



RICH MEDIA
EXCLUSIVE

**ATM Beyond
NextGen**



RICH MEDIA
EXCLUSIVE

**Have U.S. Defense
Exports Peaked?**

**Airbus's 757
Replacement**

\$14.95 JANUARY 15 - FEBRUARY 1, 2015

AVIATIONWEEK

& SPACE TECHNOLOGY



RICH MEDIA
EXCLUSIVE

**THE NOTORIOUS
MR. PUTIN**

PERSON OF THE YEAR

AviationWeek.com/awst

Powered by Penton*

“

“It’s very rare to take a technologically advanced leap
and integrate it into your fleet.”

“The 787 Dreamliner allows us to fly additional routes
to further destinations and link Canada to points
we have never been able to in the past.”

”

Ben Smith
President
Passenger Airlines
Air Canada



THE DREAMLINER EFFECT. AIR CANADA SUCCESS.

Editor-In-Chief Joseph C. Anselmo
Executive Editor James R. Asker
Managing Editors Jen DiMascio, Jens Flottau, Graham Warwick
Assistant Managing Editor Michael Stearns
Associate Managing Editor Andrea Hollowell
Art Director Lisa Caputo
Director, Editorial and Online Production Michael O. Lavitt
Director, Digital Content Strategy Rupa Haria

DEFENSE, SPACE AND SECURITY

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

CIVIL AVIATION/MAINTENANCE, REPAIR AND OVERHAUL

Editors Jens Flottau (Managing Editor), Madhu Unnikrishnan (Associate Managing Editor), Sean Broderick, Cathy Buyck, John Croft, William Garvey, Fred George, Rupa Haria, Molly McMillin, Guy Norris, Bradley Perrett, Jessica Salerno, Adrian Schofield, Brian Sumers, Lee Ann Tegtmeyer (Chief Editor, MRO Edition)

Chief Aircraft Evaluation Editor Fred George

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

EDITORIAL OFFICES

1166 Ave of Americas, New York, N.Y. 10036
 Phone: +1 (212) 204-4200

BUREAUS

AUCKLAND

53 Stainercross St., Green Bay, Auckland 0604, New Zealand
 Phone: +64 (27) 578-7544
Bureau Chief Adrian Schofield

BEIJING

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

BRUSSELS

Rue de LAqueduc 134, 1050 Brussels, Belgium
 Phone: +32 (2) 648-7774
Bureau Chief Cathy Buyck

CHICAGO

330 N. Wabash Ave., Suite 2800, Chicago, Ill.
 Phone: +1 (312) 840-8445
Bureau Chief Lee Ann Tegtmeyer

COLUMBIA, S.C.

1120 Baffin Road, Columbia, S.C. 29212
 Phone: +1 (803) 727-0809

Managing Editor, AviationWeek.com Sean Meade

FRANKFURT

Am Muehlberg 39, 61348 Bad Homburg, Germany
 Phone: +69 (69) 2999-2718 Fax: +49 (6172) 671-9791
Bureau Chief Jens Flottau

LONDON

50 Broadway London SW1H0RG, England
 Phone: +44 (207) 152-4521
Bureau Chief Tony Osborne

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 Pyasushkin

NEW DELHI

Flat #223, Samachar Apartments,
 Mayur Vihar—Phase-1 (ext.), New Delhi 110091, India
 Phone: +91 (98) 1154-7145
Contributing Editor Jay Menon

PARIS

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

SAN FRANCISCO

271 Coleridge St.
 San Francisco, Calif. 94110
 Phone: +1 (415) 314-9056
Bureau Chief Madhu Unnikrishnan

WASHINGTON

1911 Fort Myer Drive, Suite 600
 Arlington, Va. 22209
 Phone: +1 (703) 997-0333
Bureau Chief James R. Asker
Administrator of Bureaus Kyla Clark

WICHITA

1500 N. Willow Lane,
 Wichita, Kansas 67208
 Phone: +1 (316) 993-3929
Bureau Chief Molly McMillin

Art Department Scott Marshall, Colin Throm

Copy Editors Patricia Parmalee, Andy Savoie,
 Richard Leyshon, Diana Bell

Production Editors Elizabeth Campochiaro, Bridget Horan,
 Ellen Pugatch

Contributing Photographer Joseph Pries

PENTON

David Kieselstein
Chief Executive Officer

Warren N. Bimbleck
Senior Vice President, Strategy and Business Development

Nicola Allais
Chief Financial Officer/Executive Vice President

Gregory Hamilton
President, Aviation Week

OEM partners include UTAS, Safran, GE Aviation, Honeywell, Curtiss-Wright and many more.



**Production, Spares and MRO for
Business, Commercial and Military Aircraft**

EXTENDED LIFE SOLUTIONS

Under license or acquisition, Ontic supports your customers by providing OEM-pedigreed product for as long as there is a need. Value for the OEM. Value for the customer.

ONTIC
 A BBA Aviation company

Avionics, Electronics, Power, Engines, APUs,
 Hydraulics, Fuel Measurement Systems,
 Electro-Mechanical, Heat Transfer,
 Landing Gear, and much more.



(+1) 818 678 6555 ontic.com

New for 2015!

SpeedNews Aerospace Additive Manufacturing Briefings



April 7, 2015

Terranea Resort • Palos Verdes (Los Angeles) • CA

In conjunction with SpeedNews Aerospace Manufacturing Conference

Please visit www.SpeedNews.com for more information

SpeedNews

11500 W. Olympic Blvd., Suite 574 • Los Angeles, CA 90064, USA

Tel: +1-424-465-6501 • Fax: +1-424-465-6506 • conferences@speednews.com

SpeedNews is part of the Penton Aviation Week Network

AVIATION WEEK

& SPACE TECHNOLOGY



Digital Extras Tap this icon in articles in the digital edition of AW&ST for exclusive features. If you have not signed up to receive your digital subscription, go to ow.ly/AkXJo

- 6 Feedback
- 7 Who's Where
- 10-11 First Take
- 12 Up Front
- 14 Going Concerns
- 15 Airline Intel
- 16 Leading Edge
- 18 Reality Check
- 20 Commander's Intent
- 21 In Orbit
- 22 Washington Outlook
- 71 Classified
- 72 Contact Us
- 73 Aerospace Calendar

AIR TRANSPORT

- 24 Airbus launches** A321LR with a third auxiliary center fuel tank as a Boeing 757 replacement
- 25 ICAO will draft** new performance-based tracking and distress alerting standards for all airliners
- 26 Transaero Airlines** faces an uphill battle to survive as it grapples with an array of problems
- 27 GE's Passport** engine entering final phases of certification for Global 7000/8000 long-range bizjets
- 58 Air Astana** carves out niche as Central Asia's leading airline, but its growth is expected to slow
- 60 Etihad must now** prove it can restore its new equity alliance member Alitalia to profitability



10

Testing of surplus Space Shuttle Main Engines for use in the heavy-lift Space Launch System began Jan. 9, with NASA firing one of two leftover ground-test powerplants.

- 61 Rockwell Collins** cautiously optimistic its commercial aviation weather radar can find a runway

SPACE

- 28 Certification needs** slow, but do not stem SpaceX's quest for government work
- 56 Arianespace expects** to post record revenues in 2014, thanks to 12 launches listing 23 spacecraft
- 56 Sierra Nevada** to proceed with Dream Chaser despite failure to thwart NASA's selection for CCVs

DEFENSE

- 29 Lockheed Martin** dusts off Thaad-ER design as counter to Chinese hypersonic boost glide vehicle
- 31 Indications are** that Belgium may be drawing closer to selecting the F-35 as its next fighter aircraft

- 32 Pentagon reverses** plan to terminate the U-2, reopening a debate about high-altitude recce platforms

- 50 MRO assignments** signal a path toward financial return for the F-35 partner nations

- 51 Germany may turn** to U.S. Navy's Triton to resurrect Euro Hawk program and claw back €600 million

TECHNOLOGY

- 33 Terrafugia wants** FAA to waive limits so its flying car can still be called a light sport aircraft
- 34 Testing keeps** truss-braced wing configuration in running for energy-efficient airliner designs



ON THE COVER

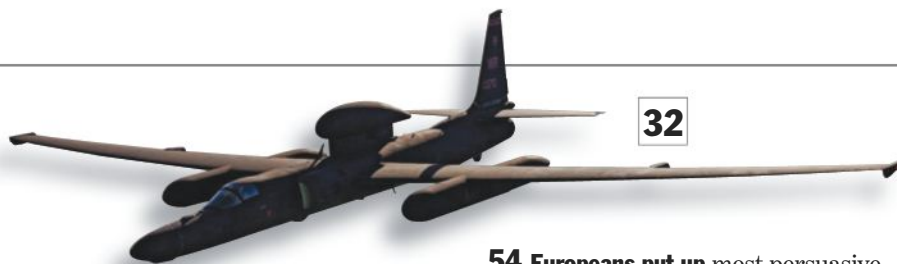
36 No one had more impact on aerospace and aviation in 2014—for better or worse—than Russian President Vladimir Putin. Fallout from Russian behavior like annexing Crimea and militarily supporting separatists in Ukraine affected defense, space and commercial aviation sectors (see page 36). Getty Images photo. Elsewhere in this issue is a report on defense exports (page 42).



24 Airbus assumes a standard cabin layout for 206 passengers in its newly launched A321LR.



62 NASA is building a ladder to air traffic management technologies post-2040.



PERSON OF THE YEAR

36 Russian President Putin named Aviation Week's Person of the Year for his aerospace sector impact

40 Russia's ongoing military transformation to ease rapid deployments became apparent in 2014

DEFENSE EXPORT TRENDS

42 Despite real reforms, U.S. A&D exports are slow to benefit as the world changes quickly



44 Brazil faces complex and unique set of defense, security and economic challenges and opportunities

45 Turkey maturing its products with ambitions of becoming one of the largest defense exporters

46 Inexperience challenges Japan in export weapons sales so its arms producers must adapt to succeed

47 South Korea becoming player in exports as foreign sales grow from \$250 million in '06 to \$3.6 billion

48 India slowly building ability to export indigenously developed weapons systems to neighbors

ROTORCRAFT

53 Airbus to begin ground tests of a diesel-cycle piston engine with the goal of a 30% fuel-use reduction

54 Europeans put up most persuasive offers for South Korea's next battle-field utility helo and civil derivative

55 Airbus urging Japan to base its next army utility helo on the X4, which is developing for the civil market

AIR TRAFFIC MANAGEMENT

62 In 2040, ATC will 'team' with the ATM system to optimize aircraft routing, capacity and fuel savings

64 NASA advances flight deck with one seat for a captain and one on the ground for a first officer

66 Airbus and Boeing repurpose and bundle existing ATM technologies to boost capacity and efficiency

70 NASA moving quickly to develop a system to enable safe, efficient operation of civil UAS at low altitudes

VIEWPOINT

74 Landing people on Mars is a goal on which there is consensus but disagreement on the steps in between



Get the New App



Download & Login Instructions

Start reading today by following the steps below.

DOWNLOAD. Go to the Apple App Store, search for "Aviation Week" and download the *Aviation Week & Space Technology* app to your iPad or iPhone.

OPEN. Once the app is downloaded, open it on your device.

LOGIN. Tap on any locked article to get the login screen OR on the menu icon in the upper right corner of the app screen (image with three parallel lines) and tap "Login." Log in using the email address associated with your subscription.

Forgot Password? Tap the "forgot password" link on the login screen and follow the reset instructions emailed to you (this password may not be the same as for your Zinio digital edition).

Already Downloaded? Make sure you have the upgraded version of the app, which fixes some bugs and adds a tutorial for users. Go to the Apple App store and click on "updates" to download. You can also improve performance by going into Settings, clicking on Safari and selecting "clear history and website data."

Android User? An Android version of the app has been developed and will be available shortly.

Problems? If you don't have a registered email or password, or are having problems with the download or login, contact our customer care team for assistance:

Toll-free (North America)
800-525-5003
Outside North America:
(+1) 847-763-9147

Email: awstcustserv@halldata.com
Web: AviationWeek.com/awstcustomers

SCALED COMPOSITES' SPEAKS

I would like to take exception to the unsupported assertion by Graham Warwick in "Designer Aircraft" (AW&ST Dec. 15/22, 2014, p. 16) that since Scaled Composites was acquired by Northrop Grumman in 2007, "its priorities have shifted."

