the leading edge to minimize consumption. Power leads are laid flush to the surface then the coating is sprayed on, minimizing the need to penetrate the wing skin. The coating can also be repaired or replaced easily, he says.

Battelle is talking with aircraft and paint manufacturers, looking at both large and small platforms, while continuing risk-reduction work in areas such as coating application and power management. "We need to look at the full regime of icing," Ontiveros says, and operating strategies need to be developed based on an aircraft's flight envelope and available power. He notes, "We are ready to look a

full-scale integration and test on an aircraft."

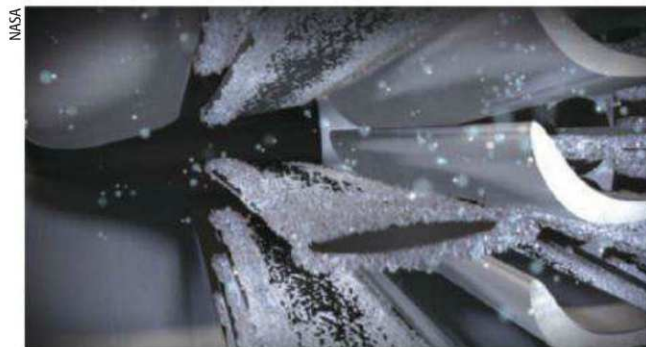
GE's Niskayuna, N.Y.-based Global Research Center, meanwhile, is continuing research into superhydrophobic materials with nanotextured surfaces that repel water and prevent ice from forming and adhering. GE's interest is in anti-icing surfaces and coatings for both aircraft and engines as well as wind turbines, where increased drag caused by ice buildup can significantly reduce the power-generating capacity and efficiency.

Having demonstrated via icing-tunnel tests that microscopically textured aerodynamic surfaces can dramatically reduce ice adhesion, GE says it has now shown that they can significantly delay ice formation. "Compared to standard surfaces . . . nano-enabled anti-icing surfaces would delay ice formation for more than a minute on their own," says a company representative.

Nanotextured coatings on aerodynamic surfaces and engine blades "could one day reduce and possibly even eliminate the need for existing anti-icing measures," the company states. But it cautions that further development is required before such surfaces are durable enough to be ready for commercial application.

EADS Innovation Works, the research and technology arm of Airbus's parent company, is investigating water-repellent coatings to prevent ice adhesion and accretion at a new laboratory-sized cryogenic tunnel in Ottobrunn, Germany. Mississippi State University is providing computational fluid dynamics modeling of supercooled water droplets impacting aerodynamic surfaces. The work is in support of Europe's Aeromuco research program, which is to include flight tests of ice-resistant coatings.

NASA, meanwhile, has begun modifying a Gulfstream G-II to investigate how ice crystals—formed in high-altitude, warm-weather storms—can enter the core of an engine (see photo), melt and then refreeze, causing loss of power or shutdown. Trial flights are planned for Florida in August, ahead of a test campaign set for January-March 2013 over Darwin, Australia, an area known for storms with high levels of ice crystals. ☐





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

COMMENTARY

Facing the Facts

As EADS nears leadership transition, small political gaffes cannot be easily ignored

A junior German politician is trying hard to undermine EADS's newly restored peaceful governance. Peter Hintze, aviation coordinator of Chancellor Angela Merkel's government, claims that Germany's interests in the aerospace and defense group are not being preserved. This surprising assertion comes in the aftermath of Thomas Enders's proposal to consolidate in Toulouse the group's double headquarters, which are now in Paris and Ottobrunn, Germany. Enders, who is currently Airbus chief, will become EADS's leader in May when Louis Gallois retires.

The envisioned relocation to Toulouse is clearly not to Hintze's liking. Airbus, which was established in Paris in 1970, moved quickly to southern France because then-CEO Henri Ziegler wanted to his executives to be where the A300B twinjet was assembled. Ten years ago, following an unprecedented industrial consolidation initiative, EADS was formed under the umbrella of national-pride-sensitive governments—France and Germany being the driving forces. In no way could one

tempts, at least on paper, the cross-border EADS still does not speak with a single voice and is far from being a truly unified organization; and it most probably never will. Cultural problems are unlikely to disappear over the years, and the nationalistic quest for power (as well as petty jealousies) shows no signs of evaporating.

Forty years ago, Airbus's founding

Franco-German undertaking—the U.K. at first was no more than a sub-contractor and Spain joined later—the founders had to carefully anticipate the problems that might arise in reconciling strong national egos. But France was the de facto leader.

The A380 mega-transport's chaotic industrial start revealed “parallel hierarchies” and spotlighted the fact that managers in charge of French and German production facilities applied conflicting processes despite decades of joint effort. To remedy this shortfall, Gallois worked hard to implement more efficient habits, and he largely succeeded. It helped that he was seen as a highly respected top executive, so members of the chain-of-command agreed to listen to him and act accordingly. And he was not competing against anyone owing to his approaching retirement. Before being EADS co-CEO, Gallois headed Airbus. In both positions, he worked smoothly with Enders.

Now, weeks before Gallois's exit, Hintze's comment seems in bad taste, although he probably is unaware of how sensitive the issue is. Meanwhile, across the border, Gallic “common sense” requires ignoring such criticism of France's alleged objective to modify the balance of power inside the group. Nevertheless, Hintze made a serious tactical error that could yield collateral damage.

EADS/Airbus is no longer the Franco-German company of the early 1970s. It has evolved into a genuine global player and cannot allow itself to be distracted by narrow-minded views, even from politicians. The priorities—looking beyond operational matters of the moment such as A350 program delays and efforts to restore the A400M military airlifter's profitability—are aimed at devising a long-term business strategy. Should, for example, Airbus establish an A320 final assembly line in the U.S.?

For the company to grow and prosper with a clear focus, small-minded disputes must be avoided. Moving executives to Toulouse is a non-event, while a decision to assemble A320s in the U.S. would be major. Even Berliners should be encouraged to grasp the big picture because they have a stake in EADS's fate. ☛

The final assembly lines for A320-series single-aisle twinjets are located in Toulouse, Hamburg (right) and Tianjin, China.

of them give the impression that it would dominate the other; however, this cautiousness resulted in duplications such as maintaining double headquarters. Some top executives have two offices and two personal assistants as they commute between the cities. But such a costly waste of time has long been considered a taboo topic.

Despite the corporation's best at-

fathers weighed the merits of establishing the new company's headquarters at a neutral location and considered Zurich as a potential choice. “We would have been close to major banks,” long-retired Chief Executive Roger Beteille concedes with a knowing look. Since Airbus initially emerged as a



COMMENTARY

The Worriers Within

CSeries' largest customer sees echoes of Boeing 717 in Bombardier's order tally

In a speech to the Wings Club in New York last month, Bombardier President/CEO Pierre Beaudoin defended the Canadian aircraft manufacturer's new CSeries against "naysayers," including the ones who have raised questions about the supposed "slow" order uptake for the 100-145-seat aircraft.

"This one is a case of some people playing fast and loose with their sales figures," he said, citing the figure for orders, options and purchase rights and noting that Bombardier has sold out delivery slots for the first two-and-a-half years. That all-in number tops 300—which sounds better than the 138 firm orders Bombardier has from seven customers.

"We're not competing against the A320NEO or the Boeing 737-800 MAX," Beaudoin added. "When you compare apples to apples, we have outsold competitors in the below-150-seat category and our order trajectory is as good as we want and need it to be."

It was a spirited defense of the aircraft program, with just one problem: At least two of the program's order-book skeptics happen to be CSeries customers, including the biggest one of all, Republic Airways, which worries the CSeries could be on the same path Boeing was with its 717.

For Bombardier, that's not a welcome comparison.

Republic Airways CEO Bryan Bedford recently expressed concerns about the number of CSeries orders that Bombardier has received, and he repeated those concerns when stock analysts asked Bedford about it during the fourth-quarter earnings call on March 1.

Korean Air executives also have expressed some concerns, but Republic's are particularly telling because the airline is the CSeries' biggest customer, with a firm order for 40 of

the aircraft and options for 40 more.

In an interview with me after his company's earnings call, Bedford elaborated on his concerns.

He says Bombardier has told him it is aiming for orders for about 400 of the aircraft from about 40 customers. "It's not looking for giant orders; it's looking for a nice breadth of customers globally," Bedford says. But having seven customers with firm orders for 138 aircraft is pretty far from that goal.

Republic's chief says he believes Bombardier when it says it still is going to build the aircraft, and he still believes that it will be a good one; Bombardier says the CSeries will burn 20% less fuel than existing aircraft of its size. But Bedford says a robust orderbook makes lessors and debt owners less concerned about residual risk and asset values. Bedford points out that Boeing had a difficult time selling its 717 and terminated the program in 2006 after building 156 of the type.

"It's not a great place to be right now, being the owner of a 717," Bedford notes.

Asked if there is an "out" in the



BY ANDREW COMPART

Transport Editor
Andrew Compарт blogs at:

AviationWeek.com/wings

andrew_compарт@aviationweek.com

CSeries contract for Republic if the orders do not pick up, Bedford declined to discuss contract specifics. He says only that Republic has expressed its concerns to the manufacturer, and "we'll cross that bridge when we come to it."

That cannot be a very comforting answer for Bombardier, given that there have been questions about the viability of Republic's CSeries order ever since it reached a deal with Airbus last summer to acquire 80 A320NEO family aircraft for its Frontier Airlines subsidiary.

At the time of the CSeries order, Republic seemed to clearly intend them for Denver-based Frontier. It asked for the CS300 aircraft in a single cabin configuration with 138 seats, including 25 "Stretch"-branded seats with extra leg room to match what Frontier offered. Republic subsequently insisted the CS300 could coexist with the NEO order, providing "significant operating capability from Denver's hot-and-high geography to our international destinations."

But with Republic hoping to sell or spin off its Frontier subsidiary this year, Bedford now is coy about his airline's CSeries plans. He suggests the usage options would not be limited to Frontier, referring to some "interesting ideas" on how to make use of the aircraft but declining to provide any specifics.

"When we get closer to 2015, we'll reveal them," he says, referring to the timing of the first CSeries delivery for Republic.

Of course, that assumes the airline takes them.

Bombardier's defense of its CSeries orderbook, during its own earnings call, was not confined to its usage of the all-in number of about 300. Beaudoin also assured analysts that Bombardier has "new customers that we're working on," adding that "China typically orders closer to production." Bombardier Aerospace President/CEO Guy Hachey insisted that the company's CSeries clients "understand the progress we are making with the programs" and are "very committed" to it.

For Bombardier's sake, it needs to be correct on both counts. ☛



Senior Editor Frank Moring, Jr., blogs at: AviationWeek.com/onspace
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COMMENTARY

Past Is Prologue

Solar System scientists have been here before

Planetary scientists in the U.S. and Europe are smarting from a \$226.2 million cut in NASA's requested funding for robotic Mars exploration. That drives the final nail in the coffin of a joint Mars effort with the European Space Agency and obscures the future of Mars exploration in general.

This time last year, NASA and ESA were eagerly planning to send at least two big rovers to the red planet's surface to find and cache samples for eventual return to Earth. Now ESA is hoping its leadership council will endorse a plan hammered out in a hurry with Russia for a less ambitious set of missions, and NASA managers are back to square one in setting up a single, smaller-scale mission in 2018 or 2020 (AW&ST March 5, p. 38; Feb. 20, p. 33). Even scientists with ongoing missions are worrying that funding to continue collecting and analyzing data may evaporate.

This isn't the first time scientists have faced a retrenchment in planetary science spending. Fortunately, participants at the recent Mars Exploration Planning and Analysis Group (Mepag) meeting had a chance to review what happened the last time, in the form of an essay by space-policy expert John M. Logsdon on "The Survival Crisis of the U.S. Solar System Exploration Program" in 1981. In the thoughtful piece that circulated at the Mepag meeting, Logsdon—a keen student of the vicious politics that precedes most big U.S. space missions—outlines what happened after Ronald Reagan was elected president.

"Initial Reagan administration budget cuts, the cancellation of a previously approved planetary mission, and the unsuccessful attempt to gain White House support for a U.S. mission to Halley's Comet eventually threatened the program with almost total termination," Logsdon writes. NASA already had opted to terminate



its part in the joint NASA/ESA Solar Polar mission, "greatly angering its European partners," and the space shuttle was gobbling up funds.

The analogies to today's situation are clear, but not perfect. There is a lot of blood on the floor over the allocation of funding in the fiscal 2013 NASA budget request. Today, planetary scientists feel they have lost out to the James Webb Space Telescope, which will be completed despite serious budget overruns and schedule slips. Advocates of turning low Earth orbit over to commercial vehicles want more money to get off the ground. And NASA's Orion capsule and heavy-lift Space Launch System are "metering" money to stay in business long enough to put something into space.

There are differences, too, in the

White House policy deliberations. Logsdon's work is fascinating for its account of the game of chicken NASA managers such as then-Administrator James Beggs played with the supply-side economists in David Stockman's Office of Management and Budget under Reagan. White House counselor Edwin Meese comes across as a relatively good guy, while Reagan seems about as engaged with space policy as President Barack Obama does.

Ultimately, the infighting didn't help NASA, and Stockman recommended terminating the planetary program outright. The battle headed to Capitol Hill, where vicious politics is redundant. Setting the stage, Martin Marietta President Thomas Pownall cautioned Meese that planetary exploration "enhanced significantly" his company's ability to meet Pentagon requirements. Arnold Beckman, a trustee at the California Institute of Technology, which runs the Jet Propulsion Laboratory, noted the "obvious implications to the support of the president and to his party should the administration permit such a catastrophe."

In the end, the president of Caltech, Marvin Goldberger, a Democrat, prevailed on Senate Majority Leader Howard Baker, a moderate Republican, to take action. Baker wrote to Reagan expressing his strong personal desire that the planned Galileo mission to Jupiter not be terminated. Logsdon notes wryly that it isn't clear Reagan ever saw Baker's letter, but Stockman got the message and Galileo was saved. It launched on the space shuttle Atlantis in 1989 (see photo) and produced some spectacular science (as well as a demonstration of JPL's operational capabilities when its high-gain antenna failed to deploy).

In the wake of the 1981 crisis, NASA developed a planetary-science program driven by big science questions. The Magellan Venus mapper, Cassini-Huygens mission (with ESA) to Saturn and its moon Titan, and other missions grew out of that effort, typically as descoped versions of earlier plans.

It's a safe bet that Mepag members are pulling every string in sight to retrieve some of the Mars money. They have one advantage over their predecessors in 1981—this is an election year. ☛

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BY JAMES R. ASKER

Executive Editor
James R. Asker blogs at:

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jim_asker@aviationweek.com

COMMENTARY

Talkin' Real Money

Asia's defense spending will top Europe's

The official Chinese military budget exceeds \$100 billion annually for the first time, but don't take that number too seriously. The figure Beijing cops to each year is only a fraction of its actual defense spending. It is more useful to tea-leaf readers trying to divine the message being sent than it is for analysis of year-to-year trends. Personnel costs are proportionally much larger than for Western nations. Still, U.S. lawmakers note, China is extending a buildup in new stealth aircraft, electronic warfare, cyberwarfare and naval fleets.

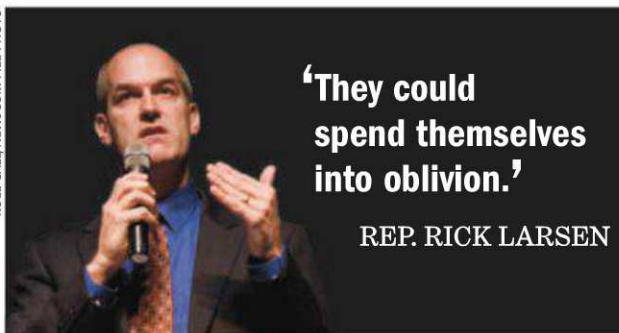
"That should be a concern to U.S. policymakers. But . . . there's very little we can do to prevent China from spending its own money to develop its own military," says Rep. Rick Larsen (D-Wash.). Still, Larsen isn't flinching. Many Asian countries are looking to the U.S. as an ally and a partner, he says.

"The U.S. is a Pacific country. We're not going to give that up. One thing the Chinese policymakers ought to understand is that they could spend themselves into oblivion thinking that would encourage the U.S. to leave Asia. And they would be wrong." Meanwhile, the International Institute for Strategic Studies in London expects Asian defense spending to top Europe's this year. And one analyst warns that the real China threat might be as an defense industry competitor (see p. 58). ☛

MORE DEATH THREATS

It is not just the defense industry that fears draconian budget cuts in the next 10 years. If lawmakers fail to overturn a looming \$1 trillion penalty, known as "sequestration," aerospace industry officials say that could end the FAA's NextGen air traffic modernization program and set back efforts to use UAVs in civilian airspace. Congress recently expressed its support for NextGen, setting deadlines for the implementation of key technologies by 2020 in the FAA re-

ROLL CALL/NEWSCOM FILE PHOTO



'They could spend themselves into oblivion.'

REP. RICK LARSEN

authorization bill. If spending is slashed starting in 2013, the impact on NextGen would depend on how the government handles cuts, says the Aerospace Industries Association's Dan Elwell. If reductions are implemented across the board within the FAA, "maybe NextGen limps along," Elwell says. But if the FAA can target its budget reductions, he fears the agency would gut NextGen in order to meet its contractual labor obligations, adding, "Sequestration could end NextGen." ☛

ODD COUPLE

House Majority Leader Eric Cantor (R-Va.) and Minority Whip Steny Hoyer (D-Md.) are teaming up on support for military aid to Israel. Cantor and Hoyer announced they would be sponsoring a U.S.-Israel Enhanced Security Cooperation Act. The bill would require a report from the Obama administration about six months after enactment that considers Israel's "urgent requirement" for the Joint Strike Fighter and how to

improve the "cost efficiency and timely delivery" of the F-35. Cantor and Hoyer also seek to expand cooperation on homeland defense, counterterrorism, maritime security, aerial refueling, satellite intelligence, missile defense and cybersecurity, and "integrate" Israel into the defense of the eastern Mediterranean. ☛

EXPANDING SLOWER

A billion passengers will board U.S. airlines in 2024, and revenue-passenger-miles will nearly double over the next two decades, the FAA predicts in a new forecast. That number sounds impressive—and it is—but consider it in context: A year ago, the FAA thought enplanements would hit the billion mark by 2021 and that RPMs would more than double in 20 years. What changed? More U.S. airline consolidation and another bankruptcy, for starters, the FAA says. Also, the projected GDP growth for the near term is lower, and the expectation is that fuel prices will be higher than previously thought over the life of the forecast. ☛

GAG ORDER

The space agency challenges the logic of asking experts for their honest opinions, reminding scientists on the NASA Advisory Council that they are "temporary" government employees when in formal session, and as such required to support—at least in theory—the Fiscal 2013 NASA budget proposed by President Barack Obama. The budget would gut the joint Mars exploration program with the European Space Agency. NASA science chief John Grunsfeld is not keen on having his independent advisory body turn into a lynch mob. Look for the panel's recommendations to include a call for restoration of the lost funding in the Fiscal 2014 request. ☛

OFF-GASSING

Ray LaHood calls the EU emissions trading system (ETS) "one of the biggest irritations" of his tenure as Transportation secretary. "This system makes no sense at all!" he fumes. The ETS could violate the landmark U.S.-EU open-skies treaty, he says, adding, "I'm working very closely with Secretary [of State Hillary Rodham] Clinton on the things we can do." ☛

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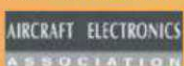


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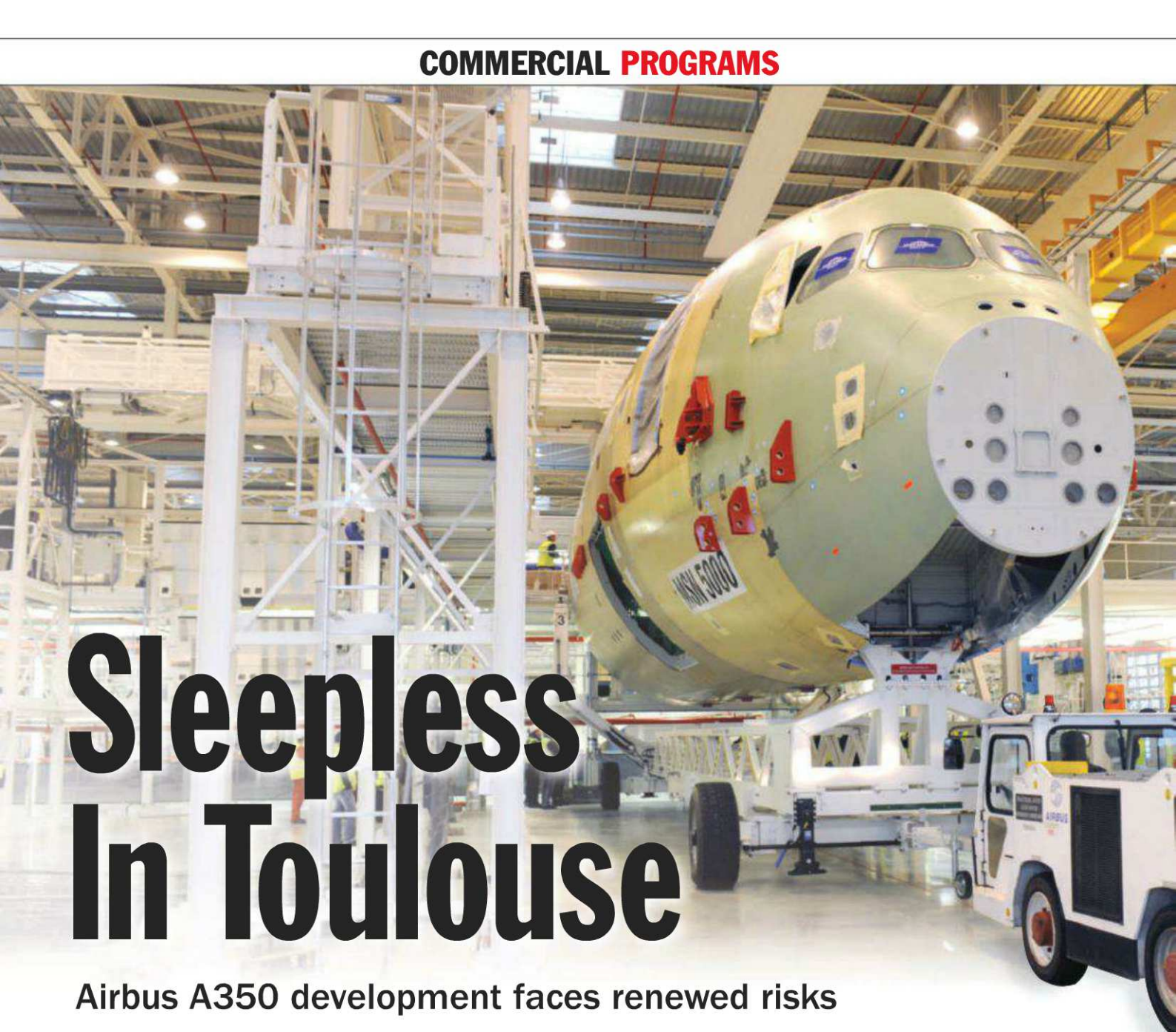


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Sleepless In Toulouse

Airbus A350 development faces renewed risks

JENS FLOTTAU/PARIS

Late last year, Airbus shifted its A350 schedule by six months. But increasingly, suppliers are expressing concerns that a more serious delay could be just around the corner.