We applaud the work by Dzyne and many others in our industry, but rest assured our priorities remain the same, and include the efficient and safe design of aircraft for private customers such as Burt Rutan's gas-electric roadable aircraft, BIPOD, and a number of other proprietary project aircraft. These are the same priorities Rutan pursued during his tenure as the inspirational leader and CEO of Scaled Composites.

We continue to pursue projects of all sizes and complexity, cutting across many aviation market domains. I am extremely proud of our history of building general aviation-size, prototype demonstrator aircraft for a wide variety of courageous, visionary entrepreneurs and business leaders. I am equally proud of the less noticed, less publicized, and yet significant work we have done for aerospace primes, NASA and the Defense Department.

I would contend that since 2007, the opportunities that have been available in the small aviation market space have been few. The current project mix at Scaled reflects both the marketplace and the strong confidence we earned from our customers on smaller projects. Our customers recognize that in addition to building small prototypes, we also have the skill and capability to succeed at a project of the size and complexity of Stratolaunch (1.3 million lb. gross takeoff weight).

We continue to cultivate new opportunities and are eager and ready to service aviation and aerospace customers whose requirements range in all sizes and complexity.

Our priorities and mission remain consistent with our legacy "Design, Build, Test" philosophy, which is our history and will be our future.

Kevin Mickey, President

Scaled Composites

MOJAVE, CALIFORNIA

SAME SAD STORY?

Most pilots and engineers I know are second-guessing what took place in those final minutes of the doomed

AirAsia Flight 8501. Apparently an experienced pilot—faced with myriad extraneous and misleading data—had only a few seconds to draw from his experience and knowledge to effect a recovery.

When I piloted Airbus A300s and A310s for Delta Air Lines, I noted that extraneous inputs would occur to our pitot-static instruments on an infrequent and random basis in flight, causing the readouts to vary—in some cases to extreme limits. These momentary electrical or software "glitches" would trip the autopilot as a safeguard, which would trigger warning horns and lights that added another layer of distraction.

Based on experience, most of my colleagues would hand-fly the aircraft, referencing the attitude indicator until the anomaly passed, and then reset our systems. "Chasing" an erroneous increasing airspeed would result in a rapid climb, an unsafe attitude and possibly an aircraft upset as witnessed in the crash of Air France Flight 447 into the Atlantic on June 1, 2009. This same scenario seems to have happened again.

As a side note, *Aviation Week & Space Technology* used to publish extensive accident reporting, replete with detailed transcripts of voice and flight-recorder data. This was a very popular feature with the professional flying community and helped serve as an aid toward understanding the underlying causes of accidents. I hope its restoration is among your plans as you transition more to the digital side.

Capt. (ret.) Thomas Carey

FREELAND, WASHINGTON

STRIKING A CHORD

It seems to me that until the industry stops winding the aircraft center of gravity back to 37% chord, this sad litany of crashes will continue.

I would willingly pay the incremental cost of a shift to 33% on any flight I take. I sense I am not alone in thinking this way.

Lew Creedon

OCEANSIDE, CALIFORNIA

LOCATION, LOCATION AND F-35S

No wonder F-35 infrastructure costs are so high. According to "A Year of Debuts" (AW&ST Dec. 29, 2014-Jan. 14, 2015, p. 69) the Air Force has moved Hill AFB from Utah to Oklahoma!

Aviation Week & Space Technology welcomes the opinions of its readers on issues raised in the magazine. Address letters to the Executive Editor, Aviation Week & Space Technology, 1911 Fort Myer Drive, Suite 600, Arlington, Va. 22209. 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.

Seriously, AW&ST is still the "go to" source of aviation news. Keep it up and Happy 2015!

Richard Porcelli

BARNEGAT, NEW JERSEY

'B'-SPECIFIC

Every aviation-savvy person on this planet knows that the U.S. Marine Corps version of the F-35 is a "B" model. The open door behind the cockpit in the photo that accompanies "A Year of Debuts" is clearly an illustration of the



presence of a shaft-driven fan utilized by the "B" model for short-takeoff-and-landing operations, not the C version.

Henry H. Roll

WYOMING, DELAWARE

POWER ADJUSTMENT

The Military Transports To Watch table in the recent Aerospace & Defense roundup (AW&ST Dec. 29, 2014-Jan. 14, 2015, p. 74) lists the Russian Progress D-27 turboprop engine as being capable of 55,200 shp each. I believe the correct figure is around 14,000 shp per engine. The number given in the table is probably the total shp of all four engines.

Norman Foster

DUXFORD, ENGLAND

(The reader is correct.)

Who's Where

David C. Wajsgras (see photo) has been appointed president of Waltham, Massachusetts-based Raytheon's Intelligence, Information and Services, succeeding **Lynn A. Dugle**, who plans to retire. Wajsgras has been corporate vice president/CFO and will be succeeded by **Anthony F. "Toby" O'Brien** (see photo). O'Brien has been vice president/CFO of Raytheon Integrated Defense Systems and was vice president-finance for Raytheon Airline Aviation Services and CFO of the then-Raytheon Aircraft Co.

S. Daniel Johnson has been named executive vice president-information systems and technology of Falls Church, Virginia-based *General Dynamics*. He succeeds **David K. Heebner**, who has retired. Johnson will continue as president of General Dynamics Information Technology.

David Brigante (see photo) has been named senior vice president of ATR's procurement directorate. He was senior vice president-customer support and services for Alenia Aermacchi.

Robert Van Riper has become sales manager for HondaJet Southeast for *Banyan Air Service*, Fort Lauderdale, Florida.

Rebecca Davies has been appointed European human resources manager, based in Cambridge, England, for the *ExecuJet Aviation Group*.

Kevin Mitchell (see photo) has been named vice president-global supply chain for the Redondo Beach-based *Northrop Grumman Aerospace Systems*. He succeeds **Lisa Kohl**, who has retired. Mitchell was vice president-production operations/site manager in El Segundo, California.

Pastor Lopez has become CEO of *Pemco World Air Services*, Tampa, Florida. He was vice president of AAR's Aircraft Components and Landing Gear Services divisions.

Don Huth has been appointed director of operations at *Chromalloy's* Orangeburg, New York, turbine engine manufacturing and repair center. He was manager of the Eaton Corp.'s Manufacturing Center of Excellence. **Ben Sommerville** has been named director of engineering at Chromalloy's engine component service center in Phoenix.

Melanie Hinton has been named managing director for airline industry

public relations and communications for Washington-based *Airlines for America*. She was senior communications manager for the Association for Unmanned Vehicle Systems International.

Norman Anderson (see photos) has become chief operating officer at *Skybird*, Van Nuys, California. Capt. **James Topalian** has been promoted to director of operations from chief pilot. He has been succeeded by Capt. **Power Johnson**, who has been promoted from safety officer.

USN Rear Adm. Troy M. Shoemaker has been nominated for promotion to vice admiral and assignment as commander of Naval Air Forces/commander of the Naval Air Force of the U.S. Pacific Fleet at San Diego. He has been commander of the Naval Air Force of the U.S. Atlantic Fleet, Norfolk, Virginia. Shoemaker will be succeeded by Rear Adm. **John R. Haley**, who has been director of global operations of U.S. Strategic Command, Offutt AFB, Nebraska.

Alexander Chatkewitz has been appointed vice president/controller and **Tony Lowery** vice president-technical operations of *JetBlue Airways*. Chatkewitz held the same positions at Philip Morris International Inc. Lowery was head of maintenance operations for Qantas Airways and had been senior director of maintenance production at Southwest Airlines.

Dale Collins and **Peter Malone** have been named to the board of directors of *Paradigm Precision*, Stuart, Florida. Collins is a former executive at aerospace companies. Malone is the operating executive in the Aerospace, Defense and Government Services Group of The Carlyle Group and was senior managing director of CSP Associates Inc.

Bryan Shillito has become managing director of safety programs for the *Alaska Air Group*. He was director of safety assurance and held similar positions at Northwest Airlines and US Airways.

Matt Minetola has been appointed



David C. Wajsgras



Anthony F. O'Brien



David Brigante



Kevin Mitchell



Norman Anderson



James Topalian



Power Johnson

To submit information for the Who's Where column, send Word or attached text files (no PDFs) and photos to: stearns@aviationweek.com For additional information on companies and individuals listed in this column, please refer to the Aviation Week Intelligence Network at AviationWeek.com/awin For information on ordering, telephone U.S.: +1 (866) 857-0148 or +1 (515) 237-3682 outside the U.S.

chief information officer for U.K.-based *Travelport*. He held the same position at HP Financial Services.

HONORS AND ELECTIONS

Ken Hylander, a former Delta Air Lines executive, has been named chairman of the board of governors of the Washington-based *Flight Safety Foundation*. He succeeds **David McMillan**.

German Efromovich, president of Synergy Group and chairman of Avianca, and **Roberto Kriete**, cofounder of Avianca Holdings and a board member, have received Federico Bloch Awards from *ALTA*, the *Latin American and Caribbean Air Transport Association*. They were cited for leadership and vision in the aviation industry, and are credited with conceiving, negotiating and consummating the Grupo Synergy-Grupo TACA merger. The award honors the memory of Bloch, a pioneer in Latin American aviation and the driving force behind the creation of Grupo TACA.

John Stammreich has been reelected president, for 2015, of the *Aero Club of Southern California*. Other officers chosen are: **Nissen Davis**, first vice president; **Stephen Perry**, second vice president; **Arthur McAllister**, treasurer; and **Bill Withycombe**, secretary. **Julie Sims** was named to the board of directors.

Robert Saia, retired vice president of commercial engine development programs for

Pratt & Whitney, has received the Silver Medal from the London-based *Royal Aeronautical Society* "for leading the Pratt & Whitney team that brought the PurePower geared turbofan engine family to market." ☼

www.rolls-royce.com



Our people care



#TrentXWB

The story continues...

WorldMags.net

Small things make perfection, but perfection is no small thing.

“

This is a bolt, a Trent XWB fan case bolt. It may not look as eye-catching as say a fan blade but, just like one of those hollow titanium blades, it's as close to perfection as is possible. There are more than 20,000 parts in a Trent XWB and each of them has to meet the same exacting standards. Every part undergoes extreme testing to ensure it's capable of doing what it's designed to do every time. This may be just a bolt but it's designed, manufactured and installed with pride and that's what makes the Trent XWB the most efficient aero engine in the world today.

”

Michelle Carter - Purchase Programme Controller



BOMBARDIER

COMMERCIAL AVIATION

Bombardier has halted development of its all-composite mid-size Learjet 85, citing continued weak demand for lighter business jets. The company will record a \$1.4 billion fourth-quarter 2014 charge to write off development costs, and reduce its workforce by 1,000 in Wichita and Queretaro, Mexico. Queretaro will continue to make Global 7000/8000 aft fuselages while Wichita assembles Learjet 70/75s. Bombardier also warns cash flow from aerospace will be \$800 million in 2014, not \$1.2-1.6 billion as forecast. Expenditures on plant and equipment, including aircraft development costs, are expected to be \$1.8 billion, raising analysts' concerns over the company's liquidity. On the plus side, Bombardier delivered a few more aircraft than forecast in 2014: 204 business jets and 84 commercial aircraft, up 22% over 2013.

Airbus is targeting the Boeing 757 replacement market with a long-range version of the A321neo with a 97-ton maximum takeoff weight. Air Lease Corp. is the launch customer, signing a memorandum of understanding for 30. To enter service in 2019, the 206-passenger aircraft will have a third auxiliary center fuel tank and fly around 500-nm farther than an A321neo with regular 93.5-ton maximum weight. Airbus claims a calculated 4,000-nm range, exceeding the 3,850 nm of a winglet-equipped Boeing 757-200W and burning up to 30% less fuel. Airbus sees a market to replace the 469 757s flying, plus another 500 sales (page 24).

China's indigenously designed Comac ARJ21-700 regional airliner has been granted a type certificate by the country's civil aviation authority. Certification follows more than 12 years of development, including six in flight testing. The Civil Aviation Administration of China issued the Chapter 25 type certificate on Dec. 30. The first airline to receive the aircraft will be Chengdu Airlines, in April or



COMAC

May. The aircraft will belong to Comac and will help the manufacturer learn to support the type in service.

New aircraft delivered after 2020 should come equipped with a tracking data broadcast system that sends regular position updates to airline operators, a flight data recorder that automatically deploys (and floats) in the event of a crash and a tamper-proof distress reporting unit that will transmit aircraft position, the International Civil Aviation Organization working group on aircraft tracking recommends (page 24).

Airbus and Boeing are trading claims over which dominated the commercial-aircraft market in 2014, with the U.S. manufacturer delivering more aircraft but its European rival booking more net orders. Boeing delivered 723 aircraft last year, up from 648 in 2013, while Airbus deliveries were up marginally at 629. Boeing set a company record for orders in 2014 at 1,432 aircraft, up from 1,355 in 2013, but was topped by Airbus's 1,456 net orders, although this was down from 1,503 a year earlier (page 24).

Canadian helicopter engineering company Eagle Copters' reengineering of the single-turbine Bell 407 with a Honeywell HTS900 turboshaft has been certified. The installation was originally developed for Bell's ARH-70 Arapaho armed reconnaissance helicopter, which was canceled by the U.S. Army in 2008. Replacing the 407's Rolls-Royce M250-C47 improves hot-and-high performance, says Eagle, which hopes Bell will eventually adopt the upgrade for its 407GX and foreign military versions of the helicopter.

DEFENSE

RAF Lakenheath in the U.K. has been chosen as the first European base for U.S. Air Force Lockheed Martin F-35As. Nearby RAF Mildenhall is to be closed under a Defense Department cost-saving plan to reduce its infrastructure in Europe. Two squadrons of F-35s will be located at Lakenheath, with the first aircraft to arrive in 2020. Boeing KC-135 tankers at Mildenhall and a co-located special operations group flying Lockheed Martin MC-130Js and Bell-Boeing CV-22s will move to bases in Germany. The result will be a net decrease of about 2,000 U.S. military and civilian personnel in the U.K.

Bell Boeing V-22 Osprey tiltrotors will replace aging Grumman C-2A Greyhound carrier onboard delivery (COD) aircraft under an agreement between U.S. Navy and Marine Corps leadership. A Jan. 5 memo, obtained by *Breaking Defense*, says an initial batch of 12 Ospreys are to be diverted from Marine Corps MV-22 procurement in fiscal 2018-20 for conversion to Navy HV-22 COD aircraft. The Marines would receive replacement MV-22s in fiscal 2021-23. The HV-22 would be fitted with extra fuel tanks to meet Navy range requirements. Using the MV-22 avoids the need to take scarce aircraft out of service for modernization while reducing risk because it is in production and service, and can do more just than the COD mission, says Sean Stackley, assistant Navy secretary for research, development and acquisition. Northrop Grumman appears not to be giving up, saying "For the COD mission, we believe that modernization of the current fleet of C-2As will provide the most cost-effective option."



U.S. NAVY

Turkey is to push ahead with developing an indigenous combat aircraft. On Jan. 7, the country's Defense Industry Executive Committee decided to move the TF-X program into the pre-design phase. A feasibility phase was completed in early 2013: Turkish Aerospace Industries working with Saab on the definition of three initial aircraft designs: one twin- and two single-engine. Turkish media reports suggest the twin-engine design may now progress further. But it is unclear if the goal of a first flight in 2023 still stands.

The U.S. Air Force, which last year proposed retiring the Lockheed U-2 and transferring the high-altitude intelligence collection mission to Northrop Grumman's unmanned RQ-4 Global Hawk, has been directed to restore funding for continued operation and modest upgrades to the aircraft (page 32).

China's third flight test of a hypersonic strike vehicle has Lockheed Martin dusting off a dormant proposal to develop a more capable interceptor for the Terminal High-Altitude Area Defense (Thaad) system. So far the company has invested internal funds for the design of a Thaad-ER (extended range). Lockheed argues that China's hypersonic glide vehicle is intended to find a seam between systems such as Patriot and Aegis that Thaad-ER could close because it operates both inside and outside the atmosphere. Development could cost as much as \$1 billion (page 29).

Boeing is confident all four test aircraft will be "in the air in 2015" after the first engineering and manufacturing development KC-46A made its delayed first flight on Dec. 28. Major wiring installation issues delayed the flight by six months, and pushed the first flight of the fully configured KC-46A to April. The first test aircraft is a specially developed 767-2C commercial freighter variant that does not yet have any aerial refueling or other military systems. Boeing says "it remains on plan to deliver the initial 18 combat-ready KC-46A tankers to the [U.S.] Air Force by 2017."

After saying it would not bid, because of concerns over the requirements, Sikorsky has submitted a proposal for Poland's \$3 billion utility helicopter program. The U.S. manufacturer, working with Polish subsidiary PZL-Mielec, is competing against Airbus Helicopters and AgustaWestland (with its Polish subsidiary PZL-Swidnik) for an initial purchase of 70 aircraft for three different missions. Around 48 will be for troop transport, 12 used by the navy for antisubmarine warfare and search-and-rescue, and 10 for combat search-and-rescue. AgustaWestland is offering the AW149, Airbus the EC725 Caracal, and Sikorsky its S-70i Black Hawk and S-70B Seahawk.

The first 20 production MBDA Brimstone 2 air-to-surface missiles have been delivered to the U.K. Defense Ministry for operational evaluation trials this year at China Lake, California, likely fired from a Panavia Tornado GR4. The Royal Air Force hopes to have the improved dual-mode weapon, which should have entered service early in 2012, ready for operation by this November. Brimstone 2 has an insensitive-munition warhead and rocket motor, increased engagement envelope and beefed-up airframe.

The U.S. Navy's Northrop Grumman Fire Scout unmanned helicopter has flown from a destroyer for the first time, the developmental extended-endurance MQ-8C version operating off



NORTHROP GRUMMAN

the DDG 109 USS Jason Dunham off the Virginia coast. The baseline MQ-8B recently deployed to the Western Pacific on the littoral combat ship USS Fort Worth, operating alongside an MH-60R Seahawk manned helicopter.

SPACE

Sierra Nevada Corp.'s (SNC) argument that NASA overemphasized the development schedule in select-

ing Boeing and SpaceX to fly commercial crew vehicles did not fly with the U.S. Government Accountability Office (GAO), which on Jan. 5 denied the losing bidder's protest. The GAO says it "found no undue emphasis on NASA's consideration of each offeror's proposed schedule, and the likelihood to achieve crew transportation system certification not later than 2017." SNC says it "plans to further the development and testing of the Dream Chaser." The company intends to propose the reusable spaceplane for the second round of NASA cargo-delivery bidding.

Testing of surplus Space Shuttle Main Engines (SSMEs) for use in the heavy-lift Space Launch System (SLS) has begun, with NASA firing one of two ground-test engines left over from the shuttle program. Primary objective of the 500-sec. test on Jan. 9—the first time an Aerojet Rocketdyne RS-25 SSME has fired since the STS-135



NASA

Atlantis flight in 2011—was to "wring out" a prototype engine controller based on that developed for the J-2X upper-stage engine. In addition to the two development engines, NASA has 16 surviving RS-25s to be used four at a time as the main-stage powerplant for the initial 70-metric-ton SLS.

Virgin Galactic plans to assume control of the SpaceShipTwo (SS2) test program from development partner Scaled Composites when flights resume later this year. The first SS2 was lost in an accident over California's Mojave Desert on Oct. 31. At that time, Scaled was on the verge of transferring full ownership and responsibility for flight testing of SS2 to Virgin following the planned completion of key contractual milestones. The structure of the second SS2 is 90% complete at The Spaceship Co., the Virgin/Scaled joint venture formed to build the vehicles.



Kevin Michaels is global managing director of aviation consulting and services for ICF International, Ann Arbor, Michigan.

COMMENTARY

Doubling Down

Why Airbus probably will launch an A380neo

December 10-11, 2014, was one of the more eventful 24-hr. periods in recent memory at Airbus. At the company's investors day in London, CFO Harald Wilhelm caused major consternation when he questioned the commercial viability of the A380 and indicated the possibility of discontinuing production later this decade. Airbus Group shares fell 10%. The following day, CEO Fabrice Bregier reversed course and offered a ringing endorsement of the program, stating that Airbus "will one day launch an A380neo and we will one day launch an A380 stretch."

Who is correct? On the surface, the economic case for Airbus cutting its losses on the program, which industry guru Richard Aboulafia provocatively labeled "the worst new product launch decision since the New Coke," appears valid. Why spend an estimated \$2.5 billion to reengine a niche aircraft program that cost \$25 billion to develop and has managed to attract only 318 deliveries and firm orders to date? Moreover, the only customer publicly clamoring for the A380neo is Emirates.

My hunch is that the Airbus CEO will carry the day, and the A380neo will move forward for several reasons. First, there is the support of Emirates. Its corporate strategy and the prestige of the UAE depend on the A380, and it is not likely to accept a situation where it is the operator of the industry's most valuable out-of-production "orphan" fleet. Emirates has indicated that it will take as many as 70 A380neos should Airbus move forward. Assuming a worst case where Emirates is the only major customer, this would work out to a development cost of \$35 million per aircraft. Assuming that Emirates spends upward of \$40 million per year on fuel for each A380 and a conservative 10% fuel efficiency gain, this works out to a fuel savings of about \$4 million per aircraft per year. This isn't a quick breakeven by any measure, but



JOEPRIESAVIATION.NET

when combined with a maintenance holiday and new route opportunities, it appears reasonable that a major Emirates order could cover much of the program's development expenses.

The A380neo would also fit neatly into Rolls-Royce's development plans. There are rumors that Rolls is exploring several options to power the neo and possibly an A380 stretch, which range from the Trent XWB to the recently announced Advance program, which is slated to debut around 2020. Moreover, a commitment to the neo could translate to a win on Emirates' current order for 25 A380s where it has yet to select an engine. With General Electric firmly in the Boeing camp with its sole-source 777 positions, the A380neo is Rolls-Royce's opportunity to lose. The challenge will be holding down non-recurring engineering expenses to support a viable business case. A lesson here might be gained from the A330neo, where Rolls used a largely preexisting engine to create the Trent 7000.

Then there is politics. Canceling the A380 program after just a decade of production would be a political catastrophe, not only for Airbus but also for Europe. Many current Airbus executives were involved in the A380 launch decision and would undoubtedly prefer to avoid a premature termination on their watch. The same is true for many European politicians who supported the program.

Above all, the NEO would extend production at least into the mid-2020s and buy Airbus a precious commodity: time. As Emirates CEO Tim Clark said in a recent interview, "Don't bottle this. The day will come again. The global economy will take care of you." And there is historical precedent for this evolution given the Boeing 747's 55-year production run.

The launch of the A380neo is by no means a slam dunk. The business case is marginal and highly dependent on the fortunes of Emirates. The recent decline in fuel prices, if it is sustained, would reduce the attractiveness of the program. It is unclear that there will be a secondary market for used A380s if the NEO goes into production, and residual values would suffer. The 777-9X will create new and formidable competition. Finally, financial markets are jittery about the NEO's potential impact on shareholder returns and would likely reward Airbus if it terminated A380 production.

Airbus's dilemma is that by publicly floating the ideas of either a neo or premature program termination, it is less likely to attract new A380 orders. Given the four to five years required to develop a NEO and its current production backlog of roughly four years, Airbus must act fast if it would like to keep A380 production intact later this decade and assure customers that the program has a long-term future.