Airbus will be forced to postpone its entry-into-service date by at least another year, due to the complex trickle-down effect of late design changes that is affecting various parts of the aircraft, but which is likely felt most painfully in the area of cabin installation, according to various industry sources. Costs are going up and supplier relations are being strained exponentially.

"The systems side is a nightmare," says one CEO of a major Airbus supplier.

"The interiors will be late by at least one year," he believes. That does not mean that first flight is necessarily affected that much, because the initial flight tests will not need a functional cabin anyway. The full effect would not be felt until later in the flight-test campaign, when cabin testing is included.

The massive amount of redesign and the resulting delays are also understood to have led to significantly higher development costs. There is no clear picture about the precise amount, and Airbus will not address the issue. But one executive believes the total overruns might by now have reached €3.5 billion (\$4.6 billion). According to Airbus's standard supplier contracts, additional costs up through the

critical design review stage, which was reached for many individual parts last year, are to be covered by suppliers. But at least one Airbus partner—Diehl Aero-systems—now wants the manufacturer to participate in the cost overruns.

Diehl says it is in talks with Airbus regarding technical and commercial issues. A Diehl representative points out that the A350 is its single biggest development program and its scale is challenging.

Several Diehl units are involved with the A350, including Diehl Aircabin, a joint venture with Thales and the former Airbus cabin plant in Laupheim, Germany. The apparent problems could also be linked to the transition from a former Airbus unit to an independent

supplier, says an industry source. Cabin development engineers have historically been based in Hamburg, while the Lathen factory was mostly dedicated to implementing pre-developed designs.

At the time of the sale, Airbus was believed to have pushed through significant cost-improvement targets that resulted in lower prices. Neither side is willing to comment.

There have been changes to aircraft geometry and component location, concedes a senior Airbus official. But, he adds, the changes are typical for a development program. Sometimes those changes fall to the supplier who can most easily implement them, given planning maturity, he argues. He declined to specify whether Diehl was in that category. Engineering work based on a joint

Final assembly of the Airbus A350 in Toulouse is scheduled to begin in April.



AIRBUS/H. GOUSSE

digital mockup (DMU) should also help keep all participants on the same level, particularly when it comes to design changes, Airbus argues. But one industry source claims that the DMU itself is "in a big mess."

Airbus also refutes claims that the A350 schedule is already behind. The official says that, so far, the manufacturer is on track to meet all the program milestones after the latest schedule revision.

But EADS CEO Louis Gallois is more cautious. In his view, "A lot of difficult challenges are ahead of us, but efforts in risk management are paying off." He admits that "the schedule is tightening as Airbus approaches the next milestones, particularly final assembly." The first

static-test aircraft is now planned to enter final assembly in April, slightly later than anticipated. It was originally slated to enter that phase in late 2011. From a group perspective, Gallois considers the A350 to be "our single biggest risk." He lists three categories of buffers for the program: the design process; flight tests and certification; and "the difference between our industrial time schedule and the commercial time schedule."

"We are progressively eating those buffers," Gallois concedes. He says that when it is noted this is happening too quickly, "we launch mitigation actions and try to preserve buffers in other processes that are not yet impacted. For the time being, clearly we are [adhering] to the time schedule we announced in November." It calls for first flight in early 2013 and entry into service a year or so later.

But GKN, another significant A350 supplier, says the A350 is "challenging," both technically and in terms of schedule. CEO Nigel Stein recently told reporters that the company was working "incredibly hard," but he would not predict a service-entry date. That's a matter for Airbus to sort out, he stated.

Aer Lingus CEO Christoph Mueller also joined the ranks of those who are concerned that the schedule might shift again. He says he will soon begin talks with Airbus about an updated delivery plan, but would not comment further.

One Airbus observer believes that the A350 program is headed for a management reshuffle, but probably not until after the leadership transition from Thomas Enders to Fabrice Bregier in June.

Airbus has often noted that although it has learned a lot from mistakes made in the Boeing 787 program, the A350 remains challenging. When flaws are detected, they are to be resolved immediately without work traveling to the next development phase or location. That is how Airbus explained the delay of up to six months that was announced late last year, when it concluded that composite fuselage panels made by Spirit AeroSystems could not be completed on target.

One source indicates that small, but numerous changes to the detailed fuselage layout, which involve the exact location of stringers and other components, forced changes further down the line in the design process. Some re-planning was needed related to quality issues with the composite panels, and some others due to material limits, one executive explains. Excessive weight remains an issue, although the situation

is allegedly much less dramatic than in the case of the 787. However, the weight situation seems to be well on the way to being resolved, the executive notes.

Additional lessons for the A350 program could still emerge from the A380, particularly as Airbus examines how its design system failed to recognize a design flaw that led to cracks in wing rib feet across the entire fleet. The cost of repairing the existing fleet is estimated at €105 million. Repairs on the first 17 aircraft have confirmed that estimate. The figure does not include additional expenses for the redesign efforts.

"We are looking at a manufacturing solution, but we don't know if that will trigger an increase in costs," Gallois says. He points out that the target to breakeven in the program in 2014 or 2015 depends on the euro/dollar exchange rate. That guidance only includes the recurring costs of production versus revenues, not development costs.

The Type 2 cracks in wing rib feet have the potential to grow in both directions. Tom Williams, Airbus's executive vice president of programs, says "more airworthiness directives (AD) are on the horizon between now and the summer."

Williams says Airbus is considering switching aluminum alloys (from Al 7449 to Al 7210). A change in materials could lead to "a change in thickness of some sections," mainly on the inboard side of the pylon of the outboard engines. That in turn could lead to an increase in aircraft weight of 90 kg (198 lb.).

It is too early to tell when the redesign exercise will be finished, but Williams does not believe it will affect this year's A380 production rate.

The damaged rib feet have been found on Ribs 24-26. Williams says approximately 20 pieces have been affected per aircraft, but there are about 2,000 such parts per wing. The damage was caused during manufacturing, when two pieces of wing skin were joined. In some cases, the gap between the pieces has been greater than anticipated. Thus more force than planned was induced upon the parts when the bolts were tightened.

Williams says that in spite of the recent spate of ADs for the A380, the total number is actually in line or below industry average. Since first flight, there have been 43 ADs for the A380, around 14 per year. When only the time of airline operations is taken into account, that number drops to nine per year. That compares with 18 per year for the Boeing 777 and 21 for the 747, an industry source says. ☐

High Stakes

Political storms mar an improving EADS performance

ROBERT WALL and JENS FLOTTAU/PARIS

New chief executives, like political leaders, traditionally are given a 100-day honeymoon period when they take the helm. For incoming EADS CEO Tom Enders, the honeymoon has ended 100 days before he even takes office.

Enders, poised to head the company in June, faces political headwinds on many fronts. One issue is the international fracas over Europe's inclusion of airlines in its emissions trading system (ETS). This position is threatening core customer relationships at Airbus, and political pressures at home are yet again creating internal governance disarray.

The ETS dictum is casting a shadow over Airbus's plans to further boost A330 output to 11 aircraft per month, the latest in a series of widebody and narrowbody production increases for the aircraft maker. The new output level should be reached in second-quarter 2014; Airbus currently builds nine A330s per month. However, the company adds a caveat: The move will happen "provided the emissions trading system issue does not harm aircraft orders."

Deliveries to China are a particular concern, says EADS CEO Louis Gallois, noting that Beijing is blocking widebody deals because it objects to its national airlines being covered under the ETS. At risk are 10 Hong Kong Airlines' A380s, but also six A330 deliveries by the end of 2013 and 19 more in 2014. Parts production for the A330s is already under way. Another 10 A330s—on which no work has begun—are also seen as in jeopardy. "It is a significant share of our backlog and deliveries for the next two years," Gallois says.

There is some concern that more countries might follow China's lead—Russia, India and others oppose the ETS policy.

Gallois urges European politicians to pursue a global approach to the emissions situation.

At the same time, EADS is again caught in a political power play. Enders has made it clear he wants to institute long-overdue corporate structural changes when he takes over for Gallois, who is retiring. The incoming CEO wants to consolidate the headquarters in Toulouse. The tripartite situation now has the headquarters split between Munich and Paris, and Toulouse serving as home of the largest business unit, Airbus. Peter Hintze, Germany's aerospace czar, is critical of this move. He expressed concern to Enders about an erosion of German influence in the Franco-German aerospace and defense giant.

Hintze has long-advocated for an increase in German workshare on Airbus projects and he renewed those concerns, noting that Berlin was financing the A350 development and should

therefore see an equitable return on its investment, including via personnel allocations at lower ranks. The response from EADS was swift. "This letter is certainly not appropriate and certainly not in accordance with the governance of a listed company," Gallois upbraided Hintze. The EADS chief went on to call for a "serene dialogue." Even so, EADS officials suggest, they could do without most of Berlin's A350 support, and instead draw upon EADS stockpile (€13.2 billion [\$17.5 billion] at year-end) to fund the program, rather than give in to political pressure.

Although the German government backtracked a bit last week, expressing support for Enders, there is concern among some company officials that Hintze's actions could set off a similar political response in France, where the presidential election campaign is in full swing ahead of a first round of voting in late April.

Beyond these problems, the A350 program, Airbus's latest development, remains a headache (see p. 22).

And the erosion of engineering resources continues to keep executives up at night. That

is one reason the company is unlikely to green light a new ATR turboprop, signals EADS CFO Hans-Peter Ring. ATR has been working on defining a new turboprop for some time. CEO Filippo Bagnato had hoped that the joint-venture shareholders—EADS and Finmeccanica—might give the program the go-ahead this year.

The defense side of the operation has its own set of woes. Germany has decided to cut several defense programs involving EADS, but negotia-

tions have been slow. "It is essential that these talks, notably in Germany, show fast and sound results for both sides," Gallois says. Though the talks have started, all indications are that they will be protracted. The discussions, which largely center on NH90 and Tiger helicopters, could also cause a further financial drain on both projects, which have been the subject of repeat EADS earnings charges, including in the 2011 financial results released on March 8.

This will also be a critical year for the A400M, with Airbus Military working to meet its first delivery target of early 2013.

The trouble spots are partly overshadowing the strengthening of EADS's financial performance. The company reported guidance-beating earnings before interest and taxes at €1.7 billion, and due to grow to €2.5 billion this year (excluding charges). Also, a gradual uptick is seen in the earnings margin for Airbus commercial programs, reaching 1.7% in 2011 from 1.1% the year before. Long-term, Ring wants the margin to reach 10%, but concedes that will be difficult through 2015 because of the startup costs associated with the A350.

The company's long-term prospects are, however, aided by a weakening of the euro against the dollar, allowing EADS to improve its currency hedging position. What is more, Ring notes that the company has shifted some airliner financing from dollars to euros as it works to reduce its exposure to currency swings. More than \$5 billion in aircraft deliveries between 2012-16 have been converted to euro contracts, Ring says, and efforts are ongoing to expand the level. ☐



Airbus is looking to boost A330 output to 11 aircraft per month starting in the second quarter of 2014.

AIRBUS/P. NICHEVE

Evergreen Twin

Boeing 787 technology could sharpen 777 competitive edge until 777X arrives

GUY NORRIS/SEATTLE

Like miners hitting a rich vein, Boeing struck gold when it began delivering Boeing 777s almost 17 years ago. Now, with advanced 777X derivatives under study for service entry around 2019, the manufacturer is looking to protect the family for the rest of the decade with a set of interim upgrades.

Driven partly by emerging competition from the Airbus A350-1000 on the one hand, and the need for constant improvements on the other, Boeing is treading the fine line between disrupting a robust product and protecting the 300-400-passenger market franchise. The 777 is critical to its income, usurping the Boeing 747 as its twinjet cash cow in the recent lean years as development spending spiraled up on the 747-8 and Boeing 787.

Details of the upgrade study, which

also includes continuous production and manufacturing improvements, emerge as Boeing sets its sights on achieving board authority by year-end to begin offering the 777X in the market. Speaking after a ceremony marking the handover of the 1,000th 777, a 777-300ER to Emirates Airlines on March 2, Boeing Commercial Airlines CEO James Albaugh said the move would be made, assuming both the business case and technical trade studies close.

As currently outlined, the 777X family consists of two main derivatives, the 777-200LR and -300ER. The new variants will be configured with extended span, all-composite wings and new-generation turbofans. Preliminary studies are focused on a 350-seat 777-8X and a 410-seat 777-9X with a target entry into service

around 2019. The interim upgrades aim to keep the 777 competitive, while paving the way for the more ambitious 777X.

Possible aerodynamic upgrades include improved seals and gaps, particularly in the wing leading edge, as well as the use of drag-reducing hybrid laminar flow control (HLFC) technology being tested for possible application on the 787-9. If adopted, the HLFC would be used only on the leading edge of the vertical fin says Bob Whittington, 777 vice president and chief project engineer.

The HLFC system reduces drag by extending the amount of surface area over which the airflow is laminar, or smoother, with a later onset of drag-generating turbulence. Although details of the technology being tested by Boeing remain scarce, the concept is based on a semi-passive suction system that is thought to have few or no moving parts. The system proved successful in tests on the 787-8, and Whittington says its eventual use is "not a question of if, but when."

Systems improvements already planned include further block point upgrades to the Honeywell Airplane Information Management System (AIMS), which provides centralized processing

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for several functions. Updated to the AIMS-2 standard in 2003, the latest Block Point VI6 software load is in testing and due to enter service in July. The new software cures communication systems and other issues and will aid with revised fuel management schedules related to the extension of 777 ETOPS to

To double Boeing 777 deliveries beyond 1,000, the manufacturer is banking on interim upgrades and 777X derivatives.

330 min. (see p. 52). The General Electric GE90-powered variant won FAA clearance late last year, while Rolls-Royce Trent 800-powered versions should be certified in mid-year. Pratt & Whitney PW4000-powered 777s are due to be cleared by year-end, says Boeing.

Further off, Boeing expects to introduce a 17th AIMS-2 Block Point upgrade at the end of 2013 to coincide with the mandated installation of controller-pilot data links and the transition to the second-generation Future Air Navigation System. Beyond this, Honeywell and Boeing are starting on an 18th Block Point software load to be introduced in 2015.

Project engineers also continue to strive for more weight reductions beyond the 500 lb. shaved off the 777-300ER since it entered service in 2004. The ongoing weight cut target—to be achieved by a combination of structural optimization, updated systems and other advances—is 100-125 lb. per year, says Whittington.

The company's upgrade studies are also mindful of the need to avoid disrupting the production system, now preparing to accelerate in rate early next year to 8.3 per month from the current seven. The "rate break" will officially begin in October ahead of the first delivery at the new level in the first quarter of 2013, or 48 production days later, says the 777's director of manufacturing, Jason Clark. The push will see a new 777 emerge every 2.5 days, against three days today. "We've never been there before—it's the highest rate for a [Boeing] dual aisle," says Clark.

The higher rate, representing 100 777s per year, comes after several years of efforts to reduce flow time through the factory. "We were at 66 days of flow [laying up of wing spars to roll out from the factory], and that's down to 49 days, which is a 28% reduction over the last five to six years," he adds. "Because of that reduction in flow, when we get to 8.3 per month, that's almost a slam dunk. The production system is ready to absorb the demand." ☐



Team Transitions

MICHAEL MECHAM/SAN FRANCISCO

Boeing is advancing its 777 and 787 programs by shuffling duties for two veterans at its Everett, Wash., widebody jet factory.

Vice President Larry Loftis has become general manager of the Boeing 787, where the emphasis is on production increases and the introduction of the airplane's long-range 787-9 variant into final assembly. He previously headed Boeing 777 production, which already is at the build rate Boeing wants the 787 to attain.

Meanwhile, Scott Fancher has relinquished his 787 general manager hat for the same role on the 777, a signal of the emphasis Boeing is now placing on the evolution of that airplane to meet an eventual challenge from the Airbus A350-1000.

A 32-year veteran at Boeing, Loftis became a specialist in the fine-tuning of moving-line assembly on the Boeing 737 narrowbody program. For the 777, which recently delivered its 1,000th aircraft, he oversaw a production buildup to seven airplanes per month. The program is set to reach 8.3 per month early in 2013.

On the 787, he will face some new production challenges. The 787 is created by integrating large wing and fuselage assemblies completed by suppliers. While Boeing relies on outsider airframe suppliers for the 777, its own workers build the entire wing and play the dominant role in assembling the fuselage. Boeing's intent is for 787 final assembly rates to more than double

from current levels to reach seven per month by late 2013 in Everett. Another three airplanes are to come from the alternate 787 assembly site in South Carolina.

Boeing Commercial Airplanes (BCA) President and CEO James Albaugh says Loftis's experience is what is needed for the 787 as it "transitions into production." Loftis will report to Senior Vice President Pat Shanahan, head of airplane programs at BCA.

In contrast, Fancher has come to the 777 as Boeing works on the 777-8X/-9X development programs. Albaugh says the move "allows us to take advantage of Scott's vast experience on development programs." This is the second major refresh of the 777 program; it will require new engine variants and is likely to introduce a composite wing, which plays to Fancher's strength on the 787.

Fancher will not be starting from scratch. Lars Anderson, who headed development of the last major 777 expansion, which produced the 777-300ER, 777-200LR and 777 Freighter, came out of retirement to initiate the X-program design studies. He will continue that work with Fancher. "Because of the importance of properly defining the next-generation 777," says Albaugh, Fancher and Anderson will report directly to him.

Morgan Stanley aerospace analyst Heidi Wood calls the moves "a prudent reallocation" of management resources. Putting the 787 in Loftis's hands "de-risks" it, while calling on the "intense familiarity" with development that Fancher gained on the 787 indicates that "a major 777 refresh is in [Boeing's] near-term plans." ☐

'Grinch' Goes East

Advanced missiles lost in Libya appear in Lebanon and Gaza

DAVID FULGHUM/WASHINGTON and ROBERT WALL/LONDON

Fears that some of the world's most sophisticated anti-aircraft weapons that disappeared from government warehouses in Libya would end up in the hands of stateless insurgent are being realized.

At least some of the roughly 480 high-performance SA-24 "Grinch" shoulder-launched missiles that disappeared during the Libyan uprising have reappeared in the hands of insurgents on the borders of Israel, say senior Israeli officials.

The advanced weapons were smuggled out of Libya to Iran. From there the supply line split, with some weapons going to Syria and finally to the military wing of the Hezbollah organization in Lebanon. Others were smuggled into Egypt and then to Hamas in Gaza.

"They are in the Gaza Strip," an Israeli official tells Aviation Week. "I don't know in what numbers. They also are in Lebanon."

The Russian-made SA-24 is a top-of-the-line, man-portable air defense system (Manpads) that is lethal to aircraft, helicopters and UAVs to an altitude of 11,000 ft. U.S. officials earlier confirmed that Libyan weapons went to Hezbollah and Gaza, but contended they did not know the fate of the SA-24s. Only empty packing crates were found in Libyan warehouses.

Opinions are mixed about the impact of these weapons.

"That should cause pause for everyone wanting to rush to the fight," says a senior U.S. congressional staffer who specializes in defense issues. However, in the few times the missiles have seen combat, they did not affect the course of the conflict. Although the weapon is one of the more advanced Manpads on the world market, Western electronic warfare experts appear to have quickly developed operational techniques to defeat it. Even without the most advanced laser-based directed infrared countermeasures systems, British WAH-64 Apache attack helicopters faced a number of SA-24 firings and defeated them.

Iran, Syria, Hezbollah and Hamas have been long linked by the exchange

Libya had several hundred sophisticated SA-24 man-portable anti-aircraft weapons that were looted and have now been handed over to Hezbollah and Hamas.



of intelligence, surveillance and arms. Syria's radar, signals intelligence and command-and-control systems, newly upgraded by Russian technicians, provide an early warning system for the Western approaches to Iran in addition to monitoring internal dissent. Iranians ran a sigint operation in Syria to support Hezbollah during the 2006 conflict in Lebanon. Israeli communications appear not to have been intercepted and decrypted, but traffic analysis of personal mobile phones provided clues to the assembly points of Israeli troops that may have telegraphed the points of offensive thrusts into Lebanon.