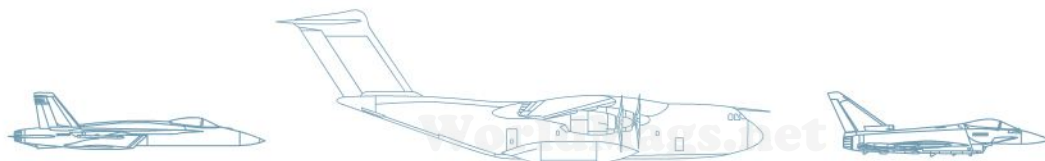
In many respects, the decision to reengine the A380 is a battle between "old Airbus," which was focused on technology and European prestige, and "new Airbus," which is focused on capital efficiency and profitability. My bet—by a very narrow margin—is that this will be the last chapter of "old Airbus" and that we will see the launch of the A380neo sometime in 2015. ☛



Ready for action – with MTU

Innovative technologies, decades of expertise, unparalleled repair capabilities, process excellence – just some of the reasons air forces all over the world rely on MTU Aero Engines. Our service experts will return your engines to peak condition – quickly and cost-effectively.

www.mtu.de/en





By Michael Bruno

Senior Business Editor
Michael Bruno blogs at:
AviationWeek.com/ares
michael.bruno@aviationweek.com

COMMENTARY

Check the Oil

The A&D industry is not monolithic, and neither is oil's impact

The questions started flying almost as quickly as Wall Street realized oil barrel prices were going down last summer. Key among them: What, specifically, does it mean for industry?

It depends.

Like all conundrums, oil's impact is not universal and clear, even within the aerospace and defense industry. First come more questions: How low will prices go, and for how long? And what part of industry are you asking about? The results may turn out to be surprising, even to insiders.

"For A&D, the consequences are likely to be mixed," notes financial analyst Robert Stallard at RBC Capital Markets. His advice this month to clients for the year ahead when it comes to oil: "Watch this one."

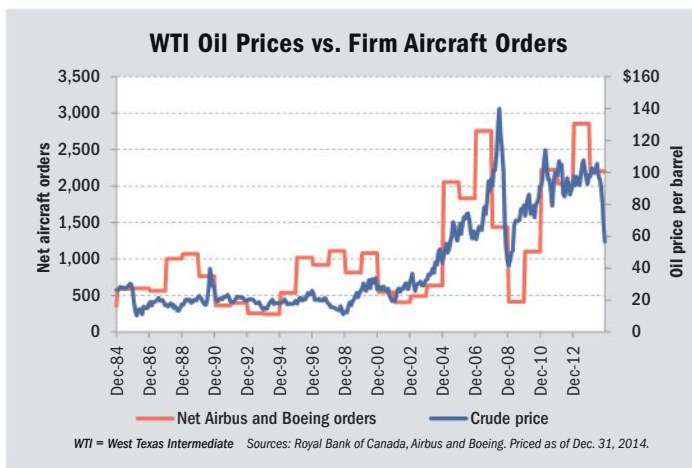
To be sure, the big original equipment manufacturers (OEM) have not changed their story. Just last week, Randy Tinseth, vice president of marketing for Boeing Commercial Airplanes, reiterated that the Chicago giant is seeing little impact on its airliner orders as oil prices touch lows last seen when the world was entering the Great Recession, and specifically in 2009. West Texas Intermediate crude oil has plummeted about 47% since June.

In fact, Tinseth argues, recent history points to orders rising as prices drop, because airlines are making even more money than planned. Moreover, they still face aging fleet issues that are pushing them toward buying new, more fuel-efficient aircraft. And price drops are coming from oversupply, Boeing has contended.

Not so fast, say financial analysts at Moody's Investors Service and RBC, especially if lower prices persist.

"Airlines globally just got handed a huge cost reduction, even if delayed by hedging, and we'll see what they do with it," RBC states. "The same goes for the economies of every oil importer. However, oil exporters see the other side, so we'll see what that does to defense imports and airlines in the Middle East, for example."

Moody's analyst Russell Solomon



sees pressure building on OEMs sooner rather than later. "From an aerospace and defense industry perspective, falling oil prices and the increasingly likely 'lower for longer' outlook elevate the risk of aircraft order deferral and/or cancellation," he said this month. That is because the value proposition for airline carriers in terms of reduced cost of ownership for new/next-generation aircraft relative to existing equipment is "markedly reduced."

Defense is no easier to divine. "The decline in the prices of oil and petroleum products is a variable with pros and cons for the sector whose impact

should become more apparent in the coming months," says Capital Alpha Partners analyst Byron Callan. "There isn't a one-size-fits-all answer for defense stocks or firms where defense is an investment factor," he said early this month.

For instance, whether Saudi Arabia or other oil-exporting customers of Western arms sales cut back expected orders due to lower domestic revenue is one possibility. At the same time, the Pentagon—the world's single largest energy customer—should see more relief in its annual budget due to lower operations and maintenance costs.

A reverse is always welcome, but especially as so-called sequestration spending caps tamp down research, development and procurement of eagerly sought weapons and systems. Still, it will take time for dollars to work back to the armed services—unless the defense comptroller opts to quickly move

money, which entails a bet that oil stays low for the year or more. Any benefit also could be overcome by budget reductions Congress may allow for in fiscal 2016.

The outcome for other subsectors is more direct. Lower oil spending should free up funds for deferred maintenance and other aftermarket services on the commercial and civil side of A&D, several analysts have said.

Cheaper oil also could give a boost to small general aviation aircraft, small and mid-size business aircraft, fractional ownership companies and service providers if they are sustained, according to aviation consultant Brian Foley. "Lower fuel prices will further act as a sales catalyst since the smaller segment is very price elastic, meaning people are more inclined to fly and buy when fuel is more affordable," he said.

Then again, if offshore drilling for oil and gas is curtailed, operators and helicopters flying crews to rigs could feel a hit. It just shows that, as with everything else in A&D, the impact from oil is similarly significant, but different in effect. ☐



By Jens Flottau

Managing Editor for Civil Aviation
Jens Flottau blogs at:
AviationWeek.com/thingswithwings
Jens.flottau@aviationweek.com

COMMENTARY

Learning The Right Lessons

Flight-tracking initiatives should not distract industry from crucial safety issues

Last year was truly tragic for airlines in Malaysia. In March, Malaysia Airlines Flight 370 (MH370) disappeared; wreckage of the Boeing 777 has yet to be found. A few months later, another Malaysian 777 was shot down over eastern Ukraine by a surface-to-air missile. And on Dec. 28, an Indonesia AirAsia Airbus A320 crashed on the way from Surabaya to Singapore. The airline is a subsidiary of Malaysian low-cost carrier AirAsia.

The events say little—if anything—about the state of safety in Malaysia's or Asia's air transport industry and little—if anything—about a few other issues that have been discussed intensively since the Air Asia tragedy in particular.

The number of casualties in air transport was higher in 2014 than in previous years. But there is no indication that it has become less safe to fly statistically. In fact, the accident rate continued to decline. The picture is also skewed somewhat, because some of the aircraft involved in crashes were very large and almost fully occupied. There was no overarching safety theme for the year; the two worst crashes took place in very unusual circumstances.

Since MH370, the industry and—even more so—governments and the general public have argued that aircraft should be better tracked. With modern communication technology in place, there should be no reason not to know where aircraft are at any given time, goes the argument. While there is nothing wrong with the push for better tracking per se and the initiative has its merits, there is a danger that the debate will distract the industry from other important issues.

That should be kept in mind as the International Civil Aviation Organization (ICAO) prepares for its summit discussing aircraft tracking next month. Proposals for how such a sys-

tem could be phased in over the next few years are on the table now and sound like promising ideas.

However, the fact is, even the best tracking technology would not have kept MH370 safe. While better tracking may have helped find the wreckage sooner, if the initiative's aim is to find out more about aircraft involved in crashes more quickly, tracking alone is not enough. Some sort of data streaming is almost certainly a better option or at least a necessary additional tool. For now, the ICAO proposal includes only the idea of automatically deploying on-board flight data recorder and cockpit voice recorder (see photo)

in the event of a crash, so that they would be float rather than having to be located underwater. With airlines investing so much in inflight connectivity to provide passengers with Internet access, the technical and financial hurdles for streaming may be lower than one might think. But, this merely addresses how to deal with crashes rather than preventing them.

Some, like Emirates President Tim Clark, believe firmly that someone in the cockpit of MH370 turned off the transponder to make it impossible to track the aircraft. How such security breaches—if eventually confirmed—can be prevented may be an even more important initiative to pursue.

The AirAsia incident does nothing to support the tracking argument. Aircraft parts were found within a matter of days and the cockpit voice and flight data recorders relatively soon afterward, even though the aircraft went down many miles off the Indonesian coast. With the recording devices recovered, over the next few days it is likely that the information they provide will point in new directions.

As with Air France 447 and Air Algerie 5017, the AirAsia incident appears to be the third major crash within a few years involving serious weather and subsequent loss of control. Sometimes in the aftermath of crashes it can be more fruitful to look at basics—like pilots' flying skills—rather than technological solutions with more limited safety benefits. ✎



REUTERS/LANDOV



By Graham Warwick

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



LOCKHEED MARTIN

COMMENTARY

Fire with Fire

When fast-changing technology is the challenge, a fast-adapting answer is needed

As the Pentagon draws up a list of technologies it hopes will guarantee U.S. military superiority beyond 2030, the threat to be addressed this time is not Soviet forces but technology itself, and its pace of development and global proliferation.

The Defense Department plans to finalize its Long-Range Research and Development Plan (LRRDP) by mid-year. This is also called the Third Offset, a reference to two previous efforts to focus investment on offsetting threats to U.S. military superiority. But where President Eisenhower's New Look defense policy of the 1950s set out to deter the Soviet Union with superior nuclear forces and the Pentagon's offset strategy of the 1970s aimed to counter the Soviet conventional buildup in Europe, the Third Offset must tackle security challenges ranging from Islamic radicals to a resurgent Russia.

"In 1973 there was a clear unipolar concern—Russian armor in Central Europe. Versus any given threat, the real concern today is the evolution of technology," says Steve Welby, deputy assistant secretary of defense for systems engineering. As a result, the LRRDP report due mid-2015 is not expected to produce any "silver bullet" answers, or even to have as lasting an effect as the two previous offsets.

"The 1973 report was a remarkable document; their crystal ball worked pretty well, but they had a unitary

adversary and a clear technology story," says Welby. The resulting technologies—precision-guided munitions, intelligence, surveillance and reconnaissance (ISR), stealth aircraft (photo), and space-based communications, navigation and ISR—"have had a 40-year run, which is remarkable," he says. "We are unlikely to get 40 years out of any future technology because the pace of technological change has accelerated."

Since the last reset of the Pentagon's R&D priorities, commercial technology development has outpaced the military, and the global availability of those commercial technologies has allowed adversaries—real or potential—to challenge, and in some cases overtake, U.S. capabilities. An example is electronic warfare, where globalization of commercial technology combined with a lack of Pentagon attention has seriously eroded the U.S. edge over peer and near-peer forces.

The technologies that make it into the LRRDP therefore need to be "robust, flexible and extendable." The plan is being drawn up by five working groups focused on space, undersea,

air dominance and strike, and air and missile defense technologies. The fifth panel is looking at emerging military and commercial technologies and will "mine the technology space and imagine future capabilities the technologies could enable," Welby says.

The goal of the report is to identify and prioritize concepts and technologies that can be accelerated, prototyped and moved into development programs within the next five years to field new capabilities in the 2025-30 time frame. The plan will be used to shape Pentagon investment in R&D programs beginning with the fiscal 2017 budget.

The technologies identified are unlikely to be entirely new or surprising. Instead, Welby says, the intent is to "harvest things we can see the outlines of today." Publicly, Pentagon leaders have identified candidate technologies only generically, citing "robotics, autonomous systems, miniaturization, big data and advanced manufacturing." Rather than focusing on specific areas such as electronic warfare and low observability, Welby says, the panels are looking more widely for new architectures, concepts and technologies that could allow the U.S. to project force into denied areas.

Minaturization, for example, does not mean just making things smaller. It also means moving away from large, expensive platforms and putting capabilities into subsystems that are disaggregated rather than fully integrated, he says. This recognizes that the Pentagon practice of specifying highly capable "exquisite" platforms has led to increasing schedule delays and cost overruns that have forced reductions and even cancellations of procurement programs and weakened U.S. forces.