U.S. intelligence officials say claims of how much the Syrian systems have been improved were exaggerated in early reports, as were reports of how long it would take U.S. forces to crush Iranian air defenses and successfully stage an attack on Tehran's missile and nuclear development programs. At least one retired U.S. Air Force chief of staff said the process could be completed in three days. Critics of that assessment suggest that suppression and destruction of the Iranian shield would take longer, depending on how active Iranian defenders are in the first few days of any conflict. In recent years, foes have simply kept some sites inactive just to preserve them for pop-up attacks.

"The Syrian air defense system is being improved significantly, but not so much because of the low- and very-low-frequency surveillance radars but rather because of the introduction of the SA-17 ["Grizzly"/Buk-M2E]," the Israeli official says. "Two months ago they showed their SA-17 in public. It's a new and severe threat for all types of

flying systems including UAVs." The effective altitude range of the weapon is advertised as 100 ft. to 82,000 ft. and an effective range of 2-26 mi.

U.S. and Israeli surveillance also has tracked the movement of arms from Iran—some of them looted from Libya—into Lebanon's Bekaa Valley. At first there were reports of Syria's ballistic missiles being stored there to protect them from rebel forces. Now it appears the traffic has been Libyan arms going to Hezbollah.

"There are reports that [the missiles] are in the hands of Hezbollah, as are any types of arms that exist in Syria with the exception of the SS-21," the Israeli official says. The SS-21 "Scarab" is a 120-km-range (75-mi.) ballistic missile.

Moreover, U.S. and Israeli analysts are worried that stocks of chemicals for weapons of mass destruction (WMD) also may have been taken from Libya for sale on the black market. Both Hezbollah and Hamas have been developing or obtaining ever-larger and longer-range missiles to bombard Israel, according to Israeli analysts. The weapons—new, locally developed 8-in. rockets—were tracked by radar when test-fired from Gaza into the Mediterranean and the Sinai Desert. Hezbollah also has rockets big enough to carry WMD warheads.

The WMD threat, however, does not appear to be an active capability of Hezbollah. "We don't think so yet," the Israeli official says. Nonetheless, "there are hundreds of heavy rockets facing Israel now that could bring severe destruction to the central part of the state."

But there is an assumption in the West that Israel may yet be forced into action if Syria's large stockpile of chemical weapons is at risk of falling into in-

urgent hands. Syria has the world's fourth largest chemical weapons arsenal, and both the U.S. and Israel are keeping a close watch on it, says Mark Fitzpatrick, director of the International

Institute of Strategic Studies' (IISS) nonproliferation program. Options could include raids to extract the warheads or destroy the stocks in place.

One unknown of the current conflict

in Syria is what effects regime change might have on Iran. Fitzpatrick notes that possible outcomes range from Teheran feeling pressured to open itself to dialogue, to the country deciding it

Missile Vs. Missile

Israel's Arrow anti-missile system is slated for Block 4 upgrades, and the Arrow 3 interceptor is moving toward production.

Israel accelerates missile defenses as insurgent weapons multiply

U.S. MISSILE DEFENSE AGENCY

DAVID FULGHUM AND JEN DIMASCIO/WASHINGTON

Israel usually does not telegraph its punches or hype new technology, but now its leaders have done so. They say they are upgrading the long-range, high-altitude Arrow and other anti-missile systems and intend to test them soon.

"We are introducing Block 4," says a senior Israeli official. "That involves the new Green Pine radar [with more and better transmitter/receiver modules], new software for command and control, and enhanced performance of the Arrow 2 interceptor missiles against a variety of threats, including a much-expanded battlespace."

Two other systems are in full-scale development—Arrow 3 (Israel Aerospace Industries and Boeing) and David's Sling (Rafael and Raytheon). The latter handles threats below the Arrow's high-altitude purview but above the low-altitude Iron Dome air defense system.

"The logic behind Arrow 3 is that to cope with weapons of mass destruction or nuclear warheads, there have to be two, three or four consecutive interception opportunities," the official says. "One is not enough. Each will catch 80% of the targets."

That means in a 100-missile attack,

20 will leak through the first intercept point, but the survival rate drops to only 0.16 missiles at the fourth.

"That's why we need long-range interception," he says. "The second half of this year, we will conduct the first flyout of this missile. There will be no attempt at intercept, but next year there will be an interception."

It also will be a seminal year for David's Sling, the official asserts. "It's a very capable interceptor with the advanced command-and-control system needed to handle the heavy rockets and short-range ballistic missiles," he adds. "It's being developed by Rafael, and we plan to conduct its first interception test in the third quarter of this year, depending on the availability of the test range."

Rumors that Israel's Patriot air defense system suffered a reduction in funding are not true, according to Israeli officials. While the nation's overall military budget was reduced, missile defense was spared. Nonetheless, the increase was far smaller than officials had expected.

"The U.S. is involved in a 10-year, \$300 billion program to support Israel's security," Defense Secretary Leon Panetta told the American-Israel Public Affairs Committee policy conference in Washington. "Over and above [that], President [Barack Obama] has committed more than \$850 million in Defense Department funding for Israeli missile defense."

Joint development projects and exercises with the U.S. will continue. However, an exercise scheduled for May has been postponed until November or December.

"Even in our flight test three weeks ago, Israeli and U.S. radars tracked it and we shared and exchanged data in real time," the Israeli official says. "Also being added to this [interactive air defense] is the U.S. commitment to deploy the TPY2 radar in the Negev Desert and other places in the Middle East." The advanced, X-band TPY-2 was designed as a Patriot PAC-3 improvement.

Carl Levin (D-Mich.), chairman of the Senate Armed Services Committee, describes the mutual support program as

needs to pursue its nuclear program even more fiercely to protect itself. What is more certain is that there would be a disruption of the supply lines between Iran and Hezbollah.

A secondary effect of the fighting in Syria could be increased Iranian pressure on Iraq. There is concern in Baghdad that if Tehran suffers a strategic defeat from the loss of a

key ally, Syria, it may try to offset the impact by expanding its influence in Iraq, says Toby Dodge, a consulting senior fellow on Middle East affairs for IISS. ☛

an under-recognized factor that could help pressure Iran to abandon its nuclear ambitions, and he cites Iran's missile arsenal as the primary threat to Israel. When combined with nuclear weapons, "it must be thwarted," Levin declares. "Israeli missile defense systems provide a formidable, layered defense against a full range of missile threats."

Do Israel's future defenses include directed-energy, lasers and high-power microwave (HPM) weapons? Perhaps, but those devices will have to be cheaper, less manpower-intensive and more efficient than the kinetic weapons they replace.

"The introduction of directed energy to missile defense is always an option," the Israeli official says. "We are flexible and open to evaluating all types of directed energy, including HPM systems. It is a question of price. If we see the prospect of additional capabilities,

within reasonable time and cost, why not? We are doing such tests, and we are evaluating these technologies all the time."

Because of the short times of engagement involved in protecting commercial jet aircraft, lasers will remain the best approach. However, weather limits range. When range is reduced by 50%, the defended area drops to 25%, the official says. And while the cost of a single shot is low, the life-cycle cost is high. What planners want is fewer missiles with larger footprints, he adds.

Israel's small population is also a problem for manning an extensive air defense network.

"The nation is limited by funds and manpower," the official says. "It has only 7.5 million people. So the number available to man an around-the-clock defense is small. Therefore, some of the

batteries—such as Iron Dome—will be populated by [military] reserves."

This situation is problematic because rockets and missiles in the hands of Israel's neighbors are increasing in numbers and sophistication.

"There is an arms race in the Middle East," the official declares. "That means there are offensive improvements not only in quantity but quality. In 2004, the first Qassam rockets were fired from Gaza to Israel. Now they have almost 10,000 rockets and some of them [such as the Fajr 5 and a locally developed 8-in.-caliber weapon] have a range of about 50 miles, which threatens the center of Tel Aviv."

On the Israeli side of the equation, the Iron Dome has three fielded batteries of at least three launchers each. A fourth will be deployed this year, followed by two more in 2013. ☛



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Balancing Act


U.K. weighs program changes to bring defense budget in line

ROBERT WALL/LONDON

In perhaps a sign of its seriousness in wanting to balance its defense equipment plan and budget, the U.K. is contemplating reversing a key modernization decision by again switching which F-35 Joint Strike Fighter model the country will buy.

The potential move to commit the U.K. to once more buying the F-35B short-takeoff-and-vertical-landing version, two years after it was abandoned for the carrier-version F-35C, is being discussed as the Defense Ministry looks to complete its latest defense planning round (PR12). At the time of the switch, the Defense Ministry argued that the F-35C's greater range and enhanced weapons carriage made the change worthwhile, even though it would require modifying existing aircraft carrier designs and delay fielding of the carrier strike force.

U.S. NAVY



Having abandoned the F-35C, the U.K. is mulling a return to the F-35B, the aircraft type that has begun weapons trials, shown here with the AIM-9X and gun pod.

When the U.K. made the switch, the Defense Ministry acknowledged it did not have a complete understanding of all the cost implications. In now defining those costs, they are exceeding initial assumptions, mainly associated with modifying the aircraft carrier. The costs "are exploding," says an industry official watching the discussions. A second official notes that a bill once estimated to be around £500 million (\$791.4 million) has now ballooned to £1.5 billion.

Although most of the cost deliberations are linked to the aircraft carrier, there are some F-35 costs that could be mitigated by returning to the B model. For instance, because the U.K. initially was due to purchase that version, the F-35B has been configured to allow for internal weapons carriage and release of the Asraam dogfight missile. The F-35C may need to be structurally enhanced to allow for the use of that weapon.

A reversal could also address another concern of senior Royal Navy officials: building up the skill set for large aircraft carrier operations beyond those associated with flying aircraft. Those include orchestrating the complex deck operations for seamless launch and recovery operations.

There are also public perception issues that could cause the Defense Ministry to think twice, not least because the switch to the F-35C was a centerpiece of the Strategic Defense & Security Review in 2010.

But what has changed since then is a switch at the top of the ministry. Defense Secretary Philip Hammond has made balancing the books a major priority, notes a senior military official. That has led to the particularly close scrutiny being given to PR12 and, in effect, led to the delay in closing the books. The Defense Ministry will not pinpoint when the process, which was expected to have been completed last month, is due to wrap up, saying only it will be done before April 5.

Hammond also is looking to build some budget flexibility into the long-term spending assumptions past 2014. To help guard against program delays and cost increases, as well as to be able to respond to new requirements, the long-term equipment plan will likely leave headroom between the budget topline and equipment plans to respond to unforeseen circumstances, says a ministry official.

The budget flexibility also may be needed as the ministry determines which unfunded operational requirements (UORs)—fielded for Afghanistan—will be retained. The UORs are largely financed by the treasury, but once they become part of the formal equipment program, the entire bill should shift to the ministry. With the U.K. looking to complete its involvement in Afghanistan in 2014-15, any bills associated with maintaining UOR capacities would come due then.

The focus in the PR12 program review now being finalized is less on balancing the 10-year equipment budget than making sure the next few years are in balance—not just over the span of that period, but actually year by year. That is forcing several more difficult spending decisions, which has delayed completion of PR12.

Although the ministry is reluctant to discuss elements of PR12, it acknowledges that the carrier strike program is one of the issues being examined as part of the deliberations. The prospect of a change in the F-35 strategy was first raised by Labour shadow Defense Secretary Jim Murphy in a letter asking Hammond for information on the issue. The letter, first reported by *The Guardian* newspaper, described the potential change as "worrying."

The discussions appear decoupled from a U.S. decision

to defer purchase of 179 F-35s, which is likely to drive up near-term costs. However, U.K. Defense Equipment Minister Peter Luff recently told Parliament that the unit cost increases were manageable within the U.K.'s spending plan. Although long-lead funding is expected to be approved this year for the first production purchases, a firm commitment from London to the initial batch of operational F-35s is not expected until next year.

The Pentagon's decision to take the F-35B off probation may also make the switch more palatable.

This year, the U.K. is to receive two F-35B test aircraft and has made arrangements with the U.S. to convert a third to a "C" model when it shifted its procurement focus to the

carrier configuration. Uncertain is whether the U.K. will aim to reverse that decision if it refocuses its long-term plans on the F-35B.

For the Defense Ministry, there are still other F-35 issues being debated, although most of those will not reach the critical decision point for some time. One is how much to push Lockheed Martin to fully exploit the aircraft's intelligence-gathering capability. Another concern is that an F-35 could collect so much data that it could dwarf an aircraft carrier's communications if all the collected information had to be retransmitted to intelligence centers ashore, says the military official. Sorting through those issues will take several more years, though, he concedes. ☐

UAVs for Hire

New contracts boost the growing unmanned-aircraft fee-for-service market

GRAHAM WARWICK/WASHINGTON

Unmanned aircraft are maturing fast and, with Pentagon procurement slowing, more companies see a growing market in operating fleets of vehicles to provide intelligence, surveillance and reconnaissance services on behalf of customers. This is bringing new competitors into the market.

The U.S. Navy has qualified AAI Corp., Boeing Insitu and CSC to bid competitively to provide sea- and land-based ISR services under a five-year, \$874 million contract vehicle. AAI and Insitu both have experience in operating their unmanned aircraft systems in the field, but this is a new business for information technology services giant CSC.

"We have not done ISR services before, but this is not a design and development contract, it's operations—and CSC does billions of dollars of that. It's a business model very familiar to us," says Bob Frizzelle, vice president and general manager for ISR mission systems.

Under the Navy's new ISR contract, Insitu has won the first task order for sea-based services, with its ScanEagle unmanned aircraft system, says an industry source, while AAI will perform the initial two land-based services tasks, with its Aerosonde UAS. AAI has also won a contract potentially worth \$600 million to provide ISR services, again with its Aerosonde, to U.S. Special Operations Command (Socom).

CSC has qualified to provide land-

based services to the Navy with the Arcurus UAV T-50, but has yet to win an ISR task order. "The aircraft are bought and paid for. Our people are trained. We're not in the money, but we are in the hunt," says Frizzelle. The company proposed the vertical-takeoff-and-landing Saab Skeldar for the sea-based portion of the contract, but was excluded because the unmanned helicopter did not have the required mission duration.

Both the Navy ISR services and Socom Medium-Endurance UAS II programs will replace sea- and land-based surveillance services that have been provided by Boeing and Insitu using the ScanEagle UAS. Under services contracts, ScanEagles have accumulated more than 575,000 combat flight hours since 2004 operating from ships and land for the U.S. military and allies.

"The market is going to fee for service, and is less about which vehicle you offer," says Fred Strader, CEO of Textron Systems, of which AAI is an operating unit. "Fee for service arose during the Iraq and Afghanistan wars, and makes sense when technology is changing a lot," he says. "For five years, the Navy will not be tied to any one company, until they buy systems down the road."

The ISR services program will bridge the gap until the U.S. Navy and Marine Corps' own Insitu RQ-21A small tactical unmanned aircraft system (Stuas) is fielded beginning in 2013. In January, In-

With its Aerosonde unmanned aircraft, AAI Corp. is taking business away from ISR services incumbent Boeing Insitu's ScanEagle.

situ delivered two Integrator UAS to the Navy to provide an early operational capability for the Stuas program. The first system is being used for Marine Corps predeployment training at Twentynine Palms, Calif. The second was delivered to the Navy.

Frizzelle says the Navy's "level of service" requirements under the ISR services contract are similar to the quality-of-service demands built into IT outsourcing contracts. "You prebid a fixed price for a level of service and if you miss it they decrement your fee." The Navy set requirements in areas ranging from mission duration to the resolution of full-motion video from the UAS's electro-optical and infrared sensors.

CSC decided to enter the ISR services market after acquiring CenTauri Solutions in December 2010. Providing services was seen as an extension of the small company's experience integrating ISR sensors on to the Scheibel S-100 unmanned helicopter for the Joint Improvised Explosive Device Defeat Organization's Yellow Jacket program. "Platforms are becoming a commodity," says Frizzelle. "And once they are a commodity, companies like CSC can be competitive as service providers." ☐



AAI CORP.

Thrust for the Moon

Engineers in China's space industry pursue an enormous range of engine developments

BRADLEY PERRETT/XIAN, CHINA

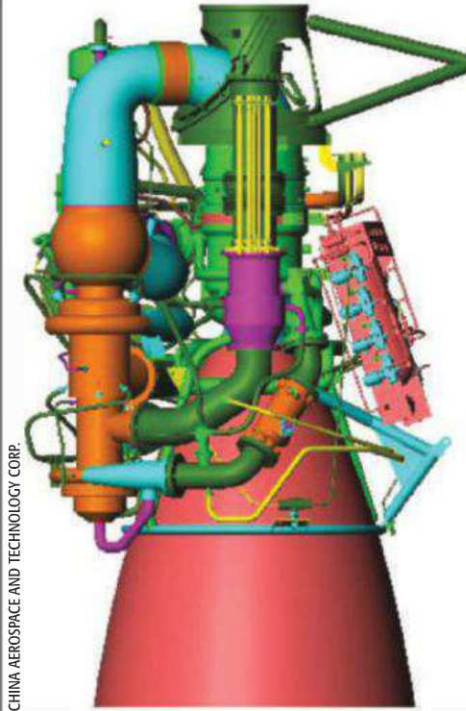
China is nearing what many space engineers think is the ideal for a family of space launchers: a set of rockets built with just a few standard engines and airframe modules, maximizing production runs. The family—the Long March 5, 6 and 7—will cover the 0.5-25-ton payload territory to low Earth orbit and up to 14 tons to geosynchronous orbit, meeting the great bulk of space launch demands.

So it may come as a surprise that the launcher and engine firms under national space industry group CASC are not satisfied. They are looking at introducing solid rockets into the mix, as boosters or small launchers, including some dropped from aircraft. The Long March 7, at least, will get non-standard second stages as its manufacturer, CASC subsidiary CALT, looks for ways to vary its payload (see following article). Chinese engineers are also working on engines fueled by methane or liquefied petroleum gas.

Although the major engine for the new launcher family, the YF-100, is now revealed to offer excellent performance with an advanced operating cycle, the industry's main propulsion center, the Academy of Aerospace Propulsion Technology (AAPT), sees reasons to replace it with a much bigger unit. Under that scheme, the big new engine would then be doubled to form the basis of a second powerplant for China's proposed Moon rocket.

Yet maybe all this should not come as a surprise. China's space program is clearly well funded. And the country's devotion to engine development was flagged in 2010 when CASC President Ma Xingrui told a delegation of U.S. space engineers and scientists: "I remind government leaders that engines are the heart of space launch technology, and that is where money must be invested."

The engine developers have quite a few ideas of how they can spend the money that Ma is obtaining for them, beginning with the expectation that China needs two launchers bigger than the Long March 5—one lifting more than 35 tons



CHINA AEROSPACE AND TECHNOLOGY CORP.

The YF-100 engine, with a staged-combustion cycle, has achieved a sea-level specific impulse of 305 sec.

to low Earth orbit for manned missions, and the "super-heavy" Moon rocket, research on which has been approved.

With no engine producing more thrust than the 120-metric-ton (260,000-lb.) YF-100, China is still far behind other countries in space propulsion, AAPT engineers Li Ping, Li Bin and Zou Yu told the Asian Joint Conference on Propulsion and Power here on March 2-3. "The thrust requirement of future Chinese heavy or super-heavy launch vehicles is on the order of 4,000-7,000 kn [900,000-1,570,000 lb., about 400-700 tons]" per engine, the officials write in the paper, part of which was also published last year, attracting little attention.

Such an engine would represent a technical and economic challenge. The proposed solution is to first make the largest engine for which China has a viable commercial use, using familiar liquid oxygen (LOX) and kerosene propellants.

"Based on available technologies and test facilities in China, it is possible to

develop a 2,000-3,500-kn [450,000-790,000] class LOX-kerosene engine with single chamber in [a] short time," say the AAPT engineers. This engine "can be applied to optimize the configuration of [the Long March 5] launch vehicle to reduce engine number and to increase reliability. The second step is to develop the 4,000-7,000-kn-class heavy thrust engine with double chambers with a heavy-power turbo pump."

CALT has said that a Moon rocket would need 3,000 tons (6.6 million lb.) of thrust at liftoff. In an earlier paper, Li Ping and Li Bin showed two possible launcher configurations. Both had two 9-meter-dia. (29.5-ft.) core stages (compared with a maximum of 10.1 meters on the Saturn V first stage) and four 3.35-meter-dia. kerosene-fueled boosters. In one configuration, the first core stage was fueled by hydrogen, which gives more impulse for its mass, and the other by kerosene, which would be easier to develop and is now backed by the researchers.

The upper stage would use hydrogen. In the earlier paper, the engineers say it is "necessary" to develop a new hydrogen engine of 1,500-2,000 kn, compared with the 700 kn of China's current largest, the YF-77 of the Long March 5.

In its biggest configuration, the Long March 5 will have four boosters each mounting two YF-100 kerosene engines, plus two hydrogen-fueled engines in the core. Using 10 engines at liftoff heightens the risk of failure, and so the Long March 5's design has been highly controversial in the Chinese industry.

Separately, China has been working on a staged-combustion hydrogen engine for the highest possible specific impulse. The Long March 5's core engines use the simpler gas-generator cycle.

The paper presented to the conference can be taken as an approved guide to AAPT's thinking, since its contents would not be discussed without careful consideration by the authorities. But development of the proposed engines and their launchers has not been approved; AAPT and CALT could yet decide on another path.

New solid-rocket launchers are definitely on the way. The Long March 6, using a YF-100 first stage, has been described as small, responsive launcher, meaning that it can be used promptly. But CALT Principal Engineer Shen Lin told the conference there would be a "new generation of solid launch vehicles, air-launch vehicles and LOX-methane

liquid launch vehicles [following a] concept of quick response, small size, low cost and high reliability.”

These launchers will loft small satellites to help deal with natural disasters, Shen says. Western analysts also see military uses—potentially hurling anti-satellite warheads or rapidly launching a reconnaissance spacecraft to acquire urgent targeting data.

Solid-propellant rockets can be launched much faster than even small liquid-propellant rockets such as the Long March 6, notes Eric Hagt, a U.S. analyst who closely follows Chinese space activities. And in modern battle concepts, “immediacy is pretty important.”

Shen gave no figures indicating the size of these solid-propellant rockets, but one industry official says they may also be introduced as boosters for the new Long March family, with the aim of cutting costs—even though that seems counter to the economical scheme of kerosene-fueled modules. China is developing segmented solid rocket boosters, say Li Ping and Li Bin. If the new boosters are related to the new solid-propellant launchers, then the latter are probably not closely related to Kaituoze 1 (Explorer 1) launcher, a ballistic-missile derivative revealed in 2001.

The Chinese will have to build the solid-propellant launchers at a fairly high rate, perhaps exploiting modularity and segmentation, says a senior U.S. space technology executive. Otherwise they could turn out to be more costly than liquid-propellant engines. The air-launched rockets would be part of the solid-propellant family, says a Chinese official.

The solid-propellant development is not the only Chinese propulsion effort that raises questions of duplication. Foreign executives wonder why China is bothering to pursue a methane launch engine when it already has good powerplants of the right size using kerosene and hydrogen.

Engineers have tested methane fuel by adapting hydrogen engines, using turbopumps instead of tank pressure to feed the combustion chamber, says a Chinese official. A thrust of 60 tons has been officially disclosed, along with possible uses for methane in spacecraft, as distinct from launchers. But Shen’s remarks associated the technology with rapid-response launchers—suggesting that Chinese engineers are working on three kinds of engines for the same task: kerosene, solid and methane.

Moreover, China plans to develop a kerosene engine for in-space use, seeming to duplicate the methane work in that area, too. Chinese engineers have also investigated using liquefied petroleum gas as a fuel.

While some CALT engineers are drawing up their plans for the two launchers that would surpass the Long March 5, others are looking further into the future at reusable or semi-reusable spacecraft.

At this early stage, the most promising prospect seems to be a winged orbiter that would act as a second stage on an expendable first stage, says one person familiar with the studies.

CASC’s full name is the China Aerospace Science & Technology Corp. and CALT’s is the China Academy of Launch Technology. The Xian conference brought together researchers from China, Japan and South Korea. ☛

Five Follows Seven

Details of China’s new launcher family emerge

BRADLEY PERRETT/XIAN, CHINA

China’s new medium space launcher, the Long March 7, should fly late next year, entering service in an initial version capable of lifting 13.5 metric tons (30,000 lb.) to low Earth orbit, making it significantly larger than current Chinese rockets.

fuel burned in generating it. That performance is excellent, say foreign engineers. The Long March 7’s 18-ton-thrust kerosene second-stage engine also has staged combustion.

The Long March 7 and its smaller sibling, the Long March 6, are overtaking

LONG MARCH 7

Propellants	Liquid oxygen, kerosene
Core stage 1	2 X YF-100, 260,000 lb. thrust each
Core stage 2	1 X 40,000 lb. thrust
Boosters	4 X YF-100, 260,000 lb. thrust each
Core diameter	3.35 meters (11 ft.)
LEO payload	13.5 tons
Sources: CALT and industry officials	

The launcher will have four boosters, says Shen Lin, the principal engineer at manufacturer CALT, adding that China is also planning new upper stages.

Speaking at the Asian Joint Conference on Propulsion and Power here March 2-3, Shen confirmed that the Long March 7 is following its originally planned configuration, with kerosene fuel. Its boosters and core first stage are to be driven by China’s new standard engine, the YF-100 of 120 metric tons (260,000 lb.) thrust.

The YF-100 has staged combustion, say officials, referring to a challenging but efficient operating cycle. At sea level, the engine has achieved a 305-sec. specific impulse, a measure that compares the level and duration of thrust with the

the biggest member of China’s new rocket family, the Long March 5, whose development began first. The Long March 6 is running behind the Long March 7 by only a few months, if at all, says an official. The Long March 5 is introducing more new technology than the other two. It will make its first flight in 2014, according to an official schedule restated by CALT Deputy Chief Liang Xiaohong.

The Long March 5 is expected to be much more costly than earlier Chinese launchers, and not only because it is so much larger, says one engineer familiar with the program. Asked about this, an official says: “It will be expensive by Chinese standards, but not by American standards.”

Cost competitiveness is an issue for



The Long March 7, although seen in this 2007 drawing with three core stages, will first appear with two. Long March 5 will have six combinations of stages and boosters.

Climate Change

ESA to ask members for billions for Earth-observation programs

AMY SVITAK/MUNICH, PARIS and CANNES, FRANCE

A sigh of relief swept the room last month at the European Space Agency's headquarters in Paris as top ESA and industry officials watched the signing of the 19-nation organization's largest and possibly most politically charged satellite contract.

Awarded two years ago to an industry team led by Thales Alenia Space of France and Italy and OHB Technology of Germany, the €1.26 billion (\$1.8 billion) contract was hotly contested by elements of the German government, which lobbied for a larger role for EADS-Astrium's German satellite division in developing the six Meteosat Third-Generation (MTG) spacecraft.

Under intense political pressure that threatened to undermine the integrity of its procurement process, ESA held firm, preventing the contract decision from being overturned by its largest financial contributor. The space agency did concede to boost OHB's role in the project, while finding more work for Astrium than it would have had under the initial Thales/OHB bid.

Volker Liebig, head of ESA's Earth-observation program, said at the contract signing, "It was hard work to arrive at this point, but it has been achieved."

MTG is designed to operate in geostationary orbit for 20 years beginning in 2018. ESA is paying 56% of the spacecraft's total contract value, while the European Organization for the Exploitation of Meteorological Satellites (Eumetsat) is covering the remaining 44%. Eumetsat, based in Darmstadt, Germany, will pay for 70% of the €2.4 billion MTG program as a whole.

With the MTG struggle behind it, ESA now turns its attention to the Nov. 19-21 ministerial-level meeting in Italy, where details of its forthcoming five-year budget will be hashed out.

ESA will ask its member states to volunteer contributions in support of agency programs with the expectation that national industries of participating governments will receive contracts equivalent to 90% of their financial backing. Despite the promise of geographic return, however, the sovereign debt crisis in Europe now is making it difficult for governments to finance any optional programs, including Earth observation, particularly when ESA is already seeking a pile of money for a next-generation, polar-orbiting meteorological satellite system that ESA and Eumetsat would fund jointly.

Designed in a two-satellite configuration, the Eumetsat Polar System-Second Generation (EPS-SG) comprises a constellation of weather satellites carrying sounder and imaging instruments designed to succeed existing Metop spacecraft by 2020. ESA, which will finance design and development of the satellites, will seek at least €715 million from member states in November for its role in the project. But the search for money in a tight economic environment was not helped last year when the U.S. National Oceanic and Atmospheric Administration withdrew funding for the spacecraft's Advanced Technology Microwave Sounder (ATMS) instrument, leaving ESA and Eumetsat to foot a bill that Liebig says amounts to more than €60 million.

Even if ESA approves the program in November, Eumetsat must secure financial commitments from its own 27 member governments for the estimated €2.85 billion project, as funding of its programs must be unanimously agreed upon. Eumetsat Director General Alain Ratier says he is confident that members will support the project, though drawing support for even low-level preparatory work to the tune of €41.2 million in 2012-14 has been a struggle.

"There are difficulties in certain countries, and every country has its own view of its expenditures," Ratier says, alluding to new governments in Greece and Spain that need time to figure out how to deal with their respective debt crises. "The question is whether the time line is sufficient to get full approval in July, but we don't think it will be a problem."

Under pressure to begin the preparatory work this year, Ratier says he is looking at workarounds. "There are legal ways to start without having everybody on board at a given

the commercial market. But for China's military requirements, the key feature of the Long March 5 and 7 is payload. Whereas the U.S. uses launchers capable of throwing 20 metric ton loads into low Earth orbit (LEO), China has been unable to loft a satellite heavier than about 9 tons. That will soon change. Although this new family is supposed eventually to supplant the current launchers, the first version of the Long March 7 is above their payload range.

The YF-100 is also the Long March 5's booster engine and the Long March 6's first-stage core engine. Six YF-100s will propel the Long March 7—two in the core first stage and one on each booster.

CALT, a subsidiary of national space conglomerate CASC, is developing the Long March 5 and 7. It made the pre-

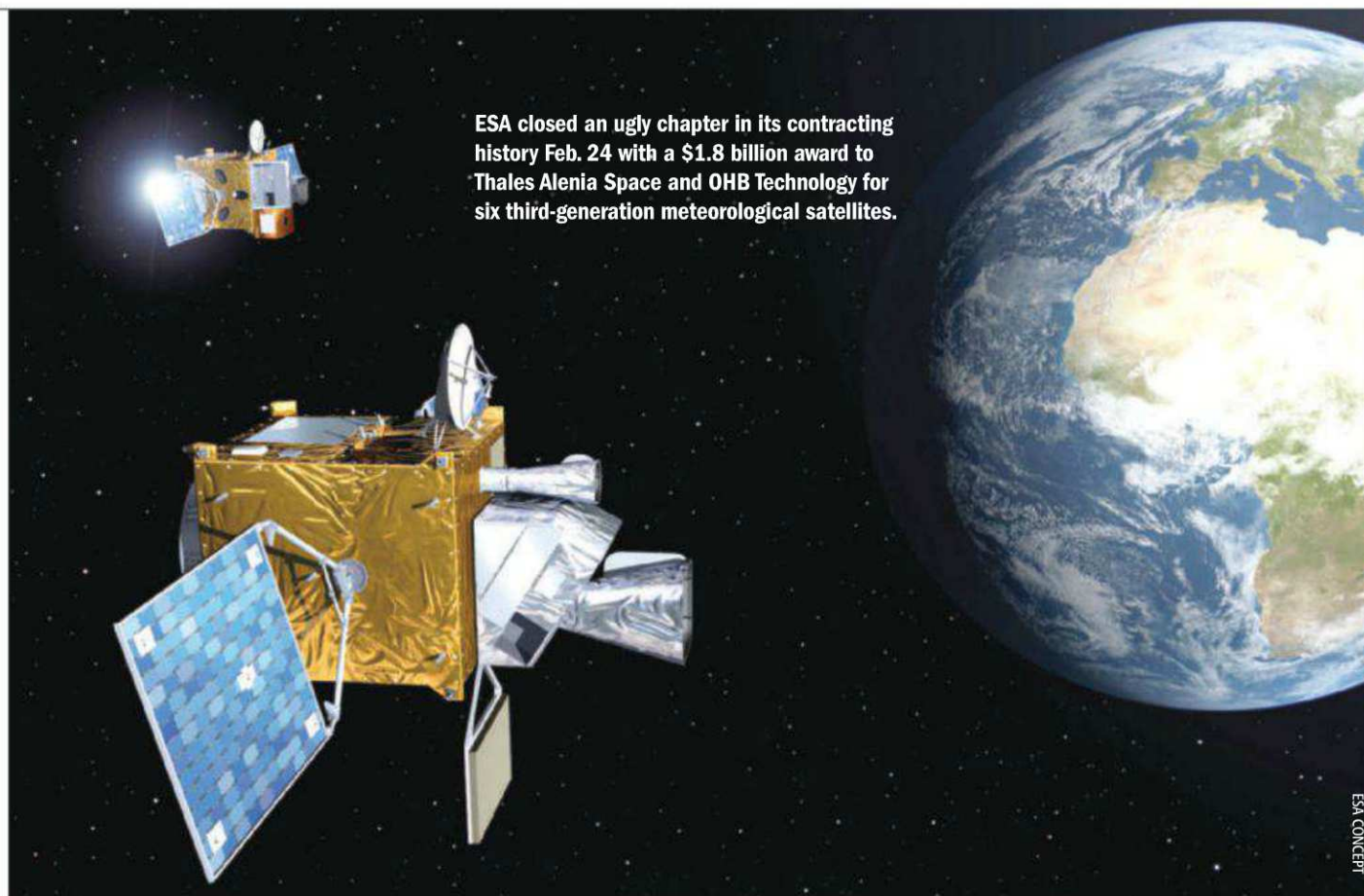
liminary design of the Long March 6, but CASC assigned detail design and production to another subsidiary, SASC. The exact configuration of the Long March 6 is uncertain. In the preliminary design, its first and second stages used the smallest of China's three standard body diameters, 2.25 meters, but officials told Aviation Week in 2010 that it would be built with the same 3.35-meter diameter as the Long March 7. Other Chinese engineers now say they assume it is still going ahead with the narrow body.

Its throw-weight is also unclear. Yu Mengjun, a member of the general design section of CALT, says it will be able to deliver "not less than 1 metric ton" to a sun-synchronous orbit of 700 km (435 mi.) altitude, implying rather more to lower orbit with a shallower angle to

the equator. But the whole Long March 5, 6 and 7 family is described as covering the LEO payload range of 0.5-25 tons.

The three diameters form a modular family. The Long March 7 uses the 2.25-meter modules as boosters. In a further important rationalization, all of the new rockets will use a new launch base being built on Hainan, says an official. The Long March 5 can only be fired from the seaside Hainan base, because its body diameter exceeds the loading gauge of the Chinese railways.

The throw-weight of the Long March 7 will be varied by introducing the new upper stages that Shen mentioned, says an official familiar with the plans. That person says China can easily develop several different upper stages because it has quite a few engines of appropriate size, including old hydrazine engines. ☼



time but with the understanding that they will come," he says.

ESA is also expected to seek €1.9 billion over five years for its fourth Earth Observation Envelope Program, which includes several satellites. Another €405 million would fund the Sentinel 5 instrument slated to fly on a Eumetsat spacecraft under the Global Monitoring for Environment and Security (GMES) program as well a series of Jason ocean altimetry satellites.

Moreover, faced with a June deadline to commit to launch the first GMES Sentinel satellite in mid-2013, ESA may store

the spacecraft if the European Commission opts not to fund €5.8 billion in GMES operations in its next seven-year budget.

Liebig says the European Union's new Danish presidency is expected to decide in May whether to include GMES among a list of programs to be negotiated within the EC's multi-year budget. In the meantime, Liebig says ESA is willing to absorb about €2 billion in R&D costs associated with GMES and the Galileo satellite navigation system, which could lower the EC's GMES commitment to about €3.8 billion. ☼

Dead On Arrival

NASA managers face another uphill battle on human spaceflight, science priorities

FRANK MORRING, JR./WASHINGTON

U.S. space-policy leaders remain divided over NASA's direction as President Barack Obama's first term winds down, with another slugfest between the White House and Congress over the agency's fiscal 2013 budget request likely this year.

The chairman of the House Appropriations subcommittee that funds the space agency has rejected plans to immediately shut down cooperation with the European Space Agency (ESA) on robotic Mars exploration. And based on questioning in the first round of hearings on NASA's new budget, the "balance" between spending on the agency's internal follow-on to the retired space shuttle fleet and on seed money for a private fleet of crew vehicles to service low Earth orbit continues to be a major point of contention.

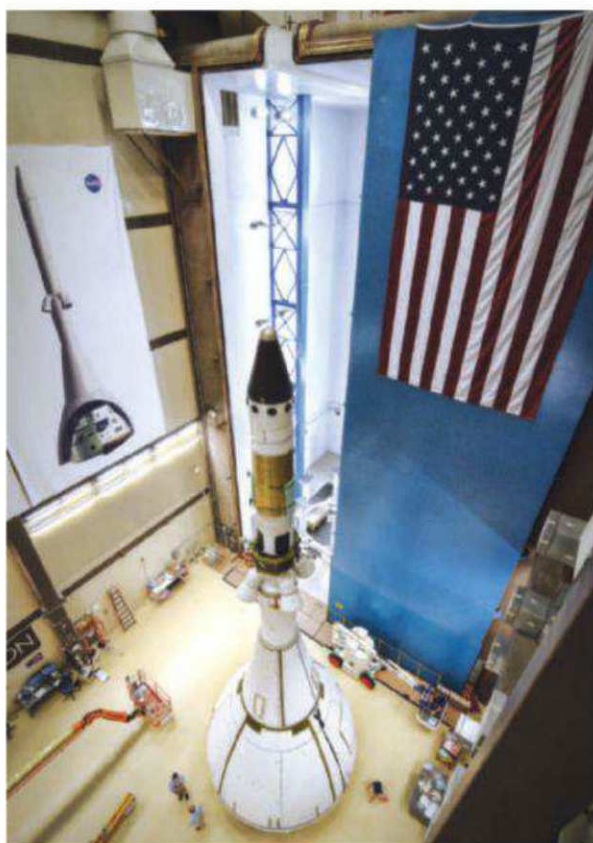
In his first trip up to Capitol Hill with the \$17.7 billion request, Administrator Charles Bolden ran into unusually sharp questioning from a strategically placed Republican senator, who says the agency was "fudging the future" by shifting funds from the Orion multipurpose crew vehicle (MPCV) and its Space Launch System (SLS) heavy-lift rocket to the commercial crew development (CCDev) account.

Instead, the senator, Kay Bailey Hutchison (Texas), has a suggestion: The agency should cut back on the number of companies receiving CCDev funding.

"I see a \$326 million combined reduction in Orion and SLS, and a corresponding increase of \$330 million for commercial crew," she says. "And I was frankly floored . . . that it would be so blatant to take it right out of Orion and SLS and put it into commercial crew rather than trying to accomplish the joint goals that we have of putting forward both."

Hutchison was a key broker in the compromise between the White House and Capitol Hill that preserved the over-

budget James Webb Space Telescope, funded Orion and SLS for deep-space human exploration, and allocated funds to help private companies develop commercial routes to the International Space



LOCHHEAD MARTIN

The first Orion crew vehicle, with launch abort system attached, underwent acoustic testing last summer.

Station (ISS) under the CCDev program. She is the ranking Republican on the NASA-authorizing subcommittee and on its appropriations subcommittee in the Senate.

Even before Bolden testified before the House and Senate authorizing committees March 7, Rep. Frank Wolf (R-Va.), chairman of the House Appropriations subcommittee on commerce, justice and science, weighed in on the issue of Mars exploration by rejecting a fiscal 2012 reprogramming NASA requested. He says this would "drastically

scale back spending on Outer Planets Flagship missions" in addition to abandoning U.S. cooperation with ESA on the ExoMars missions set for 2016 and 2018.

"[T]he committee believes that so radical a change in policy needs and deserves to be fully considered by a process that is more rigorous" than the reprogramming notification, Wolf wrote in a Feb. 29 letter to Bolden. He suggested the appropriations process for the fiscal 2013 budget would be a better forum for that debate.

Hutchison notes that after the planned first flight of Orion and SLS there will be a four-year "gap" before the stack can fly with a crew on board.

Bolden argues that the CCDev competition will hold down the ultimate cost of commercial crew transport, and says: "We have not slowed the development of SLS and MPCV."

An agency official says although Hutchison is correct that funding for SLS and Orion would be cut, the more accurate figure for the size of the cut is \$144 million when ground-support development is removed from the equation. And Hutchison's figures don't take into account "the continued closeout of shuttle," which saved NASA enough—\$486 million—to cover the \$424 million increase in commercial crew, the official notes.

Bolden says the 2017 date for a first flight of the full SLS/Orion stack is fairly well established, but the 2021 flight-with-a-crew date is "conservative" and could change with additional cost and schedule reviews later this year. On the commercial side, however, Bolden blames the congressional cut in fiscal 2012 for the slip to 2017, and

says that without "full funding" of the fiscal 2013 CCDev request, the date could slip even further.

The administrator ran into the same issues in the House, where Science Committee Chairman Ralph Hall (R-Texas) says he did not agree with NASA that there would be a market for commercial crew vehicles beyond "NASA-funded ferry flights" to the ISS. The skepticism was bipartisan.

"I wonder if you can tell me how we can expect support on this committee for a 104% increase when you've yet to provide to us, despite being asked numerous times, a credible cost and schedule estimate?" asks Rep. Donna Edwards (D-Md.). ☛

Slow Progress

Streamlining Europe's air traffic flows is taking longer than expected

ADRIAN SCHOFIELD/AMSTERDAM

This year is supposed to be pivotal for Europe's ambitious effort to redraw its convoluted airspace. But even if states meet deadlines to form new cross-border airspace blocks, airlines are skeptical that this will bring the project's promised efficiency gains any closer to reality.

Air navigation service providers (ANSPs) argue that crucial steps have been taken to unravel complex political and bureaucratic obstacles. The International Air Transport Association (IATA), however, says the process is so badly off course that Europe is in grave danger of missing this opportunity to streamline its busiest routes.

A cornerstone of the wide-ranging Single European Sky initiative is forming functional airspace blocks (FABs), which would eliminate many of the national boundaries that complicate traffic handling. This would also allow consolidation of facilities and functions to reduce costs and, by extension, the fees paid by airlines.

In European Union legislation passed in 2004, states agreed to negotiate among themselves to form FABs. Since the beginning of this program, many observers doubted that the states would be able to do so without strong direction at the pan-European level, or that they would be willing to cede sovereignty over their airspace. So in many respects it is remarkable that they have progressed as far as they have.

States are coalescing into nine multinational airspace blocks covering almost all of Europe. They range from two-nation partnerships to the multinational grouping known as FAB Europe Central (Fabec).

The FABs are required to submit their plans to the European Commission by June 24 to receive comments



Nine multinational blocks will replace the jigsaw puzzle of Europe's airspace boundaries, although it remains to be seen when the full benefits of this approach will emerge.

from airlines and other stakeholders. And by Dec. 4, every FAB must be fully operational.