But when the principal threat to security is global technology development, the biggest challenge the Pentagon faces is the glacial pace of its procurement system. The LRRDP will come to naught if the U.S. cannot field the identified technologies fast enough and adapt them to evolving threats quickly enough. Welby says the Defense Department has to become "a fast follower of commercial technology." If the Pentagon cannot keep pace with the commercial world, its Third Offset will fail. ☛



TAKE OFF 3: 33,000 lbf

THRUST

$$-\left(\frac{dp}{dx} + \frac{\rho c}{A}\right) + X = \rho u \frac{du}{dx}$$



$$H = U + pV$$

① 22.1 HPC COMPRESSION RATIO

② 1,003 INNOVATIONS

③ 11:1% BYPASS RATIO

④ LOWER EMISSIONS

$$\eta_p = \frac{2}{1 + \frac{c}{V}}$$

$$\frac{\partial^2 V}{\partial r^2} + \frac{1}{r} \frac{\partial V}{\partial r} + \frac{1}{r^2} \frac{\partial^2 V}{\partial \theta^2} = 0$$



50% MARGIN IN
NO_x EMISSIONS

It really is rocket science

1,003 patented innovations backed by 700 million flight hours. Intellect + experience = LEAP.

CFM gives you more to believe in.

Go to cfmaeroengines.com

CFM International is a 50/50 joint company between Snecma (Safran) and GE.

PERFORMANCE | EXECUTION | TECHNOLOGY

WorldMags.net

LEAP

MORE TO BELIEVE IN



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

COMMENTARY

France's Ghost Airport

Political goals outweigh practicality when it comes to aviation in France

In a recent statement that took many by surprise, French Prime Minister Manuel Valls asserted yet again that the envisioned Notre-Dame-des-Landes (NDDL) regional airport will be built—despite fierce opposition from environmentalists. Other influential members of the Valls team have confirmed that they do not understand the need to replace Nantes Atlantique, the existing airport, noting that such an endeavor would take a huge capital investment. Segolene Royal, the minister of ecology, has stated often over the last several months that NDDL makes no sense and, referring to the overwhelming opposition to the project, ironically wished Valls *bon courage* (good luck).

Such a public display of dissention indicates the level of ignorance at the top echelons of power when it comes to the airline industry's true needs. However, Valls's declaration should be viewed as pure political posturing: He seeks to demonstrate firmness and probably does not really care about slots and airport terminal capacity.

The unprecedented difference of opinion could lead to a major and disproportionate crisis of political confidence as well as to a financial fiasco. According to Valls, work on the airport will begin in mid-year, after the pending appeals process; the opening is tentatively planned for 2017. He is convinced that the judges' forthcoming decision—from the highest court—will rule in his favor.

FRENCH GOVERNMENT



French Prime Minister Manuel Valls is a vociferous proponent for building NDDL regional airport.

The complex NDDL case also serves to underscore the absence of a national airport policy. By far, France maintains too many active runways, most of which are underused. To add to the dissenting voices, local authorities say NDDL will not add capacity but merely replace Nantes Atlantique, which reportedly is near its saturation point. In 2013 the airport handled 4 million passengers, close to its theoretical capacity of 4.3 million per year. It should be noted, though, that the terminal could be easily extended; an average 50,000 aircraft movements per year confirm its ample growth potential.

The prime minister's political resolve to build the new airport is simply out of context. The heated discussions of the last several months

have gone beyond air transport matters to encompass lifestyle priorities and environmental objectives that include the airlines' share of global pollution. Opponents label Valls's backing of the new airport as "strange" and out of touch.

In the next few days, the NDDL matter could come full circle. On Jan. 16, an all-new working group is scheduled to meet for the first time. It comprises 60 experts in commercial aviation who will seek to determine how the existing airport could be maintained and optimized to serve the public well. Group leaders say they will try hard to restore a more nuanced approach to the airport situation, despite Valls's stance.

Bruno Le Roux, an influential left-wing member of parliament (and Valls's political ally), recently completed an in-depth report on the French airline industry's plight in the hopes of obtaining some tax relief for that sector. He is expected to be a major voice in the ongoing airport controversy.

Airlines, including ailing Air France, play a major role in the country's economy but are not being treated as valuable contributors. No leading politician in the past several years has taken a serious interest in air transport. To top it off, the lobbying efforts of the airlines' top executives have been ineffectual and at times nonexistent.

Air France, although partly privatized and no longer a flag carrier, is stagnating while low-cost carriers are rapidly gaining market share. France's once illustrious role in aviation is now tarnished, some say beyond redemption.

Le Roux expects his report to serve as a long-overdue wake-up call, but at this point this is far from being the case. In the meantime, local politicians—many of whom have tunnel vision—waste time arguing about runway capacity in Brittany but are unable to see the bigger picture.

National leaders, driven by short-term goals, are responsible for the pall of pessimism that enshrouds the French airline sector. ☹

MRO

MIDDLE EAST

ORGANISED BY

AVIATION WEEK F&E AEROSPACE

February 2-3, 2015 • Dubai World Trade Centre • Dubai, UAE



CO-LOCATED WITH



The region's leading MRO exhibition and conference for commercial aviation maintenance.

This is where the aircraft MRO community convenes year after year to do business!

ENGAGE Foster new relationships, strengthen existing ones, and expand your reach across the MRO community

LEARN Hear best practices, case studies, and proven ways to overcome your most pressing business challenges

DISCOVER Get hands-on with the latest technologies and services that will translate into solutions and savings for your organization

EXECUTIVE SPONSORS



SPONSOR



OFFICIAL MEDIA PARTNER



MEDIA PARTNERS



SUPPORTED BY



Qualified airlines & aircraft lessors also attend the conference for free!

Get your FREE exhibition hall pass now at www.aviationweek.com/mromideast





COMMENTARY

JSF's Year Ahead

Cost and counter-stealth will be key issues

“If you don't follow the defense business closely, then you can be excused for believing that the F-35 Joint Strike Fighter (JSF) is in trouble,” a Lockheed Martin consultant wrote five years ago, a few weeks before the program office director was fired in disgrace. His replacement found that the published schedule was 3-4 years adrift from reality.

Today, you could be excused for thinking that most of the F-35's troubles are behind it. The schedule set at the end of May 2013 may survive its second anniversary, a first for the program. The Marines will likely declare initial operational capability this year, come hell or high water, and the latter is unlikely to be an issue at Arizona's MCAS Yuma. Progress reportedly is being made on sorting out the engine problem that caused last June's runway fire.

It looks as if the F-35 could meet its key performance parameter (KPP) requirements, but that is a narrow definition of success. Development cost and schedule, and acquisition and operational expenses, were not KPPs. Those numbers are stabilizing (it would be a disaster were they not) but are not what the program aimed for.

Programmatic risk has become a reality that users must accept. The Netherlands is buying 37 aircraft rather than the planned 85; the money that would have acquired 60 F-15s for South Korea pays for 40 F-35As. The U.S. Air Force has put its badly needed F-16 upgrades on ice and is suffering readiness issues: The F-35

fleet, with a deficient diagnostic and logistics system, has a big appetite for experienced support people.

Cost will drive more JSF stories this year. The program has 700-plus international sales on its books, and relies on them to achieve planned production rates before 2020, but fewer than 5% are covered by signed contracts. Getting firm orders is an increasingly urgent matter. Denmark's decision is due this year, as is a U.K. defense review that may indicate whether and when Britain plans to acquire most of its on-paper 138-aircraft fleet.

F-35 customers looking at budgets and schedules will want to know what the Block 4A/4B upgrade package will contain. Block 4A development starts next year and 4B becomes operational in 2024, making it the best capability before 2026. The wish list includes nuclear capability, Norwegian and Turkish cruise missiles, Brimstone and Meteor for the U.K., AIM-9X Block 3 for the U.S. Navy, “5th to 4th” communications and close-air-support systems for the Marines. Nobody is perfect, so 4A/4B will also fix discoveries from operational testing. Customers had better be ready to compromise.

By Bill Sweetman



Read Sweetman's posts on our blog Ares, updated daily:
AviationWeek.com/ares
bill.sweetman@aviationweek.com

The second class of risk, as the programmatic issue closes, is operational. Counter-stealth technology went from theory to big green pieces of hardware in 2013 with the appearance of Russia's 55Zh6ME radar complex, comprising a VHF active, electronically scanned array (AESA) networked with higher-frequency radars. Last year saw claims of stealth detection by the infrared-search-and-track community and radar developers, and the appearance of China's analog to the 55Zh6ME. Nobody argues that stealth is dead, but has the operational advantage of the F-35 been eroded?

Expect more of the same in 2015: China is building its new, bigger Type 055 destroyer—it will not be surprising to see a low-band AESA on its aft deckhouse. Everyone and his aunt is selling digitized versions of the veteran Russian P-18 radar—counter-stealth on the cheap. In response to concern over low-band threats, Congress has extended the F/A-18/EA-18G production line and, with it, the debate over the future makeup of the carrier air wing.

The Marines will continue to mitigate operational risk by developing ways to use the short-takeoff, vertical-landing F-35B. The latest concept of operations seeks to place ships and main bases outside the range of mobile missiles while keeping refueling and rearming points close to the targets. Survival depends on moving those forward strips faster than the adversary can target them.

The Marines' plan highlights that the F-35 represents the continued preeminence of tactical fighters in the budgets of the Pentagon and other customers. That is not a program or operational issue but a strategic risk. The Third Offset strategy has already generated one paper that calls for reduced emphasis on 600-mi.-range fighters and more investment in bombers and UAVs. The Navy's debate over its air wing, and the possible role of extreme-low-observables and long-range UAVs is part of that discussion, but will become more important as the Long-Range Strike Bomber program gathers speed.

We have passed at great cost through much of the era of programmatic risk with the F-35. Now, we are looking more at operational risk, with strategic risk on the horizon. ☛



Senior Editor Frank Moring, Jr., blogs at: AviationWeek.com/onspace
moring@aviationweek.com

COMMENTARY

Water World

JPL spacecraft will add climate detail

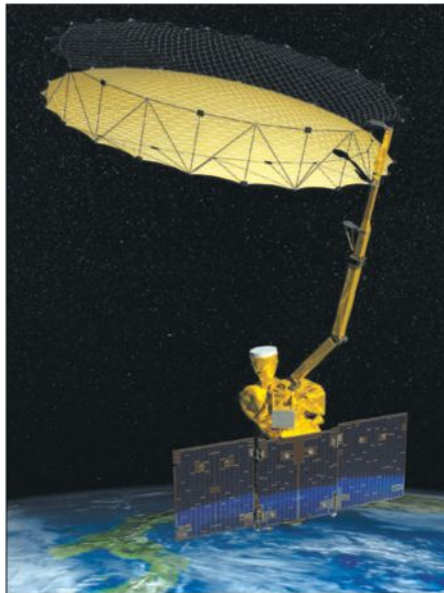
Researchers at the Jet Propulsion Laboratory calculate the State of California is short about 11 trillion gallons of water, more than the state's 38 million residents have used over the past three years of severe drought for drinking, washing and handling their sewage. Based on data from NASA's twin Gravity Recovery and Climate Experiment (Grace) satellites, which detect subtle shifts in gravity below their tandem orbits by precisely measuring the distance between them with laser rangefinders, JPL scientists say it would take 42 cu. km. of water to replace the supply lost during the drought.

Airborne sensors flying over the Sierra Nevada suggest the situation is unlikely to improve quickly, because the snowpack last year was only half what it had been estimated to be. The overhead data give a much better picture of what farmers in the state's Central Valley breadbasket already know. The crops are dying.

"Spaceborne and airborne measurements of Earth's changing shape, surface height and gravity field now allow us to measure and analyze key features of droughts better than ever before, including determining precisely when they begin and end and what their magnitude is at any moment in time," says JPL's Jay Famiglietti. "That's an incredible advance and something that would be impossible using only ground-based sensors."

The view is likely to improve later this year, if NASA's new Soil Moisture Active Passive (SMAP) satellite reaches orbit and performs as planned. Designed and built at JPL, it is intended to give detailed maps of the water content of topsoil worldwide, updated every three days. That would be a dramatic improvement over what is available today.

"There are significant activities going on right now combining surface soil moisture measurements, which respond on . . . very small spatial scales, and Grace measurements, which are columnar and with much coarser



NASA

resolution," says Dara Entekhabi of the Massachusetts Institute of Technology, the SMAP science team lead. "Together with models, these two very different resolution and very different sensing depth measurements can get integrated in order to produce a much better picture of the terrestrial water cycle."