All the proposed FABs are likely to meet the December deadline. However, while this requires the FABs to be formally and legally established, the work to deliver the efficiency benefits will only just be beginning. This means that the FAB proposals are "still a cosmetic exercise," says Hemant Mistry, IATA's director for industry charges, fuel and taxation. He sees the December deadline as nothing more than ANSPs and states "getting together and naming themselves as being participants in FABs—and that in itself will not create the result we need" from the FAB process.

Having examined the FAB agreements, IATA "sees little that is significant in terms of infrastructure rationalization, or opportunities for that [to occur]," says Mistry. The level of cooperation proposed could have been achieved without the need for FABs, he says.

IATA and many other stakeholders believe that the FABs should be designed around traffic flows instead of being based on nations grouping together.

The process can still be put back on track, says Mistry. However, it would take "a step change in the way [states and ANSPs] are thinking" about FAB development. "There needs to be a realization that what they are doing so far is not going to create the scale of improvements expected."

Eurocontrol Director General David McMillan agrees that the FAB process is not moving as quickly as many stakeholders had hoped. By the end of the year FABs will be established in Europe, but "the question is how big of a difference they will make."

Industry criticisms of the FAB plans submitted in June will call for them to go faster and further toward the Single Sky goals, McMillan predicts. And they will likely "lament a lack of ambition" in delivering benefits.

However, McMillan stresses that the slower-than-expected progress should not be surprising, because the states and ANSPs were given a very daunting task. So far they have been mainly focused on establishing the institutional and political framework for the FABs, and in doing so they have had to deal with some tough issues.

It has been difficult for groups of independent ANSPs to begin to work as essentially a single provider. "Finding the right mechanisms to act as one [entity] is proving quite challenging," says McMillan. For example, the ANSPs have different charging rates, so moving toward a common fee regime is complicated.

However, McMillan says he has observed substantial work being done on the difficult questions. While a lot of focus has been on the FAB governance, there is also "a huge amount of activity" on the service-provision side. And even if this year's deadlines are not as

meaningful as many had hoped, “the timetable process is a useful discipline,” he says.

“I still believe the [FAB process] will build momentum and will deliver” the predicted benefits, says McMillan.

One of the keys will be ensuring strong partnerships among the FABs. This will be particularly true of the relationship between the U.K.-Ireland FAB and Fabec, he says. Between them they will oversee the busiest traffic routes, involving London, Paris, Amsterdam, Frankfurt and Munich. Getting these flows right will go a long way to solving Europe’s airspace problems.

McMillan says there are probably still too many airspace blocks under current FAB plans. But he says the

The December deadline is in many ways ‘the start of the story’ for FABs

focus now should be on getting the nine proposed FABs up and running, as further adjustment will still be possible later.

The December deadline is in many ways “the start of the story” for FABs, says Daniel Weder, who is chair of Fabec’s Air Navigation Strategic Board as well as CEO of Switzerland’s Skyguide. The framework will be established by December, but after that the ANSP groups will “have to fill out the framework with content.”

Defining the relationships among all the service providers was a major challenge, says Weder. Fabec involves 10 air traffic service providers—seven civil and three military. On top of that, the relationships among states and ANSPs had to be clarified. The agreements

Power Test

CFM set for Leap tech run on GENx as Pratt is poised for MRJ engine flight tests

GUY NORRIS/LOS ANGELES

Like heavyweight boxers preparing for the propulsion fight of the century, the two mid-thrust challengers—CFM International and Pratt & Whitney—are squaring off with new sets of critical hardware tests for their competing designs.

For CFM, the coming tests are key milestones on a carefully planned technology road map designed, it hopes, to allow the Leap engine to seamlessly continue the market-leading position won with the CFM56. For Pratt, with much more to prove as the newcomer, the focus is on ensuring smooth development of the first members of its PW1000G geared turbofan family as it prepares to assemble the first engine for the Airbus A320NEO.

Pratt has so far garnered more than 2,500 orders and options for its geared turbofan series, which was launched with the PW1200G and PW1500G versions for Mitsubishi’s Regional Jet (MRJ) and Bombardier’s CSeries, respectively. In the mid-thrust battle for the A320NEO with CFM, Pratt is banking on valuable lessons from these two smaller engine programs as it develops the larger PW1100G for the re-engined Airbus, as well as the follow-on PW1400G for the similarly sized Irkut MC-21.

The CSeries powerplant, mounted

on one of Pratt’s two Boeing 747SP testbeds, completed a second phase of flights at the company’s Mirabel, Quebec, test facility on March 5. The first MRJ engine to fly, PW1200G Test Unit 404, is now in Mirabel being prepared for mounting on the company’s second 747SP. The engine completed sea-level testing in Florida in February and is due to take to the air for the first time in April.

“The program is going well,” says Bob Saia, Pratt’s next-generation products family vice president. With assembly about to begin of the first PW1100G A320 engine, Saia says that “this is the first program I have been involved with which has had such synergy.” Almost 2,000 engine-test hours have so far been accumulated, of which 1,300 have been amassed by five CSeries engines. Four MRJ engines have been built and run, and together with rebuilds of two CSeries and one MRJ engine, this means a total of 12 PW1000Gs have been produced so far.

As with the CSeries and MRJ engine-test programs, the A320NEO effort will involve eight powerplants, with the first on track to start tests in the fourth quarter. “It has more capable materials for higher temperatures and advanced cooling for the 33,000-lb.-thrust rating, but the fundamentals are virtually the

same,” says Saia. “We are already up and making parts, [and] we can apply optimizations developed for the earlier engines to the first NEO engine.”

Following an initial 25-flight, 115-hr. test effort on the 747SP, CSeries Engine 802 was returned to undertake ground tests with a production Goodrich nacelle. Design improvements and “minor upgrades” were added prior to the start of a cyclic endurance test covering 1,000 simulated flights. Modifications were made to the oil and lubrication system to optimize “pressure across bearings and seals that manage oil distribution and aero leakage that we use for cooling. It’s a part of early testing, so we’ll run a series of experiments to look at a matrix and see what’s best for the engine,” says Saia.

The second test effort lasting 26 flights and 130 hr. explored engine handling, restart capability and modifications to improve the efficiency of the compressor and fan. The changes were concerned with thermal growth and tighter clearances, as well as slight changes to the aerodynamic profile of the production-standard fan blade, which was given “more twist to the outer part,” he says.

A third phase in “late summer” will fly the CSeries engine with the full-up production nacelle and validate the final electronic control logic. “This will manage the compressor as well as the variable area nozzle,” notes Saia. Denying suggestions that this key design feature may be abandoned, he says the rumor may have stemmed from test flights in January aimed at exploring the failure modes in which the engine ran at full power with the nozzle in cruise setting.

The first Block 2 engine to incorporate the improved design features for

reached still have to be ratified by individual governments.

Managing costs collectively will not be easy, since each FAB has its own accounting and finance management systems, says Weder. But this must be achieved, as ANSPs will eventually be required to meet performance and efficiency targets as FABs rather than individually.

On the operational side, Fabec has focused on airspace redesign. It has already launched a free-route airspace program, which will give airlines much more flexibility within the FAB boundaries. Technical cooperation has also begun in many areas.

Weder agrees with McMillan that cooperation with other FABs will be essential. The relationship with the U.K.-Ireland FAB is working well, and representatives from this grouping attend many Fabec meetings as observers. As long as there is close cooperation, it does not matter that the two FABs are separate, says Weder.

Overall, Weder says the FABs are making progress step-by-step. Because of the complexity of the task, huge breakthrough steps are not really possible.

The central European FAB, known as FAB CE, is also turning to operational

improvements after spending last year putting a framework in place. "Now is the time to start implementing," says Jan Klas, chairman of the CEO Committee for FAB CE and head of the Czech Republic's ANSP. This process will occur incrementally, beginning with greater cross-border cooperation in the busiest airspace.

Klas says it has been important to persuade the members of FAB CE of the advantages of working together. Since all seven ANSPs are relatively small, he says the FAB process "is not just an obligation to be met, but an opportunity to create a stronger business model." ☐



Pratt & Whitney's PW1200G for the Mitsubishi Regional Jet will be flight-tested in April.

February 2013 a third test is slated to evaluate a full set of advanced blades, while a fourth in June 2013 is expected to collect detailed data from a heavily instrumented engine.

Development of the Snecma-led lightweight resin-transfer-molding (RTM) fan and containment system is "well along," according to Carlson. The focus in this area is gradually shifting from development to enabling the supply chain to support the coming ramp-up

certification is starting ice testing at the joint Pratt & Whitney/Rolls-Royce facility in Manitoba. Following ice work, the engine will return to the U.S. for bird-ingestion testing. "The full Block 1 tests are complete for the CSeries and we're two-thirds done on the MRJ program," Saia declares.

CFM's strategy, meanwhile, is focused primarily on perfecting the Leap advanced high-pressure core. Both CFM partner companies, General Electric and Snecma, are "committed to a series of risk-reduction core tests and technology maturity programs that will go into the Leap product," says Dale Carlson, newly appointed general manager of CFM Leap technology strategy. "We are not going to risk the franchise with failed execution," says Carlson, who notes that, over 40 years, CFM has in-

troduced 21 new engines and eight block upgrades into service "on time and on specification."

Hardware is being assembled for the third eCore demonstrator core, which will run at GE's Evendale, Ohio, site "sometime late in the third quarter," says Carlson. Also planned in the next few weeks is the start of the first of four key endurance tests of advanced technology for Leap using a series of GENx 747-8 and 787 ground-test engines. The first test, on a GENx-2B, will evaluate the next-generation high-pressure (HP) turbine blade with advanced cooling intended for Leap. The engine will also be fitted with a shaped multi-hole combustor liner and ceramic matrix composite shrouds.

The next test in September, this time using a GENx-1B, will add new combustor, HP turbine and compressor coatings. In

in production. "We've had a manufacturing team in place for two years to industrialize this technology," he says, noting that Snecma is set to break ground on a new RTM blade-manufacturing site in Albany, N.H.

The challenge is daunting, as CFM took record orders in 2011—including 1,500 CFM56s and commitments for more than 3,050 Leap engines. Since the start of 2012, the numbers have continued to climb with a further 326 CFM56 sales and 206 firm Leaps logged so far this year. Leap production will increase gradually in 2015-16, with the newer engine expected to form the bulk of production by 2018-19.

The engine family is in development for entry into service in 2016 on the A320NEO and Comac C919, and in 2017 on the Boeing 737 MAX. ☐

Italian Integration

Alitalia acquires two domestic airlines to counter competition from low-cost carriers

ANDY NATIVI/GENOA

Low-cost carriers such as Ryanair are capturing more market share in Italy, which has prompted Alitalia to fight back by seeking to acquire Blue Panorama and Wind Jet.

Blue Panorama, owned by Franco Pecci, operates both charter and leisure flights, as well as scheduled traffic through its low-cost arm, Blu-Express. It has a fleet of 12 mostly leased Boeing aircraft, half of them widebodies, and operates from bases at Rome's Fiumicino Airport and Milan's Malpensa Airport. In 2011, it carried around 2 million passengers.

Wind Jet is a pure low-cost carrier, born of the aim to break the Alitalia monopoly on routes to Sicily. It later expanded services to other markets and flies 12 Airbus aircraft from bases at Palermo, Catania and Rimini. It is owned by Nino Pulvirenti.

What Blue Panorama and Wind Jet share is pressure from increasing jet fuel costs and the domestic and European financial crisis, which are leading both to merge with Alitalia for relief.

Details of the merger have not been disclosed, but it appears cash payments will not be involved. Instead, Alitalia will issue shares to its new stakeholders and likely grant them seats on its board. Alitalia should finish the due-diligence phase by the end of March.

Through the merger, Alitalia aims to beat back the low-cost carrier offensive through its "smart carrier" Air One unit and establish charter and leisure operations. It seems to be aiming to follow Air France's strategy of acquiring smaller French players to fight competition in the domestic market.

Alitalia has not announced what will happen to the acquired "brands." Blue

Panorama could become the charter division, since it has a strong name and reputation, while Wind Jet and Blu-Express could be integrated with Air One.

The fate of the acquired fleets also is unclear, especially if Blue Panorama retains its agreement with Superjet International to buy SSJ100 regional jets. That most likely will not be determined

experience in the air transport business. Alitalia Chairman Roberto Colaninno, is likely to see his role in the company further expand.

In 2011, Alitalia carried almost 25 million passengers, with a 72.8% load factor and a passenger volume increase of 5.5%. But this positive result was not enough to keep Alitalia in its traditional role as the main Italian airline.

Ryanair has the largest share of the Italian market, carrying 28.1 million passengers, with a 20% increase on 2010 results. Its load factor was 82%, as it was in 2010. Melisa Corrigan, Ryanair's director of sales and marketing, says the airline has a strong Italian network consisting of 10 operating bases, 22 airports and 390 routes, 61 of them



ALITALIA 2011 FINANCIAL SUMMARY

Operating loss	(€6 million)*
Recorded revenues	€3.47 billion
Net loss	(€69 million)
Overall financial debt	€854 million
Total liquidity	€326 million

*€1 = \$1.32
Source: Alitalia

until after the merger is sealed. It is doubtful that Alitalia will add the two carriers' fleets to its own, given that it already trimmed fleet expansion plans. Alitalia's 152 mainly Airbus aircraft averaged 8.3 years old at the end of 2011. The carrier says it plans to retire 16 aircraft this year and introduce "at least" 20 new ones, including five Airbus A350s.

To guide Alitalia in its new phase will be Andrea Ragnetti, who recently became its chief operating officer. He also will become CEO and board member when the current CEO, Rocco Sabelli, leaves the company immediately after the shareholders meeting. Ragnetti, who came from Philips Electronics, has no

domestic. Ryanair's target is to transport 30 million passengers this year.

EasyJet is also improving in Italy and saw traffic in 2011 increase by 13%, to 11.4 million passengers.

Alitalia's share of the market is close to 50%. Most of its revenues are generated on international and intercontinental routes, which in 2011 were worth 62% of the total. Among major European carriers, Alitalia has the lowest share of its domestic market. ☺

The Albatross

MAS faces huge financial hurdle just as it prepares to receive A380s



MAS has developed a new livery especially for its A380s, an aircraft that the carrier hopes will boost its image as a premium airline.

LEITHEN FRANCIS/SINGAPORE

Aircraft manufacturers are adamant that airlines will continue to be able to raise the needed funds to finance aircraft on order, but a more pertinent question for the airlines is “at what price?”

A case in point is Malaysia Airlines (MAS), which in 2011 posted a loss of 2.52 billion ringgit (\$838 million), the largest in its corporate history. The financial results show that in 2011 its cash balance fell to 1.1 billion ringgit, which is insufficient to pay for the aircraft it has on order—six Airbus A380s, nine A330-300s, one A330F and 39 Boeing 737-800s, according to the Ascend database.

The airline's top managers recently told financial analysts that the carrier is planning to dedicate 6 billion ringgit this year and 3.5 billion ringgit next year to capital expenditure. This year the airline is scheduled to take delivery of five A380s, five A330-300s, one A330F and 13 737-800s.

Management acknowledged that it must strengthen its balance sheet and increase cash reserves. This could be achieved via a rights issue. Singapore's Tiger Airways pursued that route earlier this year when it needed to bolster its balance sheet following successive quarterly losses. In the case of MAS, however, that is unlikely to occur.

The founders of AirAsia, Tony Fernandes and Kamarudin Meranun, late last year acquired a 20.5% stake in MAS.

The government's investment arm, Khazanah Nasional, granted them the MAS shares in return for a 10% stake in AirAsia.

Fernandes already has other financial commitments—including sports franchises—and would not be pleased to see his MAS stake diluted via a rights issue.

Another option would be to raise cash through the sale and leaseback of aircraft. But it is becoming more difficult for carriers to profit from this, because so many are trying it. MAS already completed a significant number of sale and leaseback deals last year on its 737-800s. Lessors may be reluctant to approve more because they would want to avoid having too much exposure to the struggling MAS. Also, lessors themselves are finding it increasingly difficult to obtain financing. Many have aircraft on order with manufacturers, so their priority is to finance these.

One way out of MAS's financial predicament is to have its 49% shareholder, Khazanah, lobby local Malaysian banks on the airline's behalf. The other option would be for Khazanah to have Penerbangan Malaysia Berhad (PMB) to take over the aircraft on order and lease them to MAS. PMB is a wholly owned government subsidiary that was created in 2002 to help with an earlier financial bailout of MAS that involved transferring a large portion of the airline's assets and debts to PMB. The assets—mostly

AIRBUS CONCEPT

A330s, Boeing 737-400s and Fokker 50s—were then leased to MAS.

Revisiting that path may be MAS's most affordable option. Overseas banks may be less receptive, because the airline still faces enormous fiscal challenges. About 1.10 billion ringgit of its 1.28-billion-ringgit net loss in fourth-quarter 2011 can be attributed to one-off provisions such as obsolescence of engineering spares. But excluding all that, MAS still posted a loss, largely related to high fuel prices. Managers tried to counter the fuel spike by raising airfares, but it turns out that the airline has very little pricing power. As soon as it increased its fares, the passenger load factor in the fourth quarter fell to 72.5%.

The carrier faces enormous

competition internationally, particularly from Middle Eastern airlines such as Emirates. Earlier this year, the latter succeeded in getting MAS to withdraw from the Kuala Lumpur-Dubai route.

MAS, meanwhile, plans to start operating A380s on July 1, and to deploy all five slated to be delivered this year on flights linking London Heathrow with Sydney via Kuala Lumpur. It is currently serving these routes using 747-400s and 777-200ERs. The airline has had difficulty filling its 747s, so the challenge will only intensify when the A380s enter the picture.

The airline announced last year that its A380s would have 508 seats, 420 in an economy-class configuration. But it later altered the arrangement, reducing the number of economy-class seats to 350 and increasing the business-class seats to 66 from 54. It also increased the number of premium-economy seats to 70 from 26. The number of first-class seats remains at eight. Fernandes is thought to be one of the driving forces behind the last-minute change.

The move ensures that MAS will be positioned to appeal to high-end customers. This is in line with the new collaboration agreement between AirAsia and MAS, in which AirAsia will focus on price-conscious consumers and MAS will target premium travelers. ☐

With Robert Wall in London.

Betting on Bandwidth

New K_a-band satellites are going head to head with terrestrial broadband

AMY SVITAK/PARIS

The promise that high-bandwidth satellites can bring fast, cheap Internet to the masses will be put to the test in 2012 as a new generation of K_a-band spacecraft enters service in the U.S. and Europe, with plans to expand into Russia, Australia and Latin America.

Over the past decade, intense crowding in lower-frequency C- and K_u-bands has spurred satellite broadband providers to explore the electromagnetic wilderness of K_a-band frequencies, a portion of spectrum offering orders of magnitude more capacity compared to conventional satellites operating at lower frequencies.

With Europe's new KA-SAT satellite in service since June 2011, fleet operator Eutelsat expects its 70-Gbps of throughput to attract 300,000 subscribers and generate €100 million (\$132 million) annually in revenue within the next two years. Built by Astrium Satellites, KA-SAT was the first of a new generation of high-capacity K_a-band broadband satellites to launch in early 2011.

"We are experiencing very high reliability of the network, which is really a success for K_a band," says Arduino Patachini, Eutelsat's director of multimedia, who declines to specify the current number of subscribers until the system has been in operation for a full year. "We've only been operating for seven months, but so far the behavior of the system in terms of performance is much better than what we were expecting."

In January, following the October launch of ViaSat Inc.'s ViaSat-1 spacecraft, the 6,700-kg (14,770-lb.) satellite began delivering a stupefying 140 Gbps of throughput to consumers in North America, making it the world's highest-capacity commercial satellite. Built by Space Systems/Loral (SS/L) of Palo Alto, Calif., with considerable design and technical input from Carlsbad, Calif.-based ViaSat, the satellite provides more than 20 times the throughput capacity of ViaSat's legacy Wild Blue satellite Internet service.

"Our mission is to show that satellite broadband actually can be a better option than other terrestrial alternatives," says ViaSat CEO Mark Dankberg, whose new Exede Internet service offers 12 Mbps download and 3 Mbps upload bandwidth across much of the U.S.

Dankberg, who spent years pressing the case for high-throughput Ka-band Internet and the transformational leap in technology it offers, says the key to higher-quality satellite broadband is to flood the zone with bandwidth.