The relatively small amount of water in topsoil, compared to the oceans, rivers, lakes, underground reservoirs and ice, is important because three major climate factors—water, the energy it takes to vaporize it, and the plants that need it to grow, "are intimately

linked through the water variable," says Entekhabi.

The three-year, \$916 million SMAP mission also will give weather forecasters in agricultural regions an early warning signal for drought. And because soil that is too wet or too dry doesn't absorb rainfall very quickly, the SMAP maps will allow better near-term flood warnings.

Following liftoff Jan. 29 from Vandenberg AFB, California, on a United Launch Alliance Delta II vehicle, the SMAP spacecraft will deploy a 20-ft.-dia. mesh antenna and spin it like a cowboy's lasso (see illustration). Based on larger antennas developed by Northrop Grumman for commercial communications satellites, the SMAP antenna will spin at 14.5 rpm to serve as a shared aperture for SMAP's L-band radar and passive radiometer. Combined, the two instruments will map soil moisture across a 1,000-km-wide swath from its 680-km polar orbit.

Depending on latitude, the spacecraft will overfly each point on the surface every 2-3 days, producing a 40-km resolution with the passive instrument and higher resolution—as fine as 1 km—with the radar. When combined electronically, the moisture data from the top 3-5 in. of soil will have a resolution of about 10 km.

"You have this very noisy active radar sharing the same aperture with a very sensitive scientific receiver that wants to live in a very quiet neighborhood," says Kent Kellogg, SMAP project manager at JPL. "The way we deal with that is the two measurements are at different frequencies, so that helps. The radiometer actually listens in between the radar pulses."

While it cannot measure the water content of frozen soil, SMAP will be able to determine if the soil is frozen. That will be invaluable for tracking the role of the vast boreal forests in the Northern Hemisphere in the worldwide carbon cycle, an important factor in gauging the greenhouse-gas role of human-generated carbon dioxide in global warming.

"That is a very important component of the global carbon budget, and in fact is referred to as the 'missing carbon problem' because we can't account for it," says Entekhabi. ☼



COMMENTARY

What's in a Name?

U.S. Navy declares littoral combat ship a frigate

The Littoral Combat Ship (LCS) has suffered its share of program delays, cost overruns and program setbacks. Now it is going through a rite of passage for troubled Pentagon programs—a name change. LCS, an L-class vessel, which denotes an amphibious ship, will now be designated “FF,” for frigate. “I spend a good bit of my time explaining what ‘littoral’ is,” Navy Secretary Ray Mabus told the Surface Navy Association National Symposium. It is a good time, he says, to reestablish Navy tradition for naming ships properly. “It’s a frigate. We’re going to call it one.”

Along with the change in wording, some engineering changes may also be in order for future ships. Engineers designed LCS with the goal of speeding at 50 kt., cutting weight to drive speed. But Defense Secretary Chuck Hagel has directed the Navy to cut back on its proposed LCS fleet buy and instead develop a more lethal and survivable ship for the small surface combatant (SSC) role. Adding weapons and defensive shields to the ship permanently—instead of switching them on and off under the module switch-out operational concept developed for LCS—means a heavier and slower ship. The Navy recently said it plans to use existing LCS classes as templates to develop the SSC. A team led by Lockheed Martin currently builds a steel-bottomed monohull LCS, while another led by Austal USA builds an all-aluminum trimaran for the program. ☛

CHANGING CLIMATE

It is a mark of the dramatic shift on Capitol Hill that Sen. Ted Cruz (R-Texas) is the new chairman of the Senate Commerce space subcommittee that Albert Gore headed when he was a Democratic senator from Tennessee. The former vice president went on to create the landmark climate-change documentary *An Inconvenient Truth*.

But as NASA continues climate study missions, environmentalists worry Cruz will use his subcommittee gavel to turn back the clock on the issue. Cruz is on record as saying the Senate “must not sacrifice funding for NASA’s core mission of space exploration to continue expanding climate-change funding.”

But as veteran space-policy wonk Marcia Smith notes, not all committee chairmen are equal. Sen. John Thune

(R-S.D.) chairs the full Commerce panel, and he has said that humans contribute to climate change. Plus, funding for climate-change research goes through the more powerful Senate Appropriations Committee, where Sens. Barbara Mikulski (D-Md.) and Richard Shelby (R-Ala.) have just switched leadership roles. “Both are NASA advocates, and Mikulski is particularly supportive of NASA Earth science programs and NOAA’s weather satellites,” Smith writes. “Even though she is in the minority now, she still is very powerful, and it is difficult to

imagine a Senate appropriations bill that includes disproportionate cuts to either of those programs.” ☛

LICENSED TO FLY

The FAA is teaming with universities and news organizations to explore the use of UAVs by news organizations. That includes an agreement between the agency and broadcasting giant Cable News Network (CNN) to test UAV integration into news operations. “Unmanned aircraft offer news organizations significant opportunities,” says FAA Administrator Michael Huerta. CNN is already sharing data about the technology, personnel and safety issues with the Georgia Tech Research Institute, which holds more than 24 FAA certificates to operate UAVs. And the Virginia Polytechnic Institute and State University is working on a similar project with a coalition of 10 media companies, including *The New York Times* and *The Washington Post*. ☛

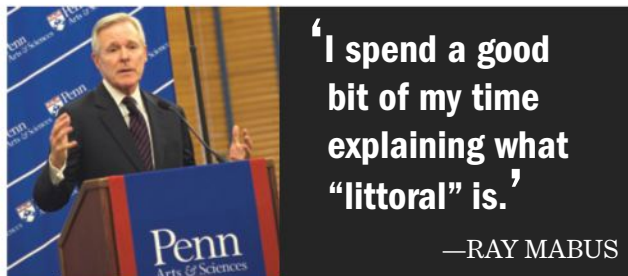
ON DECK

In the first week of February, the Senate Armed Services Committee plans to hold a nomination hearing for Ashton Carter to become the next defense secretary—the same week that the federal budget request is expected to be communicated to Congress. Although committee Chairman John McCain (R-Ariz.) was prepared to hold the hearing immediately, “he gladly accommodated a request by Dr. Carter for additional time to complete his recovery from a recent medical procedure,” according to McCain’s spokesman Dustin Walker. (Carter recently had back surgery.)

Carter, a former Harvard professor who was President Obama’s first Pentagon acquisition chief and later the Pentagon’s No. 2 civilian, left office in 2013. While awaiting his confirmation, he is preparing for the transition back to the Defense Department. On Jan. 8, Carter met with current Defense Secretary Chuck Hagel, their first face-to-face since Carter’s nomination, according to Pentagon Press Secretary John Kirby. ☛

With Frank Morring, Jr. and Michael Fabey

U.S. NAVY FILE PHOTO





April 14-16, 2015

**Miami Beach Convention Center
Miami, FL**

Celebrating 20 Years of Changing how MROs and Airlines Do Business!

MRO Americas - the most comprehensive conference & exhibition program on aircraft maintenance.

- Learn from case studies.
- Implement better processes.
- Meet the experts.
- Test-drive new products.
- Uncover new revenue, partnership and growth opportunities.

mroamericas.aviationweek.com

Filling the Gaps

Airbus launches A321LR as a Boeing 757 replacement; its competitor decides to wait

Jens Flottau **Toulouse** and Guy Norris **Los Angeles**

How to replace the Boeing 757 has been one of the last open portfolio questions for civil aircraft manufacturers. Airbus's A321LR has one answer. Boeing may have a second. But if its model is launched, it will be a longer-term step.

Airbus formally launched a long-range version of the A321 with a 97-ton maximum takeoff weight (MTOW). Air Lease Corp. (ALC) is the first customer for this type, with a memorandum of understanding for 30. "[ALC Chairman/CEO] Steve Udvar-Hazy said to us that we could make this a 757 replacement, so we have to thank him for the idea," say John Leahy, Airbus chief operating officer-customers.

Leahy anticipates a market of around 1,000 aircraft for the A321LR as replacements for the 469 Boeing aircraft still flying plus another 500 more. "We are burning up to 30% less fuel than the 757," he says.

First deliveries of the new A321neo version are planned for 2019. The aircraft will be equipped with a third auxiliary center fuel tank and could fly approximately 500 nm farther than the A321neo with a regular 93.5-ton MTOW (and only two additional fuel tanks). For the new aircraft, Airbus now assumes a standard cabin layout for 206 passengers. The European manufacturer claims the calculated

4,000-nm range even exceeds the 3,850 nm of the Boeing 757-200W (winglet-equipped). The longest current 757 route is United Airlines' New York-Berlin service, which is slightly more than 4,000 nm and therefore can only be flown with less than maximum payload. United has 169 seats on its transatlantic 757s.

Airbus initially pitched the aircraft to airlines in a premium 164-seat layout with 20 seats in business class, 30 in premium economy and 114 in economy. But discussions with potential customers showed that higher seat counts

are prized by many airlines. In the premium configuration, the A321LR range decreases slightly to 3,904 nm because of the extreme assumptions in terms of weight per passenger.

The 206-seat configuration includes 16 seats in business class at a 36-in. pitch and 190 in economy at 30 in. "The interest has gone beyond what we initially thought," Arnaud Demeu-sois, A320 family product marketing director, says. In theory, Airbus could offer the aircraft with up to 240 seats (its certified maximum); however, that configuration is mainly geared toward short-haul, low-cost carriers and would likely offer less range.

Airbus is targeting airlines that are currently flying the 757 on long-range

are also planned, which will lead to a weight increase of less than 100 kg (220 lb.). The standard-range variant and the 97-ton MTOW version would share the same build standard, thus shorter-haul operators will suffer a small weight penalty. Customers who have opted for the legacy door positioning are not affected.

Boeing is signaling it will not compete directly with the newly launched longer-range version of the A321neo, leaving Airbus with the only offering in the sector while the U.S. manufacturer focuses on a longer-term, all-new middle-of-the-market (MOM) aircraft to fill

the gap between the 737 MAX and 787.

Although the move effectively sacrifices the near- to mid-term 757 replacement market to Airbus, Boeing believes the size of the sector will not be as large as its competitor forecasts. Boeing Commercial Airplanes Marketing Vice President Randy Tinseth says: "The thought of a 1,000-aircraft-size market is frankly a little bit laughable."

Although Boeing delivered more than 1,000 757-200s and -300s, the company says of the surviving fleet that only "50 to 60" are currently fly-

Airbus and Boeing Net Orders and Deliveries, 2013-14

	NET ORDERS		DELIVERIES	
	2013	2014	2013	2014
Airbus	1,503	1,456	626	629
Boeing	1,355	1,432	648	723

Sources: Airbus and Boeing

missions and those that would fly such routes but cannot, for lack of a suitable aircraft. Key routes defining the aircraft's needed capabilities are U.S. East Coast to Central Europe; Europe to the Middle East; North to South America; Europe to West Africa; and Australia to South Asia.

The Airbus Cabin Flex concept will form the basis for the aircraft's newest version. Airbus is offering a new optional exit door configuration in which door 2 is removed and replaced by a double overwing exit. Door 3 is moved aft. Some minor changes to the wing





Air Lease Corp. has signed a memorandum of understanding for 30 Airbus A321LRs.

AIRBUS CONCEPT

ing the sort of long-range sectors the A321LR is targeting. However, despite Boeing's deep reservations about the market size for a straight replacement of the 757, the company is more optimistic about the prospects for a clean sheet MOM concept. Boeing believes there could be a larger potential market for a more capable new aircraft that straddles the 737 and 787 capacity gap, but with better operating economics and greater range than the 757.

"Over the last year, we have visited 30 customers around the world to address the requirement for an airplane larger than the 737 MAX 9 that can fly a bit farther," says Boeing Global Sales and Marketing Senior Vice President John Wojick. "We are trying to understand how large that marketplace is and whether an investment in that market space can be justified."

Boeing's comments came during a briefing to mark the record-breaking 1,432 net orders taken during 2014. The tally, valued at \$232.7 billion in list prices, exceeds the 1,355 orders taken in 2013 and broke the previous all-time high set in 2007. The company delivered 723 aircraft last year, a significant increase compared with the 648 built in 2013.