"What we looked at was the way to deliver the most throughput in gigabits at

ASTRIUM

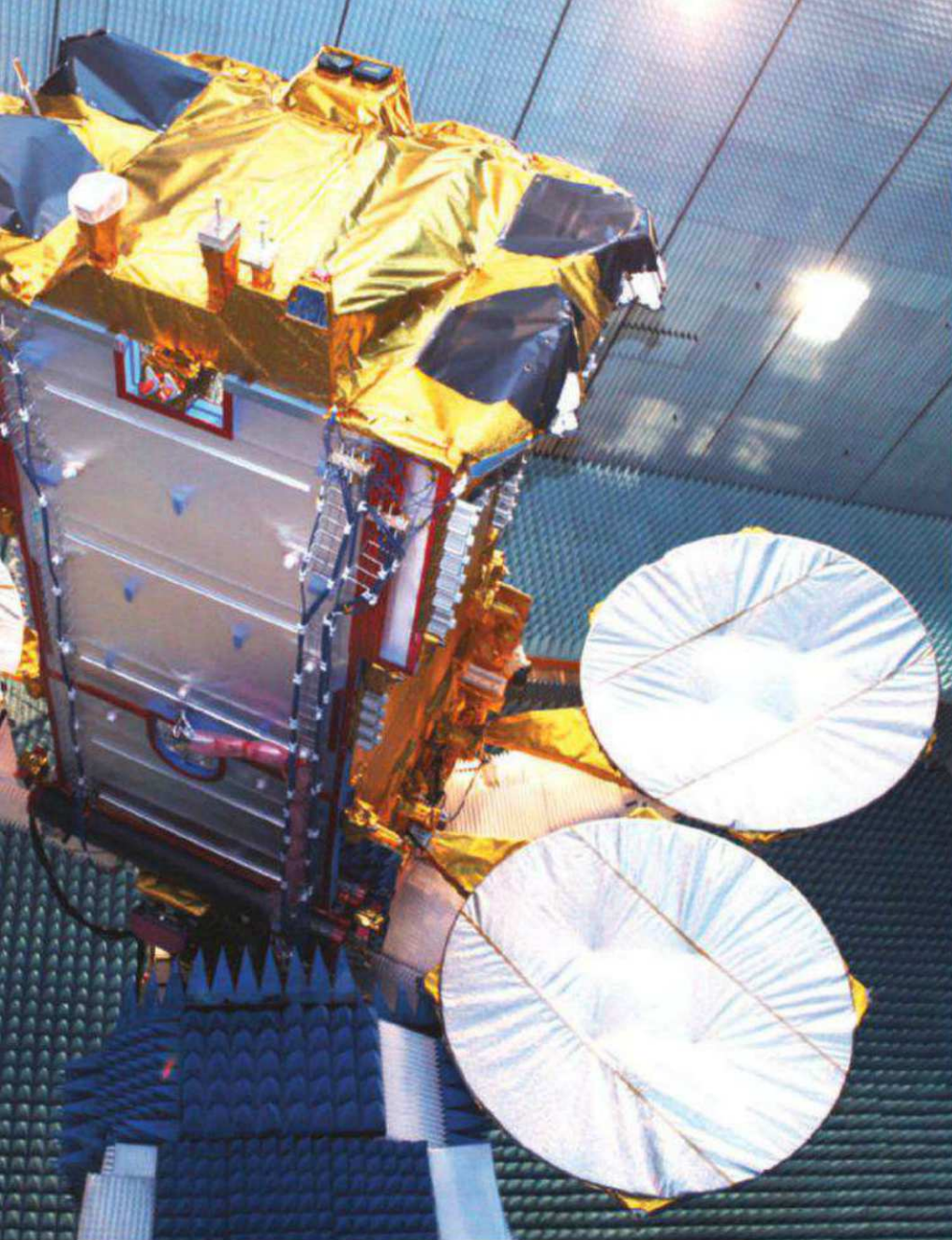
the lowest capital cost, and that turned out to be a combination of the satellite and the ground equipment," Dankberg says. "We just couldn't find other people in the industry who wanted to look at it that way."

By 2007, after more than 20 years in business, ViaSat, a company known for building broadband ground networking equipment, had amassed the cash to take on design and development of its own spacecraft. Two years later, the company purchased Wild Blue's consumer broadband service, making ViaSat an end-to-end provider of satellite operations, ground-network production and service.

"We figured if nobody else was going to do it and it's the right thing to do, then it ought to be really successful as a business," Dankberg says.

With ViaSat up and running for the past two months, Dankberg says he is





was awarded a two-satellite contract valued at nearly \$670 million from Australia's NBN Co. to build two K_a-band broadband satellites similar to ViaSat-1. Part of a broader multibillion-dollar consumer broadband initiative to provide Internet access to Australia's entire population, the contract includes satellite construction and a 15-year agreement to provide tracking, telemetry and control, and in-orbit service support during the 15-year service life of the spacecraft. The bulk of the project aims to extend fiber cable in areas with higher-density populations, with terrestrial wireless and satellite coverage for Australians not plugged in to the consumer broadband grid.

Eutelsat's KA-SAT spacecraft ushered in a new era of consumer satellite broadband.

"This was a huge technical and engineering challenge to come up with the optimization of coverage and capacity for the Australian population," says NBN Chief Technology Officer Gary McLaren, adding that the two satellites, to be placed in separate orbital slots between 135-150 deg. E. Long., will provide 90 Gbps throughput as a system and use 30-40% more spot beams than ViaSat-1.

McLaren says NBN Co. expects to place a large order for ground systems equipment for the satellites by mid-year. He estimates the space-based portion of the plan, including associated ground infrastructure, will cost about \$2 billion, including the two Loral-built satellites.

Australia is not the only country backing broadband for the masses. Russia and South America are also subsidizing satellite broadband products and services to speed development of national infrastructures.

In Europe and the Middle East, Hughes expanded its broadband reach by purchasing K_a-band capacity on London-based Avanti Communications' Hylas 1 and Hylas 2 satellites. And in Russia, where plans are being laid for a constellation of multi-spot-beam satellites under a national program to bring high-speed broadband access to more than two million subscribers over the next two years, Hughes signed contracts with the Russian Satellite Communications Co. and RTComm, the satellite services arm of national telecommunications operator Rostelcomm, to supply K_a-band systems and terminals for the Russia-wide service.

Israel-based Gilat Satellite Networks will provide network equipment and K_a-band end-user terminals for the Russian

convinced his bandwidth bet will now start to pay off.

"If bandwidth is a value proposition, then if you give people more bandwidth, they'll like the service better," Dankberg says. "The people with 3G and 4G wireless will say, 'Wow, this is better, so we'll switch to satellite.'"

Both ViaSat and competitor Hughes Communications Inc. of Germantown, Md., have invested several hundred million dollars in K_a-band technology, with Hughes planning to launch a large, high-throughput K_a-band satellite this year. In the meantime, Hughes has been adding new subscribers to its K_a-band Spaceway 3 satellite, gradually replacing the K_u-band capacity it leases on spacecraft from other operators, including Intelsat and SES S.A., over the past four years.

The new 100-Gbps-class Jupiter satellite, also built by Space Systems/Loral, is expected to add as many as two million

subscribers to ViaSat's strongest competitor, positioning Hughes to maintain its leadership over ViaSat in the North American satellite Internet segment.

The stakes are so high that ViaSat is spending more than \$1 million per month to do battle with supplier Loral, which it alleges stole ViaSat technology for use on non-ViaSat satellites, including Jupiter.

"Space Systems/Loral has been building satellites for more than 50 years, and above all else we value our relationships with our customers," says SS/L President John Celli, adding that acting with integrity is as important to his company as building reliable spacecraft. "We believe that our conduct was consistent with, and in due regard for, any applicable and valid intellectual property rights of ViaSat, and we have meritorious defenses and counterclaims to ViaSat's claims."

Despite the lawsuit, Loral on Feb. 8

national plan in partnership with RT-Comm, which is aiming to build three K_a-band satellites using spot-beam technology similar to spacecraft serving Europe and the U.S.

Last year, Gilat announced its first K_a-band contract, a \$70 million agreement over five years to supply networking equipment and consumer broadband terminals for Luxembourg-based satellite fleet operator SES in support of its Astra2Connect service.

SES has taken an incremental approach to K_a-band by adding capacity to a handful of its satellites, Astra 2E, Astra 2F and Astra 2G. The satellites, to be launched between late 2012 and 2014, will replace K_u-band spacecraft current-

ly located in SES's primary satellite TV slots at 28.2 deg. E. Long. A fourth satellite slated to be launched in 2013, Astra 5B, is also intended to support two-way services at 31.5 deg. E. Long.

The company says it has 80,000 subscribers to its K_u-band Astra2Connect service and expects to add more with K_a-band spot beams over France and Germany. But SES Chief Development Officer Gerson Souto says throwing gigabit over gigabit of bandwidth at the problem may not be the answer. And with network operators increasingly under regulatory pressure to extend terrestrial wireless links to rural areas, SES is skeptical about the long-range market for satellite broadband in Europe.

"It doesn't mean we cannot change our mind in the future, but our strategy has been [to] add incremental K_a-band capacity to payloads that have other missions," Souto says.

Intelsat is also exploring K_a-band opportunities while reviewing the pros and cons of investing in the technology.

"We have indicated that as we launch replacement satellites, we will include any of the spectrum types according to what best supports our customers and the applications," the company says in a written statement.

London-based Inmarsat ordered three big K_a-band satellites for its new high-speed Global Xpress network for launch starting in 2013. The first operator to

Back in the Game

Globalstar poised to regain lost ground in 2012

AMY SVITAK/PARIS

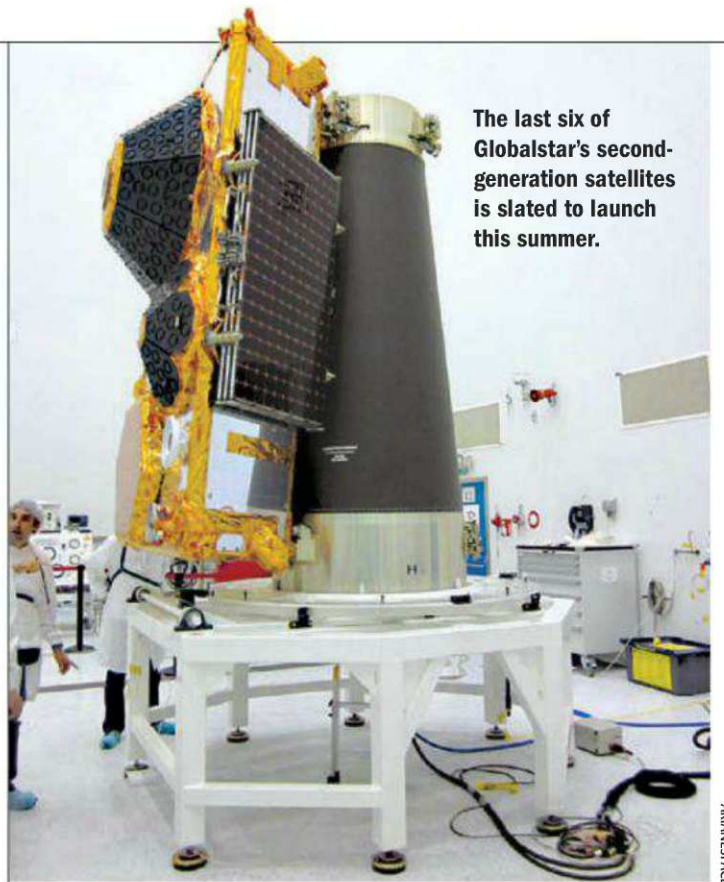
For mobile satellite services provider Globalstar, this could be the year the Covington, La.-based company claws its way back from the brink.

Since 2007, when Globalstar's first-generation satellites began degrading in orbit, the fleet operator has lost customers in droves. First, it was to chief competitors Iridium Communications and United Arab Emirates-based Thuraya, and ultimately to industry-heavyweight Inmarsat, which in 2010 brought its first hand-held satellite phone to the relatively small but growing global market for two-way satellite voice communications.

For half a decade, Globalstar has waged an uphill battle to hang on to subscribers and return to profitability. But after repeated delays in putting a new constellation into orbit, the company is poised to rebound in 2012 as the last of its next-generation satellites enters service this fall.

"With our dealers and customers now enjoying improved coverage and the fourth satellite launch just a few short months away, 2012 represents a major turning point for our business," says Globalstar Chairman and CEO Jay Monroe. "We know it will take some time to regain the growth and momentum we enjoyed historically, but by later in 2012 we expect to be solidly on our way to becoming the world's premier provider of high-quality, reliable mobile satellite voice and data services to commercial, government and retail consumers."

When Monroe signed the first contracts for Globalstar's new generation of satellites in 2006, he anticipated



The last six of Globalstar's second-generation satellites is slated to launch this summer.

the company's first-generation constellation of 48 spacecraft launched in the late 1990s would continue providing voice and data services until successors could be built and launched. Less than a year later, he was faced with the in-orbit failure of the first-generation satellites' S-band amplifiers due to radiation exposure, which sapped two-way communications delivery for all but a handful of ground spares launched in 2007 after the anomaly was discovered.

Crippled by the loss of its dominant revenue stream and seeking to curb the ensuing subscriber exodus, Globalstar diversified its product line, salvaging one-way data links unaffected by in-orbit degradation via the SPOT GPS-enabled personal tracking device. Used primarily by hikers in remote locations, the data service allowed GlobalStar

Carlsbad, Calif.-based ViaSat Inc. is suing supplier Space Systems/Loral for using intellectual property developed for the ViaSat-1 spacecraft in other Ka-band satellites, including the Jupiter being built for ViaSat's principal U.S. competitor, Hughes.



SPACE SYSTEMS/LORAL

order Ka-band spacecraft for mobile satellite applications, Inmarsat enlisted spacecraft manufacturer Boeing to pre-purchase some capacity, a move that could give it a better chance to win the next round of the U.S. Navy Commercial Broadband Satellite Program.

Meanwhile, ViaSat is pressing ahead

with plans to order a second high-throughput satellite by June. Although it is not expected to be a carbon copy of its predecessor, Dankberg says ViaSat-2 will incorporate the kind of revolutionary satellite architecture developed for ViaSat-1.

"For ViaSat-2, we've basically come up with an architecture that hasn't been

used before, but we're trying to make sure it can be built at a reasonable price in a reasonable period of time," Dankberg says.

In between major satellite developments, Dankberg says his team has been sharpening its advanced Ka-band technology know-how with work developing feeder link modules for the Iridium NEXT satellites. He says the work his team is doing provides an outlet for ViaSat to bring Ka-band technology to market. "We think after ViaSat-2, this is going to be an important ingredient in improving the economics and the capacity of these satellites." ☛

to tap into a consumer market that helped offset losses in its two-way voice business. To date, Monroe says, the successful line of consumer products attributed to the SPOT brand are responsible for initiating more than 1,500 rescues around the world.

At the same time, Globalstar has remained committed to the design, manufacture and launch of a new constellation of 24 satellites, Monroe says. After limping along for more than a year, in mid-2009 the company caught a break with \$738 million in financing from France's Coface export credit agency for new spacecraft construction by prime contractor Thales Alenia Space of France and Italy. But Globalstar's fortune turned once again as a string of setbacks followed, delaying efforts to reestablish two-way voice capability critical to its revenue stream and leaving observers to question how much longer the company could hang on.

Since October 2010, Globalstar has launched 18 of its 24 next-generation spacecraft, many of which are already in service, with more expected to come online in the next several months. But less than a year after the first new satellites were launched, the company discovered a technical glitch that rendered at least one spacecraft inoperable. Worse, the defect plaguing two of the satellite's four momentum wheels used to stabilize the platform in space could threaten other satellites as well.

In November 2011, the company said it was working on a software fix with Thales Alenia Space and subcontractor Goodrich Aerospace that could adapt the satellites' current inflight configuration and allow them to remain stable in orbit with just two functioning reaction wheels. That same month, however, Globalstar announced its last eight functioning first-generation satellites were suffering the same S-band antenna degradation affecting the first-generation fleet, and that their anticipated ability to provide two-way voice service alongside the new generation of Globalstar spacecraft is expected to cease early, in 2013.

The looming gap in coverage prompted Globalstar to pressure Thales Alenia Space for construction of six more next-generation satellites at a fixed price according to terms in the existing contract. But the Cannes, France-based manufacturer says the additional satellite construction is an option that has since expired. The two sides are currently in

arbitration, but Globalstar could start to relax in the coming weeks if the outcome of the lawsuit forces Thales to build the six additional next-gen spacecraft for the relatively low price negotiated under the contract.

In the meantime, a successful launch of its last six next-generation satellites, now slated for summer, could see Globalstar's two-way voice business fully restored in 2012. After years of hemorrhaging subscribers and revenue—and staying afloat largely with financial backing from Monroe and his company, Thermo Capital Partners, which is Globalstar's principal shareholder—the blood loss could be stemmed by fall when the last batch of satellites is expected to enter service.

Becoming cash-flow positive, however, means making good on debts to suppliers and banks. Globalstar is required to begin repaying principal on its Coface loan eight months after the last of the 24 second-generation satellites is launched. In addition, after half a decade spent battling to regain lost ground, Globalstar faces stiff competition in a market that has become increasingly dynamic in the years since its core revenue stream dried up.

During Globalstar's struggles, Inmarsat introduced its IsatPhone Pro in 2010. London-based Inmarsat, one of the original mobile satellite service providers, had until then left the hand-held market to competitors. By November 2011, Inmarsat credited the new device with garnering 10% of the market for new hand-held satellite phone users, though revenue has developed more slowly than anticipated.

Iridium, Globalstar's most direct competitor, has continued to grow its subscriber base and revenue, and it has found similar low-cost financing from Coface for its own second-generation constellation, an estimated \$3 billion satellite architecture dubbed Iridium NEXT. Meanwhile, Thuraya has continued to operate a regional system covering 99 countries and is making inroads in Australia and China.

Despite Euroconsult's forecast for the mobile satellite service market to grow nearly 13% on average each year by 2020, with wholesale revenue expected to rise at roughly 7% per year over the decade, Globalstar could continue to face an uphill battle. One hiccup along the way—a launch failure, a lengthy delay in the orbiting and service entry of its second-generation constellation, the inability to finance more satellites—and Globalstar could find itself sidelined once again. ☛

Slowly But Surely

Hosted-payload concept gaining U.S. military and aviation interest

FRANK MORRING, JR./WASHINGTON

Satellite operators see hopeful signs that their spacecraft eventually will play host to payloads supplied by cash-strapped governments trying to save a buck in today's tight budget environment, but so far concrete new deals have yet to materialize.

In July 2011 Lt. Gen. Ellen Pawlikowski, head of the USAF Space and Missile Systems Center (SMC), set up a dedicated hosted-payload office (HPO) to look for military space missions that could take advantage of piggyback rides

on other spacecraft, and to help develop and integrate the resulting payloads.

And Iridium says it will announce by June agreements to host Automatic Dependent Surveillance-Broadcast (ADS-B) payloads for aviation on the 81 Iridium Next low-Earth-orbit (LEO) communications satellites currently in development.

"At this stage we're spending quite a bit of time on this aviation payload," says Don Thoma, executive vice president of marketing at Iridium. "We're not ready to make an announcement of the specific

decisions or the specific selection of the payload. Probably sometime in the second quarter we'll be in a position to do that."

A year ago, the idea of hosting ADS-B payloads on the "Big-LEO" Iridium birds was just coming up on the scope (AW&ST March 7, 2011, p. 87). That pace is emblematic of the hosted-payload startup on the commercial side, but when governments are involved, it takes a while for promising ideas to attract attention, gain focus and take root.

"Government is starting to respond in a meaningful way," says Don Brown, vice president for hosted payloads at Intelsat General. "There's a hosted-payload office that has been established at Space and Missile Systems Center. That's a very big step. There are various groups at NASA that are starting . . . to look at ways to create common interfaces in LEO and GEO [geostationary-orbit] spacecraft. I think you're seeing an enormous amount of activity in government that's looking at hosted payloads as a potential solution."

An International Launch Services Proton is set to lift off from Baikonur Cosmodrome, Kazakhstan, on March 25 with Intelsat-22, a commercial C- and Ku-band platform that will carry a UHF hosted payload supplied by the Australian Defense Force, which was developed to "substantially enhance" ADF tactical communications in the Middle East and Afghanistan as leases on other space assets expire. When the \$167 million contract was signed in May 2009, Australian Defense Minister Joel Fitzgibbon said it would save his government more than \$150 million over launching its own satellite.

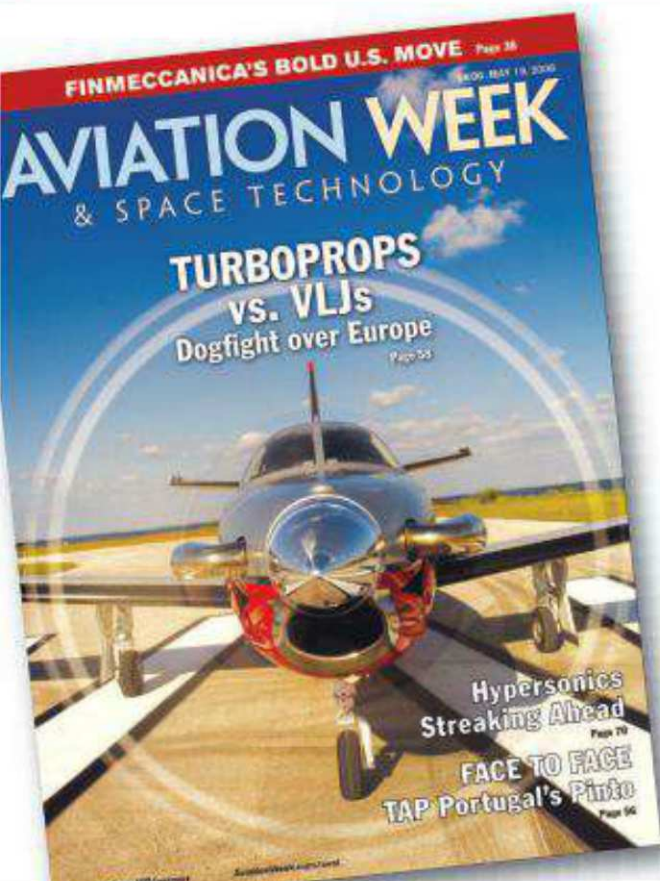
That kind of savings is attractive to the U.S. military as well, and the new SMC HPO is already moving out on a number of fronts. Brown notes that SMC has requests for information on hosted payloads in the areas of space situational awareness, satellite communications and a follow-on to the Commercially Hosted Infrared Payload (Chirp) flight demonstration that flew last fall on the SES-2 satellite built for Luxembourg-based SES by Orbital Sciences Corp.

"With the success of Chirp, the Air Force's first commercially hosted payload, there is continued interest in maturing wide-field-of-view, staring IR technology to augment the existing SBIRS program of record," states Lt. Col. Scott Krause, head of the HPO at SMC, in written response to questions. "The HPO is currently working with

Intelsat-22 satellite, with a UHF hosted payload supplied by the Australian Defense Force on top, is scheduled for launch on March 25.