Airbus delivered 629 aircraft in 2014, three more than a year earlier. It posted 1,456 net orders, compared with 1,503 in 2013. ✎

AFFIRMATIVE TRACKING

John Croft *Washington*

In early February the International Civil Aviation Organization (ICAO) will consider whether airliners should be equipped with a tracking data broadcast system that sends regular position updates to airline operators, a flight data recorder that automatically deploys (and floats) after a crash, and a tamper-proof distress reporting unit that will transmit aircraft position and identification to a global network of rescue coordination centers when unusual attitudes, speeds, accelerations or other triggering events occur.

The recommendation for a Global Aeronautical Distress and Safety System (Gadss), which includes the airborne equipment coupled with new global information-sharing networks for air traffic service providers and rescue coordination centers, comes from an ICAO and industry working group formed after the disappearance of Malaysia Airlines Flight 370 in early March. The group, which is working in conjunction with the International Air Transport Association's (IATA) Aircraft Tracking Task Force, will ask ICAO to debate and finalize the concept of operations as a first step in creating new global standards. IATA is calling on its member airlines to begin voluntarily tracking aircraft at 15 min. intervals, largely with existing onboard equipment.

The working group's recommendations include a 2020 forward-fit equipage target and a fully operational state by 2025, with all aircraft, air traffic control and rescue coordination centers fully compliant. At takeoff, Gadss would begin sending position, time and identification information at least every 15 min. to the airline's operational control center (AOC), potentially using a third-party company to provide the tracking services. If anomalies arise in flight, the tracking system would automatically enter an "abnormal" mode and begin sending out position, time and identification updates at approximately 1 min. updates, with airlines, controllers and rescue services alerted. If extreme conditions are detected, the tamper-proof autonomous distress tracking system would automatically begin sending tracking data to rescue services, with the deployable recorder ejecting in the case of an accident. ✎

Uphill Battle

Russia's Transaero seeks restructuring plan as demand falters

Cathy Buyck **Brussels**

Transaero Airlines executives are presenting a brave front by stating that operations are continuing as normal, but the reality is far less rosy.

Russia's second-largest airline has relied on the government for financial help and has hired management consultancy McKinsey & Co. to draw up a restructuring plan while its Ireland-based maintenance, repair and overhaul (MRO) subsidiary is actively trying to secure new investors.

Transaero Engineering Ireland (TEI), based at Shannon Airport, this month sought court protection against creditors due to a lack of funds, in part brought about by its parent's delinquent payments. "Transaero Airlines is, for the moment, not in a position to pay TEI monies due for services rendered and has indicated that it is not in a position to support TEI on an ongoing basis," the MRO provider explains.

The High Court of Ireland has appointed an interim examiner to help stabilize TEI's financial position and devise a rescue plan. The company, which has nearly 230 employees, is in talks with a potential investor to help put TEI on a solid footing. Transaero acquired the former Air Atlanta Aero Engineering in 2012, which at that time was profitable, and rebranded it as TEI. In addition to maintaining its parent carrier's aircraft, TEI performs third-party maintenance work,

mainly on Boeing 737s, 757s and 767s.

Two years ago, Moscow-based Transaero Airlines was still in expansion mode and pursuing the exponential growth rates it had recorded since its founding in 1991 as the first 100% privately owned passenger airline in Russia. Passenger numbers rose 150% in 2009-13 to 12.5 million and revenue almost tripled to 105.9 billion rubles (\$1.7 billion), as the airline benefited from Russia's economic boom and liberalization of the airline industry, including the opening of traffic rights to international destinations. Net profit in 2013 was 788 million rubles.

But the environment changed drastically last year. The deteriorating economic situation in Russia, the collapse of the value of the ruble against the euro and U.S. dollar (by almost 40% in late 2014)—combined with the political tensions around the eastern Ukraine conflict and trade sanctions imposed by Western governments—took a severe toll on the airline. Demand for travel, especially on international routes, dropped off and payments in euros and dollars for services such as aircraft leases became increasingly difficult, driving the airline to its current position.

As part of its turnaround plan, Transaero is considering postponing some deliveries of new aircraft slated for this year. In September 2014, the carrier canceled its orders for four Boeing 787-8s and deferred deliveries of six Sukhoi Superjet 100s.

The airline is not disclosing which other deliveries it might postpone. Transaero has eight Airbus A320neos, four A380s and four Boeing 747-8Is on firm order. The Boeing order was placed in 2012, and the first aircraft is expected to be delivered this year. Transaero said earlier it plans to operate its 747-8Is in a 460-seat, four-class layout.

The first of the carrier's A380s also is expected to join the fleet this year and a second in 2016. They will be configured for 650 seats, including 12 in first and 24 in business class. Delivery of the A320neos, which were ordered in 2011, are due to start in late 2017 or early 2018.

In early 2013, the airline signed a lease for 12 Boeing 737-800s from Sberbank Leasing Co., with deliveries scheduled in 2015-17. It additionally has a memorandum of understanding for 12 Irkut MS-21s with Ilyushin Finance Co.

On top of this, Transaero signed a letter of intent with Airbus at last year's Farnborough International Airshow for eight A330-300s and 12 A330-300s. These aircraft were not included in Airbus's orderbook at the end of November.

Transaero's fleet now consists of 103 aircraft—20 Boeing 747s, 14 777s, 18 767s, 46 737s, three Tupolev Tu-214s and two Tu-204-100Cs.

The restructuring plan also includes optimization of its passenger capacity in the first three months of 2015 (which the airline says "is excessive for a low season"), changes to its route network, initiatives to enhance passenger transfer offerings and measures to increase cargo and mail traffic.

The new network strategy calls for a hike in passenger capacity on flights to southern resorts within the



Russian Federation and services to Russia's Far East from Moscow and St. Petersburg.

In addition, Transaero says it is implementing "proactive measures to attract additional customers." These will include freezing the price of domestic tickets at 2014 levels and eliminating the fuel surcharge on international tickets purchased through the carrier's website or at its offices and travel agents' offices abroad.

Its commitment not to increase fares on domestic services until the end of the year and to decrease fares on monopoly domestic routes by 5-7% appears to be part of the rescue deal with the government.

On Dec. 25, Transaero received a three-year, 9 billion ruble state guarantee for loans by government-backed VTB Bank.

The airline asserts this government guarantee will help the carrier to "successfully overcome the difficulties of this stage caused by external factors. Transaero Airlines has been developing, operating and overcoming the challenging times along with its country for 23 years."

Although the airline was able to increase its passenger numbers by about 4.8% last year, it is unlikely to return to a double-digit growth rate soon. The Russian economy is widely expected to slide into its first recession since the global financial crisis of 2008-09. The World Bank is forecasting that real GDP will contract by 0.7% in 2015 based on an average oil price of \$78 per barrel, but the Russian central bank fears that the economy may shrink 4.7% if oil averages \$60 a barrel. Brent crude, the international benchmark, dropped below \$50 in January. ☐



Transaero will reduce passenger capacity early this year after recognizing that it is "excessive for a low season."

Close to the Finish

GE's Passport business jet engine due to enter service next year

Guy Norris Orlando, Florida

General Electric's Passport engine is entering the final phases of certification for Bombardier's Global 7000/8000 long-range business aircraft, the first versions of which are set to enter service next year.

The 16,500-lb.-thrust powerplant is being readied for upcoming water-ingestion testing and a final fan-blade-out evaluation. On Dec. 30, the engine also began flight tests on GE Aviation's Boeing 747-100 flying testbed at Victorville, California. GE adds that the Passport also recently completed hail and bird-ingestion certification tests and, earlier in 2014, underwent ice-ingestion tests at GE's icing facility in Winnipeg, Manitoba.

As part of testing for high-altitude operations in its business-jet role, the engine has also undergone ground testing in an altitude chamber at Evendale, Ohio, which demonstrated engine performance and

operability from sea level to 51,000 ft.

Although GE declines to comment, the first engines for flight testing on Bombardier's Global 7000 prototype are expected to be delivered in the coming months to support the aircraft's planned first flight later this year. Production engines will also likely begin shipping by year-end, with initial Global 7000 deliveries beginning in 2016 and Global 8000s following in 2017.

Since first running in 2013, the Passport engine program has accumulated more than 750 hr. and 300 cycles of testing. GE adds that prior to service entry, the engine will have accumulated the equivalent of 10 years of flying for an average Bombardier Global 7000 or Global 8000 aircraft operator, with more than 4,000 hr. and 8,000 cycles. Testing also includes evaluation of the integrated propulsion system from Nexcelle, a joint venture between

GE and Safran. This configuration includes a slim-line nacelle with clam-shell cowl opening to reduce weight and drag. ☐



GE's Passport engine for the Bombardier Global 7000/8000 is flying on a 747-100 testbed.



GE AVIATION PHOTOS

No Pain, No Gain

NASA, USAF certifications slow, but do not stem, SpaceX's hopes for U.S. government work

Amy Butler **Washington**, Amy Svitak **Paris** and Guy Norris **Los Angeles**

Though 2014 was a strong year for launch upstart Space Exploration Technologies (SpaceX), the company has missed several key goals including gaining certification for U.S. government launches and demonstrating reusability of Falcon 9's first stage.

Certification from the U.S. Air Force for the Falcon 9 v1.1 rocket to obtain access to a market dominated by the monopoly United Launch Alliance was hoped for by the end of 2014. It is now slated for mid-year. Certification is required for SpaceX to win work lofting national security payloads—work that would help fund the company's exploration ambitions. SpaceX is pursuing the certification while also suing the service for an alleged issuance of a multi-billion, 28-mission deal to ULA for five years' worth of launches last year.

On the civil side, SpaceX's progress to expand its missions from "low-risk" cargo carriage to the International Space Station (ISS) to "medium-risk" payloads is slower than planned. It is now expected by early June, another slip from late last year.

The company also missed its latest attempt at a first-stage recovery Jan. 10. This technology is key to SpaceX's ambitions to reduce cost and improve turn time for launch missions. Although recoverable, these issues will consume SpaceX's focus in early 2015.

USAF Secretary Deborah Lee James says SpaceX has completed 80% of the tasks required for certification, so more work remains. But she agrees there is a need for competition in the market.

"Although certification was not awarded as of the end of December, we recognize SpaceX for its thorough efforts in moving toward an aggressive certification goal, and we will continue to vigorously pursue that certification milestone," says Lt. Gen. Samuel Greaves, commander of the Air Force Space and Missile Systems Center (SMC) and certification authority. "[We] remain very optimistic, since SpaceX continues to demonstrate the



SpaceX was unsuccessful in its attempt to recover a Falcon 9 first stage during a Jan. 10 mission to deliver cargo to the ISS.

innate ability to innovate and quickly respond to open items."

At issue for the cumbersome certification process is ensuring that SpaceX—a relatively new company employing new techniques and processes in line with commercial launch needs—can adhere to standards established by the Pentagon over decades of experience and honed in the 1980s and

'90s after a series of dazzling failures. It the first company to undergo the revised certification process with the goal of garnering work for its Falcon 9.

An Air Force spokesman declined to specify what tasks remain for the certification because the data are proprietary. Last year, SpaceX completed the three launches required; the company did not reply to a request for comment on remaining work.

The delay is not a surprise. Air Force Space Command Gen. John Hyten said last September that "if they are not ready on Dec. 1, we are going to have to stand up and say that," during a speech at the 2014 Air and Space Conference hosted by the Air Force Association. At issue is balancing an eagerness to introduce competition into the U.S. military launch market and an unrelenting demand for flawless missions.

SpaceX founder and CEO Elon Musk has been a vocal critic of the certification process, complaining that the service is taking too long to accept the Falcon 9 into its fleet. A company spokesman declined to discuss the new time line, however.

James has established an independent group to assess how to "streamline and improve the certification process while protecting mission assurance," she says. "The Air Force has learned much about the process during our close collaboration, as well as identified all certification open items."

The December goal was pinned to hopes that SpaceX could compete for the forthcoming NRO-79 launch, lofting a secret National Reconnaissance Office payload into orbit. Once the draft request for proposals was released for the launch last June, Air Force officials were adamant that NRO-79 must be on contract by the end of 2014. But there has been no award announced. An SMC spokeswoman says the launch is still planned for December, but despite repeated requests she was unable to discuss the timing of when the contract will be awarded. Without SpaceX certified, it must be sole-sourced to ULA.