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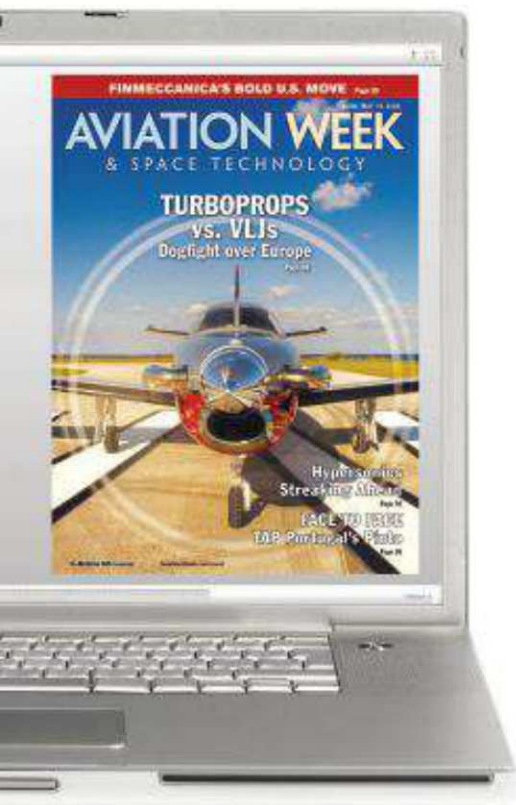
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SMC's Infrared Space Systems Directorate to develop requirements for a follow-on Chirp-like sensor to demonstrate the utility of this technology to the Battlespace Awareness and Theater Missile Warning missions. A mix of free-flier and hosted payloads could be used."

Other military hosted-payload applications using overhead persistent infrared sensors include technical intelligence, Krause states. Hosted payloads distributed through GEO and LEO could provide space and terrestrial weather-watching capabilities with ionospheric density and scintillation sensors and GPS radio occultation sensors, he says, while hosted payloads in geostationary orbits could augment GPS time and position data. Hosted payloads could deliver space situational awareness coverage of the environment around the host satellite, and they could augment military satellite communications in "the benign, unprotected communications arena," he says.

"The overall mission of the HPO is to facilitate the development and hosting of operational Air Force space capabilities via commercial, other U.S. government and potentially international host satellites," Krause states. "The HPO will do this through three key activities: providing core services to SMC's program directorates; developing key hosted payload enablers to facilitate streamlined acquisitions; and, when warranted, performing end-to-end payload development through initial on-orbit operations on behalf of the center's program directorates."

Krause notes that while interest in using hosted payloads for national security is "growing," to date the level of funding for them has not been set. That uncertainty probably is a factor in Intelsat's changing position on the hosted UHF payload it is installing on its Intelsat-27 spacecraft.

The company decided to go ahead with the integration even though the U.S. Navy had not formally procured it as expected (*AW&ST* March 7, 2011). A year later the Navy still has not signed on the bottom line, and Intelsat General is offering to lease the payload in orbit when it arrives there next year.

Technically the Intelsat-27 payload is identical to the one Australia bought on Intelsat-22, and the U.S. government already uses part of the Australian payload under an agreement with the government of Australia, Brown says.

"Intelsat is offering the same capability on IS-27," he says. "In an era of real budget constraints, the idea of commercially hosted payloads is attractive

because you can get the capability as a government operator without having to pay for the entire capability itself. So you're leveraging commercial industry to put capability on orbit, which you then use when you need it."

It remains to be seen how the Intelsat-27 UHF payload will be used. Nor has the U.S. military decided if it prefers to buy a payload outright, as Australia did, or lease it after it reaches orbit.

"Both approaches are feasible options for procuring hosted payload capabilities, but the government may prefer to develop and deliver a payload on its own rather than procuring a capability 'off-the-shelf,'" says Krause. "The former approach ensures the government retains a necessary degree of oversight of the payload development, ultimately providing a greater assurance that the payload will perform to a strict set of requirements necessary to meet national security space-mission needs."

The Iridium Next satellites are being integrated and tested by Orbital Sciences Corp. at its Gilbert, Ariz., factory under a subcontract from Thales Alenia Space. Orbital has reserved 20% of the 50-kg (110-lb.) per-satellite hosted-payload space that will be available in the constel-

lation, but has not paid the \$10 million in nonrefundable deposits required under the deal for the right to market the capability across the government.

"They're working that feverishly and quite extensively over the last year, and have gotten quite a bit of interest from different agencies on that capability," says Thoma.

Time is of the essence for Iridium, which hopes to have its constellation launches completed in 2017. It already is too late to place a sophisticated hosted payload on the first qualification satellite, set for launch in 2014. The looming deadline is driving the company to a decision on its ADS-B payloads, which would permit aircraft to broadcast their positions continuously under new government standards for air traffic control, even over oceans and the poles. Iridium is considering a business plan that would loft the payloads, and then sell ADS-B connectivity as a service to the FAA and other agencies with aviation-control responsibilities over ocean areas.

"ADS-B receivers are very attractive to us and the aviation industry," Thoma says. "It's a capability they could not get anywhere else." ☛

Wideband Ambitions

From gapfiller to a satcom backbone, USAF orders continue for WGS

AMY BUTLER/WASHINGTON

Boeing's Wideband Global Satcom began merely as a gapfiller project to provide communications for the U.S. military, but 11 years later the WGS satellites have become the backbone for shuttling the Pentagon's wideband data.

And at a time when the Pentagon is planning to cut \$487 billion over 10 years, WGS is being hailed as an example of an efficient satellite procurement.

This productivity shows in the Pentagon's orders. WGS started in 2000 as a two-satellite buy to bridge a gap until the ambitious, but now defunct, Transformational Satellite Communications (TSAT) constellation began operations. Today, Pentagon officials are planning to buy at least 10 of the WGS satellites.

This order uptick is attributable to

more than the demise of TSAT in 2009. Air Force acquisition chief David Van Buren notes that the service and Boeing worked cooperatively to reduce the per-unit price of the satellites, allowing for additional purchases and international participation in populating the constellation.

"The reason the department has decided to buy more WGS is the cost model is getting significantly cheaper," says David Madden, director of the Air Force's military satellite communications program office in Los Angeles. He says that in planning for Satellites 7-9, the team reduced per unit cost by at least \$80 million.

This is partly possible because the WGS payload is housed in Boeing's commercial 702HP satellite bus. Van

Buren notes that the cost for the bus is known, allowing for the Air Force to zero in on the "delta" in the pricing for the military-specific needs. The Air Force "tailored" the program to reduce the statement of work; this was partly due to the use of some commercial practices. The Air Force also opted to reduce some testing processes, given the success of the three satellites already in orbit.

"Building space hardware for both commercial and government customers in our El Segundo [Calif.] factory enables

with the remaining 10% handled by the seven operational DSCS spacecraft and the Navy's Ultra-High-Frequency Follow-On/G satellites, according to Bob Little, wideband branch chief for U.S. Army Strategic Command, which operates the WGS payload.

Terminals capable of operating with the new WGS satellites are still being introduced into service. But, in general, Little says: "We are seeing the transfer of commercial satcom usage to WGS, but it is really too early to see a decrease in

Command's lead officer for milsatcom. An operating slot has not yet been identified for WGS-4, which launched on Jan. 19. Global coverage will include five satellites; the fifth is slated for launch in January 2013. He says the Air Force plans to continue using the remaining DSCS satellites for X-band communications until they die. They were designed by Lockheed Martin for 10 years of life in orbit, and the average age is 13.74 years.

WGS-4 is nearing its testing slot in geosynchronous orbit more than 22,000 mi. over Earth. It is slated for operational use around July after a period of spacecraft and payload testing, says Lakos.

WGS-4 is the first Block II satellite that includes a radio-frequency bypass to allow for transmission of high-bandwidth airborne intelligence imagery at roughly three times the rates of Block I satellites, Spiwak says.

The Air Force is planning for nine WGS satellites, and approval has been given to buy a tenth. Of those, the sixth is being purchased by Australia and the ninth by an international consortium including Canada, Denmark, Luxembourg, the Netherlands and New Zealand.

Meanwhile, the Air Force is studying what enhancements could be added to WGS. Little says operators often ask for more communications on the move to support so-called disadvantaged users, or those that cannot carry large antennas for data transfer. Boeing is examining the use of a new high-gain antenna to facilitate this mission. "Given the capability of the Boeing 702HP platform, efficient package of these antennas along with the existing WGS antennas can be easily and cost-effectively accomplished," he says.

Ground-based users also hope to incorporate more anti-jam capabilities into the system as well as increased coverage for both the X- and Ka-band frequencies.

The Air Force is also in the midst of a sweeping future milsatcom study, with results expected in June. This exercise was begun after the demise of TSAT and must take into account infusing the entire architecture—from air- and space-borne assets to terrestrial systems—with resiliency so that a failure cannot cripple the entire global network. Accordingly, the service is looking at what the future military/commercial requirements will be for wideband communications, Lakos says. He notes that the Air Force will pursue modest capability improvements for WGS, but the "biggest limitation will be the budget." ☐



Testing of the first Block II WGS satellite (far right) is underway after its recent launch, while Satellites 5 and 6 are in various stages of production and being readied for launch.

common processes and procedures to be shared across programs," according to Mark Spiwak, Boeing WGS director. One example is the use of lean manufacturing techniques to build phased array antennas based on lessons from the company's commercial Spaceway work.

He notes that the Air Force is implementing a "commercial-like operating model [to] streamline testing and reduce government oversight without compromising mission assurance."

Though not originally envisioned as the wideband constellation of the future, the WGS design was expected from the start to shoulder most of the wideband traffic. A single WGS satellite—capable of transmitting in Ka- and X-band frequencies—is able to move 10 times the amount of traffic of the entire Defense Satellite Communication System (DSCS) still in orbit today.

Already, the three operational WGS satellites are handling 90% of the wideband requirements for the Pentagon,

commercial usage; as commercial bandwidth becomes available, it is quickly consumed with new user requirements."

One example of WGS usage is by ships, which can now communicate with "much higher data rates" than they would by using DSCS or commercial systems.

WGS also features a "crossbanding" capability that allows for the satellite to receive data in one frequency and transmit in another. For example, an X-band transmission can be relayed to a user with a Ka terminal. Little says this crossbanding capability has "changed the way we plan [for] wideband satcom users and allows more flexibility in support to all users with varying terminal types." The system will facilitate more mobile users and more areas of coverage—19 versus six with DSCS alone.

One WGS each is currently supporting operations in the Pacific region, over the Indian Ocean (including activities in Iraq and Afghanistan) and Europe, says Col. Michael Lakos, Air Force Space

Slipping to the Right

SpaceX bumps new Falcon 9 engine demonstration to year-end



AMY SVITAK/PARIS

For a brief moment in 2011, fledgling rocket maker SpaceX silenced critics with a deal to launch a commercial telecom satellite for one of the largest fleet operators in the world.

Announced in March 2011, the agreement with Luxembourg-based SES to loft the SES-8 satellite to geostationary orbit atop the twice-flown Falcon 9 rocket was widely viewed as a vote of confidence in the Hawthorne, Calif.-based start-up, despite its running years late in demonstrating the ability to boost cargo to the International Space Station (ISS) for its primary government backer, NASA.

But during the past two years, as SpaceX secured contracts in major Asian markets, announced plans to introduce a heavy-lift variant of the Falcon and started construction of a new launch pad at Vandenberg AFB, Calif., the company has fallen further behind schedule.

"They're running up against the reality of rocket engineering—getting these systems to work is hard," says John Logsdon, a space policy expert and professor emeritus at George Washington University. "This is the teething pain of an emerging firm that doesn't match the rhetoric, doesn't match their optimism, but matches the reality of the situation."

Earlier this year SpaceX pushed its first cargo demonstrator to the ISS under NASA's Commercial Orbital Transportation Services (COTS) program to the end of April from February. It also slipped the schedule on a midsummer debut of an upgrade to the Falcon 9 main-stage engine, which

SpaceX conducted a wet dress rehearsal of its Falcon 9 at Cape Canaveral March 1 in preparation for a flight demonstration to the International Space Station.

SpaceX is obligated to fly before it can loft SES-8 next year.

Now slated to lift off no earlier than October from the new Vandenberg site, the overhaul of Falcon 9's Merlin 1C engine aims to add enough power to boost payloads to geostationary transfer orbit. In addition to lofting SES-8, the more robust rocket positions SpaceX to deliver on commercial launch agreements with Hong Kong-based AsiaSat and Thaicom of Thailand beginning as early as next year.

"Commercial launches now represent over 60 percent of our upcoming missions," SpaceX founder and CEO Elon Musk said in February after announcing the agreement to launch AsiaSat-6 and AsiaSat-8 atop the Falcon 9 in early 2014.

With plans to debut the new Merlin 1D before year-end, SpaceX has been test-firing the motor "four or five times a week" at the company's development facility in McGregor, Texas, says SpaceX spokeswoman Kirstin Grantham. The new Falcon 9 also will feature an extended propellant tank and wider payload fairing.

At Vandenberg, Grantham says SpaceX has completed demolition of the old launch site, including removal of a tower, and recently started construction of a new hangar. The upcoming launch is expected to deliver a small, scientific spacecraft built by MDA Corp. of Canada to a near-polar orbit. Delivery of hardware to the launch site, including the new rocket and satellite, dubbed Cassiope, is expected later this year.

Although SpaceX has secured commercial launch agreements with a handful of satellite operators, including a \$500 million contract to loft Iridium's 72 next-generation satellites to low Earth orbit in 2015-17, SES-8 marks the company's first commercial mission to geostationary orbit. But with four flights on the SpaceX manifest in 2012 alone—Cassiope, the COTS demo and two commercial resupply services (CRS) missions scheduled under a separate, fixed-price contract with NASA—SES may need to consider other options.

"As an alternative, we always have a backup in place for all SES launches," says Yves Feltes, a spokesman for SES, which has existing multi-launch agreements with Ariane-space and ILS, in addition to a framework understanding with Sea Launch. "The same is true for SES-8."

SpaceX is also expected to launch at least one mission for Orbcomm Inc. this year. After pulling a prototype of the operator's second-generation data-relay satellite from the upcoming COTS demo, the two companies rescheduled the mission for mid-2012 as a piggyback on the first CRS mission.

SpaceX says it completed a dress rehearsal of the Falcon 9 at Cape Canaveral on March 1 in preparation for the upcoming COTS mission, loading the rocket with fuel and simulating a countdown to T-5 sec. But the company still has a roster of work to complete before the flight, which will be no earlier than April 20.

"It's easy to expect success along the way," Logsdon says. "But it's still up to them to deliver on what they've promised." ☐

Renewed Rivalry

Rhetoric about the Falklands remains the same, but the weapons and tactics are new



ROYAL AIR FORCE

FRANCIS TUSA/LONDON

This is not your parents' Falklands war.

With the 30th anniversary of the start of their short war between Argentina and the U.K. next month, and tempers flaring again between Buenos Aires and London, it seems little has changed over this South American archipelago. The countries continue to exchange diplomatic salvos over possible oil and mineral reserves near the islands, as well as valuable fishing stocks nearby. And the arrival of the Duke of Cambridge in his role as a Royal Air Force (RAF) search-and-rescue pilot recently, and deployment orders for an advanced Royal Navy destroyer serve as reminders of just how easily this self-governing British territory of 3,140 people still commands major military force posturing.

Yet all is not the same as it was in 1982, starting with those military forces, and "what-if" questions are emerging across the Atlantic. Could Argentina take the Falklands if it chose to today? Could the U.K. prevail, especially with austere budgets in London already triggering interservice rivalries? While the arguments are old, the weapons and tactics have changed quite a bit.

The British Defense Ministry position is simple regarding Falklands security: RAF Mount Pleasant, home to four multirole Typhoon fighters, has grown in

capability substantially from 1982-2012. An attempt to attack the Falklands by air would be met with these fourth-generation aircraft (versus no such deployment in 1982). And any Argentinean forces that leak through today would then have to face British ground-based air defenses, unlike 30 years ago.

By comparison, pitting Typhoons with advanced-medium-range-air-to-air-missiles against severely aging Argentinean aircraft (AW&ST Jan. 26, 2009, p. 240) seems one-sided. The late President Nestor Kirchner's planned military build-up last decade fizzled against worsening economic conditions. Argentina reportedly even considered buying Lockheed Martin F-16s, but has had to make do with legacy A-4s, most recently purchased in the mid-1990s.

But some observers suggest that rather than a "conventional" strike, an Argentinean offensive could revolve around asymmetric attacks. One potential scenario could entail Special Operations Forces attacking Mount Pleasant, crippling the Typhoons with mortars and explosives, and leading the way for follow-on forces arriving by air and sea.

Still, the imminent arrival of HMS Dauntless, the second of the U.K.'s newest class of advanced destroyers, also is seen as a sign that London can deploy the necessary capabilities. News re-

ports—neither confirmed nor denied—say a nuclear-powered attack submarine, likely equipped with conventional Tomahawk land-attack missiles, is a near-constant presence in the region.

Still, any talk of the Falklands is muddied by interservice rivalry in the U.K. The decision to retire all fixed-wing naval aviation assets under the 2010 Strategic Defense and Security Review saw the question posed almost immediately by Royal Navy proponents: "How could we retake the Falklands?" It is the one area in which the U.K. clearly lacks military capabilities that it possessed in 1982.

Any new skirmish over the Falklands would see deployment of modern weapons like Eurofighter Typhoons out of RAF Mount Pleasant.

By comparison, looking at the situation with frigates and destroyers leads to a more favorable conclusion. The Type 23s and 45s are leagues ahead of the vast majority of ships deployed in 1982, as are their subsystems and associated equipment. As for amphibious assault ships, the outdated HMS Fearless was being retired in 1982, and HMS Albion and Bulwark, plus auxiliary vessels today, are far improved over those of the previous generation. Still, one gnawing question is how many vessels will be available without gutting other, equally important commitments elsewhere, like the Persian Gulf.

As for the British troops to send ashore, they are vastly better equipped and more experienced today, with close to a decade of operations in Iraq and Afghanistan under their belts. The one significant difference in the 30-year span is that the U.K. has now deployed and demonstrated the use of attack helicopters from assault ships, which would be very valuable in any campaign. Argentinean troops specifically, and the military generally, have been nowhere nearly as battle-proven.

Yet perhaps the greatest factor concerning the Falklands is will and determination. In 1982, the U.K.'s decision to withdraw a permanent naval presence in the South Atlantic seemingly was seized upon by Argentina as a sign that there was no will for a fight. Then-Prime Minister Margaret Thatcher proved this assumption wrong. But given today's budget austerity, would David Cameron do the same? ☐

With Michael Bruno in Washington.

Capability Critical

New Zealand defense force eyes naval rotorcraft and advanced fixed-wing trainers

LEITHEN FRANCIS/SINGAPORE

To overcome equipment inadequacies, New Zealand's air force has set its sights on acquiring more advanced turboprop trainers while the navy wants more helicopters.

"We don't have enough naval helicopters, and the sustainability [of the existing fleet] through spare parts and support is an issue we're working through for required output," Air Vice Marshal Peter Stockwell, chief of the Royal New Zealand Air Force, tells Aviation Week. "We are looking at the potential upgrade of the current five aircraft," he says, referring to the navy's Kaman SH-2G Super Seasprites. He also says the navy "is looking at the option of complementing that," probably with new helicopters—possibly the AgustaWestland AW159 or Eurocopter equivalent; but the navy is also considering second-hand Seasprites offered by Kaman and sourced from Australia.

The air force, meanwhile, has a requirement for a more advanced trainer. Its leases on 12 Pacific Aerospace CT-4 basic trainers and five Beechcraft King Air 200 multiengine trainers expire on June 30, but the service has been told the leases can be extended, says Stockwell. However, the air force really wants to shed the Beechcraft 200s. They were second-hand to begin with, and four of the five have different cockpits, says Stockwell, noting that twin-engine aircraft are needed with the same cockpit.

The current system of training is failing to deliver the required results. "The quality of pilots coming through is not meeting our needs," says Stockwell, and it is taking longer for the pilots to reach the standards they need to meet. The air force has attributed this to the limitations of the trainer aircraft. Service leaders plan to continue using the CT-4s, but want the pilots to then log roughly 100 hr. on a more advanced single-engine aircraft, says Stockwell.

Late last year the air force issued a request for information to suppliers to present a long-term strategy for advanced training. The goal is to implement the solution in 2015, but Stockwell says



AUSTRALIAN DEFENSE DEPARTMENT

the air force hopes this can be achieved sooner. Last June, then-Defense Minister Wayne Mapp told Aviation Week he hoped the government would order six or seven single-engine advanced trainers for delivery in 2013-14. This is still the required number, but that is assuming the service also acquires a simulator, says Stockwell. Types being considered include the Beechcraft T-6 Texan II and Pilatus PC-7MKII, he says.

As for twin-engine training, Mapp told Aviation Week the King Air 350ER was being considered because it can also be used for light maritime surveillance and VIP transport. Stockwell says the costs associated with operating the air force's six Lockheed Martin P-3Ks suggest there is an argument for adding a smaller maritime patrol aircraft.

The P-3Ks are currently being upgraded, and the program should conclude by the end of 2013. "The P-3 prototype [first aircraft out of six] has completed the initial stages of ET&E [engineering

test and evaluation]," says Stockwell. "The first production aircraft at Woodbourne, New Zealand, is progressing with its acceptance test and is close to being ticked off."

The upgraded P-3Ks were due to be phased out in 2025, but Stockwell says they should fly beyond 2025.

The air force also has five C-130Hs.

The upgrade of the prototype and first production aircraft has been completed, and modification of the final aircraft is due in early 2014, according to Stockwell. The C-130H experienced delays owing to software integration is-

A New Zealand navy Super Seasprite lands on the deck of Australian navy frigate HMAS Anzac.

sues, he adds. The New Zealand government has said the C-130Hs will be phased out in 2020. But Mapp told Aviation Week that the air force could probably squeeze a few more years out of the aircraft. Stockwell says the service will phase out the C-130Hs

in 2020-30 and would like the first to exit early in that period.

The air force also has two Boeing 757s that can carry passengers, cargo or a combination. Stockwell notes that the 757s' relatively low flight time means they are good for another 15-20 years, although the C-130H replacement evaluation will also take into account the eventual phaseout of the 757s. "We're looking at it in terms of a future airlift study. We're not looking at it as a C-130 and 757 replacement. The scope is to look at the multi-mission space as well," he says.

Moreover, the air force needs to consider both its long-range strategic and shorter-range tactical airlift requirements, Stockwell asserts. The service is mindful of the fact that a capability gap emerged when it retired its Hawker Siddeley Andover aircraft several years ago. The air force could use a military transport with short-field capability, particularly for humanitarian aid missions to islands in the South Pacific, he adds. ☛

Extended Expectations

ETOPS 330 may mean maintenance changes

PAUL SEIDENMAN and DAVID SPANOVICH/SAN FRANCISCO

When an Air New Zealand Boeing 777-300ER completed a Los Angeles-Auckland flight in December, it was the first time an airline operated under 240-min. extended operations (ETOPS). But the new 240-min. limit is no longer the edge of the envelope—330 min. is now poised to become the new ETOPS gold standard—ever since last November when Boeing received type design authority from the FAA to offer a 330-min. ETOPS “option” on the General Electric GE90-powered 777 family.

According to Boeing, Air New Zealand already has purchased that option. However, an Air New Zealand spokeswoman reports that there are no plans to operate under this so-called ETOPS 330, because ETOPS 240 meets the carrier’s current requirements.

Boeing confirms that ETOPS 330 certification is expected to follow within the next few months for the Rolls-Royce Trent and Pratt & Whitney PW4000 engines, which also power the 777. The original equipment manufacturer (OEM) reports that it plans to pursue ETOPS 330 approval for the Boeing 787 and 747-8 Intercontinental.

Originally defined as “extended-range operations with two-engine airplanes,” the ETOPS acronym changed in 2007 to mean “extended operations.” This took into account the FAA’s decision to apply ETOPS to three- and four-engine jet aircraft, shifting the focus to the designed capabilities of each model, and away from the 180-min. limit, which was considered an arbitrary number.

ETOPS becomes critical on long overwater or polar flights where compliance with the 180-min. rule often means flying a less direct route to stay within the diversion time constraints.

“The southern ocean regions are open

to maximum ETOPS levels. Volcanic activity anywhere in the world can also push routes into areas beyond 180 min.,” says Terry McVenes, director of operational regulatory affairs for Boeing Commercial Airplanes.

For airlines long accustomed to the 180-min. standard, the leap to ETOPS 330 could represent new maintenance protocols, if mandated by regulators. The problem is that the authorities have

probably depend on “the comfort level” of the regulators in the home country of the airline seeking approval for ETOPS operations beyond 180 min. That, he says, could—and he emphasizes “could”—mandate inspections at shorter intervals on the engines’ external components, such as the gear boxes, fuel and oil pumps, or integrated drive generators. “Should that be the case, more resources such as mechanics and/or additional spares may be required. That is why airlines will determine if they will fly routes in specific markets where ETOPS 330 is needed to meet customer expectations and if it will generate a financial return.”

“Financial return” is a key phrase here, because from a baseline perspective at the airline level, the specific airplanes and engines to be used in ETOPS operations have to be maintained to the standards mandated by the ETOPS maintenance plan. Airframes and engines maintained to those limits

are identified by serial number. “If you have to replace an engine on an ETOPS aircraft, the specific replacement engine you use, by serial number, has to have been maintained to the same ETOPS maintenance standards,” says Jones.

This is one of the reasons why, in Jones’ opinion, ETOPS 330 will be more applicable to operators flying widebody aircraft on long routes, such as across the South Pacific—Australia to South America and Southern Africa—or those flying transpolar routes.

“For some airlines, buying a 330 ETOPS option (and complying with the requirements) would be a wise investment, but for others, it would not,” Jones says.

According to Gareth Richards, GE Aviation’s GE90 program manager, transitioning from ETOPS 180 to 330 is not likely to require significant changes to heavy engine inspections. Still, he explains that as each airline extends ETOPS, it may add requirements beyond what maintenance manuals recommend.

“The engine OEMs have no problem with this,” he emphasizes. “If the customer is already following GE’s recommendations for inspection and maintenance, no changes will be required from the OEM’s perspective. But, the individual operator still has the option to tighten the requirements.”



Boeing predicts that ETOPS 330 certification for Pratt & Whitney PW4000 engines will be granted within the next few months.

final say over extended ETOPS maintenance requirements, so to what extent ETOPS 330 will impact maintenance is not yet known.

“For a wide-bodied twinjet, we expect some airlines will apply for either 240- or 330-min. ETOPS,” says Larry Jones, vice president of PW4000 product line management at Pratt & Whitney. “However, because this is so new, it is really only now that the regulatory authorities will have to determine if any new standards of maintenance or inspections for 330-min. ETOPS will be required. We just don’t have all the answers yet.”

As Jones says, those standards will

As diversion time limits increase, airlines also will have to demonstrate that they can meet the ETOPS operational requirements on specific routes. "It's not only identifying designated diversion airports, but, for example, their strategy and procedures for monitoring potential fuel freezing."

As a bottom line, says Richards, the main focus of maintenance-related changes involving extended ETOPS will likely be at the line level, since the minimum equipment list is integral to dispatch requirements.

In addition to gaining ETOPS 330 approval for the GE90 on the 777, GE also received the same approval last December for its GENx 1-B on the 787. ETOPS 330 approval, Richards notes, is "under evaluation" by GE for the CF6 engine. He adds that GE will seek ETOPS 330 approval for all engines being designed for widebody commercial transports.

But the maintenance focus goes beyond engines. Boeing's McVenes reports that ETOPS approval for longer than 180 min. means the airplane is approved for any ETOPS operations up to the limits of the systems and equipment on the airplane.

"One of the most important time-critical systems is the cargo fire-suppression system," says McVenes. "For passenger airplanes, being farther away from a diversion point simply means installing additional halon bottles in the cargo area, and an extra one or two hand-held extinguishers in the passenger area, depending on the configuration. For dedicated freighters, differences with the environmental control system will require additional personal oxygen capacity, enabling pilots to keep their masks on longer."

McVenes explains that most regulators, including the FAA, approve two ETOPS levels: 240 min. and beyond 240 min. "The first year beyond-180-min. ETOPS is restricted to at most 240-min. ETOPS. After one year, the 240-min. limit can be lifted and the operator, with operational approval, can fly beyond 240 min., up to the airplane's capability."

For ETOPS greater than 180 min., maintenance and operational requirements will not differ much, assures McVenes, and there are few changes to servicing prior to dispatch or during overnight checks. For instance, he notes that one engine type could have a slightly lower allowable engine oil consumption rate. Still, he points out that new routes often mean new maintenance providers. ☐

Composites Considerations

Reaching a consensus among industry participants takes time

JEROME GREER CHANDLER/ANNISTON, ALA.

The call by carriers to standardize composite training certification, techniques and material mounts by the minute, with the Boeing 787 an operational fait accompli, and the Airbus A350 waiting to take wing.

The SAE's Commercial Aircraft Composite Repair Committee (Cacrc)—comprising original equipment manufacturers (OEM), operators and regulatory agencies—has worked

substantiating the airworthiness of their repair methods in their structural repair manuals. Incorporating approaches that differ drives additional costs. "This is probably the largest hurdle to universal standards implementation," Borgman emphasizes. "Who pays for it?"

That is a hard question, because to accelerate composite repair standardiza-

Spirit AeroSystems delivered the first A350 composite center fuselage section (No. 15) to Airbus in January.

since 1991 to ease the transition from largely metallic aircraft structures to those composed of increasingly large portions of composites. However, "It is hard to get an industry consensus on what the content of that certification needs to be," says Michael Borgman, Cacrc's chairman and senior composites adviser with Spirit AeroSystems.

Standardization is certainly the sticking point. Roland Thevenin, Airbus's senior expert for composite performance, says the current lack of consensus "is not due to a lack of support, but inherent simply [in] the difficulties [of] harmoniz[ing] ideas coming from different OEMs who have developed and used their own concepts during the decades."

Borgman elaborates. "To contend that you want to standardize implies you've got to pick one [approach]. And to pick one implies that you're going to identify one that's better. The OEMs, of course, are adamant that their [approach] is better, whatever it might be." He says airframers invest lots of money simply

tion, "the industry will need to work more closely together and share information that has been traditionally kept proprietary," says Larry Ilcewicz, a Cacrc member and FAA's chief scientist and technical adviser for composite materials.

Simon Waite, a Cacrc member and EASA's (European Aviation Safety Agency) structures expert, underscores that "many airlines would like to see a standardized approach to critical composite repairs to simplify things for technicians."

While standardization is on everyone's wish list, there are lots of ideas on how to get there. This has been the case ever since the establishment of SAE (Society of Automotive Engineers) International, which was founded in the early 1900s—the dawning of the automotive age—when it became clear that the growing number of nascent car (and aeronautical) manufacturers worldwide would need some unifying standards.



TIM FOX/SPIRIT AEROSYSTEMS

There are ways around the standardization impasse, and one is training, including knowing what to look for when inspecting for damage. To this end, and in lieu of certification, Cacrc has produced many training materials and it is planning even more.

"It's going to be particularly important that mechanics [are] sensitized to the notion that there very well [may] be hidden damage, and that composites tend to mask that more than metals," Borgman states.

Jan Popp, Cacrc co-chairman and Lufthansa Technik's project manager of new technologies and innovation for composite repair, says one way to augment this training is to "reduce the number of materials used." If the industry can accomplish that, you "also reduce the need for fleet-specific technician familiarization."

That is why he says Cacrc is working on standard repair materials, "such as AMS3970 [which provides information about technical requirements and qualification procedures] for carbon fibers." To ease the entry of such material into the collective composite consciousness, he says, it is important to put it in the structural repair manual (SRM).

Everyone agrees that training technicians is important. Sometimes forgotten, however, are the others who populate the composites supply chain. "There are material purchasers out there, frankly, who don't have any clue [as] to how to handle, store, process and distribute these materials," asserts Kevin Fochtman, president of Pacific Coast Composites.

He says it is not that there is a dearth of information, but that the curriculum is geared to "the engineering group, for the design and development folks," and not so much for the people working the floor or the loading dock.

Here is a case-in-point: Pacific Coast receives a call from a company that says it just realized a box that has been sitting on the loading dock for a while has lost its dry ice, and the temperature recorder has expired. This happens despite the fact that Fochtman says, "We plaster stickers all over the box that say, 'Place in Freezer Upon Arrival.'"

There is a disconnect, and it is a potentially dangerous one. Failing to strictly

follow temperature regimens degrades composites. There is no room for ignorance in the equation. "People need to understand that these are not just . . . fairings and radomes—[items] that can blow off an airplane and it can still land." Aircraft now feature composite primary structures.

Ilcewicz echoes that [everyone] in the supply chain "needs to be aware that the uncured materials are perishable, and have a specified time before [they] must be cured for a structural part or repair."

Not all repairs are created equal—especially not when it comes to composites. Hot-bond repairs have been a topic of intense debate within Cacrc since the committee's founding. If lack of stan-

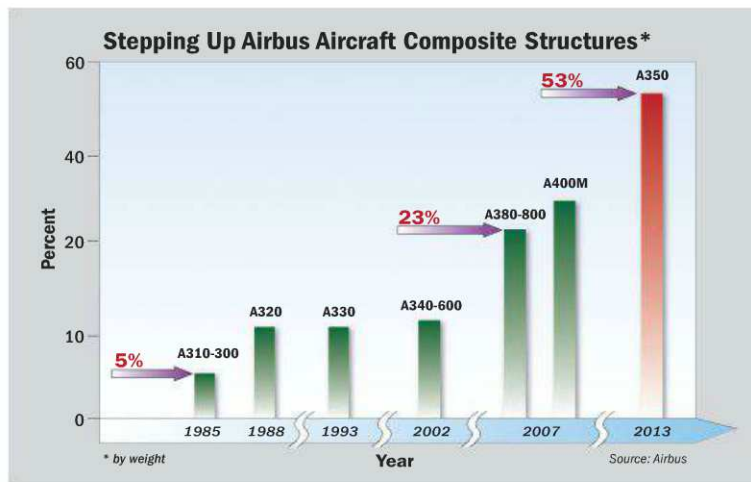
tion must be regularly revalidated, that is not the case with composites.

Borgman believes there is a growing sense of urgency out there with the launch of largely composite aircraft. "Look at Airbus and Boeing," he says. They have been working very hard to get training materials . . . to their aircraft customers."

What is missing, he believes, is not concern or first-rate training support on the part of the OEMs, but firmer common ground—the "next increment in economics and safety that would be provided by implementation of standards." He notes that what is available now is commendable. It is thorough. But approaches differ to the degree "that you [do not] have independent training that touches them both."

Perhaps that will happen some day. If it does, it probably will not happen all at once. Borgman believes a graduated, stair-step approach could lay the foundation for composites standardization in a number of arenas: training, materials and techniques.

Acting as the tip of the lance to bring that about could be the approach being pursued by Cacrc's Airworthiness Task Group. The task in this particular case is to



dardization is a problem when it comes to composites in general, misapplying a standard procedure can be even worse. It can have real-world consequences.

"The problem is," says Borgman, that "people want to generalize. They say, 'Oh, we have a standard hot-bond repair.' And then they want to use it on every aspect of the aircraft structure." One reason SAE is a bit fearful of issuing all-encompassing standards is that "when you create any repair," he says, "it's got a finite list of candidate applications."

"Bonded repairs are suitable for cosmetic repairs" and certain structural repairs, says Airbus's Thevenin. Certification agencies impose constraints on primary structure, and "significantly limit the size of such repairs, since the structure has to be able to sustain 'limit-load' in operational service."

Thevenin says improving these repairs to the point that airworthiness authorities have confidence in the fail-safe integrity of them "has not yet been achieved." He notes training is not mandatory. While certificates for welding and inspec-

tion must be regularly revalidated, that is not the case with composites.

Borgman says a draft is in place now, and that a final document could be out by year-end. Once industry players see commonality can be achieved in something as basic as a process checklist, other standardization can follow suit.

Over the past two decades SAE's Commercial Aircraft Composite Repair Committee has been anything but idle. "There's been output from the organization," says its current chairman. "The problem is getting it trickled into the [structural repair manuals] delivered to OEM customers." Borgman says he is seeing some of that happen now. OEMs "turn up the volume on participation in committees that are attempting to standardized composites."

That volume may not be earsplitting just yet, but it is out there and it is intensifying. ☺

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March 21-22—Avionics Europe 2012 Conference and Exhibition. MOC Event Center, Munich. Call +44 (199) 265-6619 or see www.avionics-event.com

March 23-24—Society of Experimental Test Pilots' San Diego Chapter Symposium. Catamaran Resort Hotel and Spa. See www.setp.org/table/san-diego

March 25—Internode Parafield Airshow. Parafield Airport, Adelaide, Australia. See www.parafieldairshow.com.au

March 26-28—CHC Eighth Annual Safety and Quality Summit. Westin Bayshore Resort and Marina, Vancouver, British Columbia. See www.chcsafetyqualitysummit.com

March 27-29—Asian Business Aviation Conference and Exhibition. Shanghai Hawker Pacific Business Aviation Service Center. See www.abace.aero/2012

March 27-29—American Astronautical Society's 50th Annual Robert H. Goddard Memorial Symposium. Greenbelt (Md.) Marriott Hotel. See www.astronautical.org

March 27-29—Aircraft Interiors Expo. Hamburg Messe, Germany. See www.aircraftinteriorsexpo.com

March 27-April 1—Fidae International Air & Space Fair. Arturo Merino Benitez Airport, Santiago, Chile. See www.fidae.cl/portal_fidae.asp

March 30—National Space Club's 55th Annual Goddard Memorial Dinner. Washington Hilton. See www.spaceclub.org

April 4-7—Third Annual Marrakech Air Show. Menara Marrakech (Morocco) Airport. See www.fr.aeroexpo-morocco.com/accueil_en.html

April 8-9—Sofema Aviation Service's Dubai Training. Jet Aviation Facility, Dubai, United Arab Emirates. See www.sassofia.com

April 12—Ninth Annual Aerolink Wales 2012. Chepstow (Wales) Race Course. See www.aerolinkwales.co.uk

April 13—Society of Experimental Test Pilots' East Coast Symposium. NAS Patuxent River, Md. See www.setp.org/table/east-coast

April 18-19—Shephard Group's Defense IT. Bristol Marriott Hotel City Center, London. See www.shephardmedia.com/events/defence-it-2012-79

April 23-26—The Geneva Forum 2012: 26th Annual Aircraft Conference on Finance and Commercial Aviation. Hotel Arts, Barcelona, Spain. Call +44 (207) 017-7200 or see www.informaglobalevents.com/event/aircraft-finance-conference

April 25—Avicon 2012 Aviation Insurance Claim Conference. Intrepid Sea, Air and Space Museum, New York. See www.rtiavicon.com

April 2-3—Engine MRO Forum. Dallas.

April 3-5—MRO Americas 2012. Dallas.

April 4-5—MRO Military Conference & Exhibition. Dallas.

April 23-25—NextGen Ahead: Air Transportation Modernization. Washington.

May 8-9—Civil Aviation Manufacturing. Charlotte, N.C.

May 23-24—MRO Regional: Eastern Europe, Baltics and Russia. Vilnius, Lithuania.

Sept. 19-21—MRO IT Conference & Showcase. Miami.

Oct. 9-11—MRO Europe. Amsterdam.

Nov. 6-7—A&D Programs. Phoenix.

Nov. 14-15—MRO Asia. Singapore.

PARTNERSHIPS

March 27-April 1—Fidae International Air & Space Fair. Santiago, Chile.

April 3-6—Aircraft Electronics Association's 55th Annual International Convention & Trade Show. National Harbor, Md.

June 11-15—Eurosatory. Paris.

June 26-28—JEC Show Asia. Singapore

July 9-15—Farnborough air show.

Oct. 1-5—63rd International Astronautical Congress. Naples, Italy.

Oct. 9-14—Japan Aerospace. Nagoya.

Dec. 11-13—Middle East Business Aviation. Dubai, United Arab Emirates.

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China's Other Defense Challenge



Byron Callan is a director at Capital Alpha Partners, a Washington research firm that advises investors. He has followed the aerospace and defense industry as an analyst since 1984.

For portions of the U.S. defense industry, China's military rise is viewed as an opportunity. As Beijing develops and fields more advanced defenses, the U.S. plans to respond with new spending on air, naval, missile defense and cyberforces. Indeed, this was underscored by the U.S. strategy pivot to Asia that was unveiled in January. But China's rise could also pose three challenges to U.S. defense companies in ways that may not be currently appreciated or understood.

In 2011, 18.5 million passenger and commercial vehicles were made in China; more than any other country. It has overtaken South Korea as the largest commercial shipbuilder in the world. Huawei and ZTE are some of the largest manufacturers of telecommunications equipment in the world. And while there are questions about its GDP growth rate in 2012-13, China could still emerge as the world's largest economy later this decade.

“China's defense exports have so far been limited to countries such as Pakistan, Myanmar and Bangladesh. This could change.”

This rising economic and commercial prowess will put a new face on China's defense industry. China's defense enterprises have historically been state-owned and not export-oriented. However, some major suppliers, such as CETC and Avic, are playing roles in respective commercial electronics and commercial aviation markets. The managerial, manufacturing and marketing skills gained from commercial market participation should affect how China develops, builds, markets and supports its defense products. These changes will pose new challenges to U.S. defense companies.

● The first challenge is that China's rise serves as a catalyst to shake up Pentagon acquisition practices. The time that it generally takes the Defense Department to design, develop and field new weapons systems remains lamentably slow. In the next few years, as China's defense sector starts seeing the fruits of its extensive cyberespionage—assuming these allegations are true—the department and industry will come under pressure to improve the pace of design,

development and testing. And some current U.S. programs could be truncated.

● A second challenge is posed by weapons costs. Wages in the U.S. are multiples of those in China. Unlike other manufacturing and technology sectors, including civil aerospace, U.S. defense companies do not have the option of significantly sourcing subsystems and parts from low-wage enterprises in Asia, Eastern Europe or Mexico. U.S. military contractors also have employee benefit costs and must comply with numerous regulations unique to the U.S. The Pentagon is driving to lower weapons costs, but there is no way defense companies can use all of the tools available to other U.S. manufacturing and technology firms, which have adjusted their costs to be competitive worldwide. While the performance of U.S. weapons systems may remain world-class, their costs may not prove globally competitive.

● The third challenge is competition in export markets. This challenge results from the potential for faster weapons-acquisition cycles in China that are along commercial lines and which cost less than for U.S. products. Chinese defense exports have not been a significant factor in global markets, which have been dominated since the 1990s by U.S. and European companies. Thus far, China's defense exports have been limited to countries such as Pakistan, Myanmar and Bangladesh that are immaterial to U.S. commerce. This could change as China's military modernization needs are sated and as China focuses on building broader relationships with other states, particularly in the Middle East, Southeast Asia and parts of Latin America.

This scenario already is playing out in the global truck market. Chinese enterprises, such as SinoTruck, are most able to penetrate truck markets in Asia, the Middle East and Latin America that cannot afford expensive Western models. These Chinese firms do not have the reputation to directly challenge these vehicles in developed markets, nor do they have the reputation and the extensive dealer and service networks that U.S. and European manufacturers have built up over decades in their domestic markets. In emerging markets, the playing field may be more level.

China's military rise may not prove to offer a one-sided benefit to the U.S. defense industry and might prove more disruptive and challenging. As other industries and institutions adapt to China's rise, so too will the Defense Department, and U.S. contractors will have to change. ☐

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