The NRO-79 launch was viewed as one of a few opportunities in the near term for SpaceX to win national security work for the Pentagon.

A mission to loft the Deep Space Climate Observatory (DSCOVR) for the National Oceanic and Atmospheric Administration (NOAA), one of two low-risk USAF launches won by SpaceX in 2012 under the new-entrant program, is now

set for Jan. 29. Greaves will be required to certify this mission prior to launch.

Higher-risk NASA payloads are also taking longer to certify than anticipated, with the scheduled March launch of NOAA's Jason-3 ocean altimetry satellite likely delayed as late as June. NASA is managing Jason-3 construction and launch for NOAA. SpaceX won the \$82 million contract in July 2012 for a December 2014 launch, although budget shortfalls prompted a delay.

Since the award, SpaceX has been working to achieve NASA's medium-risk "Category 2" launch certification, which is required for the Jason-3 mission. The Falcon 9 was given the nod for low-risk NASA missions 2.5 years ago.

"The majority of the items [have] been successfully completed," NASA spokeswoman Stephanie Schierholz said in response to emailed questions. "However, there are a few open items SpaceX is working on to fully complete their certification effort."

Meanwhile, the company is assessing results of its missed Falcon 9 core-stage recovery attempt. The first stage did navigate to the floating barge platform as required, but missed its mark and was destroyed in the attempt.

Despite the failure, Musk says performance of the guidance, navigation and control (GNC) systems "bodes well" for a successful recovery in coming tests, possibly as early as the Dscovr flight.

Following separation, the first stage was reoriented exo-atmospherically using nitrogen gas thrusters to enable a boost back burn by three of the vehicle's nine Merlin 1D engines. The reentry burn slowed the stage to hypersonic speed and, with velocity still above Mach 3, the "X-wing" grid fins deployed to enable precision targeting. The fins are designed to control the stage's lift vector and move independently to control roll, pitch and yaw.

However, because the fins are designed to operate for about 4 min. from reentry to just before touchdown, they are actuated by a short-acting open hydraulic system. Hydraulic systems are normally closed, but SpaceX wanted to reduce complexity and mass, so the system loses fluid as it operates. "The grid fins worked extremely well from hypersonic velocity to subsonic, but ran out of hydraulic fluid right before landing," said Musk in a tweet. "We were about 10% off. Upcoming flight already has 50% more hydraulic fluid, so should have plenty of margin for landing attempt."

Musk says SpaceX has "no choice" but to use the aerodynamic fin solution in place of gaseous nitrogen control thrusters that were tested to control a rotation issue that occurred on the first test flight in September 2013. "Entry velocity is too high for a precision landing with nitrogen thrusters alone. We must have aerodynamic surfaces for pitch trim," he says. Prototype versions of the steerable fins were first tested last May on a flight trial of the Falcon 9 Reusable (F9R) experimental vehicle that reached an altitude of 1,000 meters (3,280 ft.). SpaceX is developing

a new F9R after the first was destroyed in August during a trial at its rocket development facility in McGregor, Texas.

Although the first-stage control authority was severely depleted by the time it was close to touchdown, the GNC system was able to effect limited directional control via gimbaling of a single Merlin, which is used for the final braking descent maneuver. Despite this, the stage "landed hard," according to SpaceX, narrowly missing the correct section of the 300 X 100-ft. landing platform and damaging support structures around the edge of the converted barge. ☼

DEFENSE

Engagement Window

Lockheed dusts off Thaad-ER design as counter to Chinese hypersonic boost glide vehicle

Amy Butler Washington

Lockheed Martin is hoping the maturing threat of hypersonic boost glide vehicles from ambitious adversaries will spark interest in the company's dormant plan to design a more capable interceptor for the Terminal High-Altitude Area Defense (Thaad) air defense system.

Chinese officials confirmed they conducted a test last month of what they are calling a hypersonic strike vehicle. U.S. officials worry this missile could outsmart their defenses.

The U.S. has spent considerably more than \$100 billion to perfect hit-to-kill technology and improve connectivity among disparate systems fielded for protection against air-breathing and ballistic missile threats. The Army plans to field at least six Thaad batteries; the system is designed to field an area defense system capable of intercepts both inside the atmosphere and in the low regions of space.

Today, the U.S. has no optimal capability to intercept an advanced hypersonic boost glide vehicle, according to an industry source. Although hypersonic vehicles burn hot and are thus easily visible to the U.S. sensor network, they are maneuverable. There is concern that existing interceptors in the U.S. arsenal lack the divert capabilities required to counter such a threat.

However, a credible threat does not yet exist. The vehicles tested by the Chinese are considered to be basic, but Missile Defense Agency (MDA) Director Vice Adm. James Syring is said to be more concerned about Russia's hypersonic systems, which are far more maneuverable and advanced. He has already advocated quietly in the Pentagon for funding for a Thaad-ER to address what he sees as a gap in intercept capability should these threats get fielded. So far, his efforts have not paid off.

Development of offensive hypersonic systems is "one of the key reasons" a Thaad-ER (extended range) missile should be considered for introduction into the Pentagon arsenal, says Mike Trotsky, vice president of air and missile defense for Lockheed Martin, which produces Thaad.

"We see a growing interest in this capability. We are working to define what, specifically, this system would look like . . . to give it the divert capability necessary to address some of the emerging threats we are seeing," said Doug Graham, vice president of advanced programs for Lockheed Martin Strategic & Missile Defense Systems.

"One of the things the MDA is looking very closely at is the upgrade of the Thaad system to the ER configuration so we can extend the reach of

dealing with a target just like that,” says Trotsky about hypersonic boost glide vehicles. “That kind of a target is designed to find a seam between systems like Patriot . . . and the Aegis weapon system. Because Thaad operates both in the endoatmosphere and the exoatmosphere, it has intercept capability in the region where that threat flies. The [ER] version would extend our battlespace against that kind of threat.”

Lockheed Martin has been honing its Thaad-ER concept for nearly 10 years. Thaad is a \$3.8 billion program, and Lockheed invested its own research funding to explore the ER design. A full development for Thaad-ER could cost as much as \$1 billion.

With MDA’s annual unclassified

tempt to exploit this narrow window of opportunity. Although Thaad-ER would provide some capability against a rudimentary hypersonic threat, it is not an optimal solution, the industry source says. Ideally, the Pentagon hopes to have matured other technologies—such as railguns or directed energy—to counter the threat. But those are not expected until the mid-to-late 2020s. Until then, Thaad-ER could fill a gap. To do so, it would need to start no later than the fiscal 2018 budget cycle, the first to be delivered to Congress from President Barack Obama’s successor. This schedule is expected to produce a fielded product in 2022.

All of the current Pentagon interceptors “stink against this [hypersonic] threat if it has significant cross-range

first stage is designed to expand the interceptor’s range. The second stage or “kick-stage,” would then close the distance to the target and provide improved velocity at burnout, Trotsky told reporters during a Jan. 7 media teleconference. Higher velocity at burnout allows for improved divert capability, or more lateral movement during an engagement, which is needed for maneuverable targets.

“We continue to work on the booster stack and some of the system engineering that has to be done to [finalize] the design. I think what you will see from MDA is an acceleration of some of that engineering work in the next few years, because of the kinds of threats we are seeing being developed by some of our adversaries.”

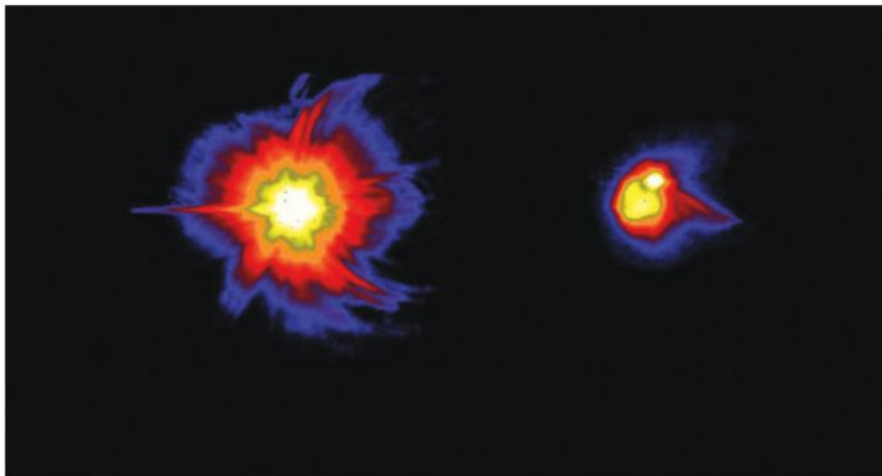
Thaad-ER’s larger booster design does not require changes to the Thaad kill vehicle. But the ground-based launcher design would have to be modified. Five of the 21-in. interceptors would fit into the launcher that now carries eight of the 14.5-in. boosters today.

However, some in the Pentagon leadership believe that this design approach is too conservative for the potential \$1 billion development cost, the industry source says. Lockheed’s approach is conservative largely due to the company’s botched ambitions for the baseline Thaad, which required a stand-down for a full system redesign more than a decade ago. “Some believe that Lockheed Martin overlearned risk aversion on Thaad,” the source notes. So it’s possible that the company could spend the next year ramping up both its sales campaign and its design.

A company spokeswoman declined to provide updated details on the Thaad-ER design beyond what Aviation Week previously reported.

Meanwhile, the Army is expecting to activate its fifth Thaad battery this year and deliveries from the first foreign military sales customer, the United Arab Emirates, are slated to begin next year. The Pentagon has notified Congress of a potential sale to Qatar as well.

Lockheed Martin is hoping the Pentagon will opt to embark on a multiyear procurement of Thaad interceptors, Trotsky says. The goal is to arrange a deal for 150 missiles for sale over five years. Multiyear procurements require substantial cost savings from industry, but provide stability for the supply system. ☐



Thaad is capable of a ballistic missile intercept, as shown from infrared sensors, both inside the atmosphere and in space.

budget hovering under \$8 billion and with MDA focused on shoring up the Ground-Based Midcourse Defense program, Thaad-ER has not become a priority. The Office of the Secretary of Defense is balancing various priorities and directives from Congress to cut spending. If, however, a Republican candidate wins the White House in 2016, it is likely MDA’s budget will receive a boost. And this would be an opportunity for Lockheed to obtain funding for the development work.

MDA spokesman Rick Lehner says Thaad-ER is not a program of record, meaning it has not received development or design funding from the agency. “It is an industry concept we are evaluating and nothing more.”

However, Lockheed is restarting its Thaad-ER campaign now, in an at-

tempt to exploit this narrow window of opportunity. Although Thaad-ER would provide some capability against a rudimentary hypersonic threat, it is not an optimal solution, the industry source says. Ideally, the Pentagon hopes to have matured other technologies—such as railguns or directed energy—to counter the threat. But those are not expected until the mid-to-late 2020s. Until then, Thaad-ER could fill a gap. To do so, it would need to start no later than the fiscal 2018 budget cycle, the first to be delivered to Congress from President Barack Obama’s successor. This schedule is expected to produce a fielded product in 2022.

Today’s Thaad booster is 14.5 in. in diameter, and features a single-stage design. Static fire trials for a prototype of a 21-in. first stage, as well as a second, “kick-stage,” were conducted by propulsion subcontractor Aerojet in 2006, Tom McGrath, who was a Lockheed Martin vice president during that time, told Aviation Week in 2009.

Funding for this early work on both stages came from Lockheed Martin’s international R&D accounts from 2006-08, he said in the interview.

The increased diameter for the

Budding Interest

Could history and nuclear weapons push Belgium toward the F-35 for its future fighter?



TONY OSBORNE/AW&ST

Tony Osborne **London**

Belgian defense officials have detailed their wish list for their future fighter aircraft, while preparing to present their case to the country's next government.

But despite shortlisting five Western fighters last summer, there are indications that the country may be drawing closer toward selection of the Lockheed Martin F-35 Lightning II.

It is far from a forgone conclusion, but key to Brussels' thinking is being a partner or part of a partnership of nations and introducing an aircraft that is "fully common with partner nations operating the same weapons system," program documents released earlier in January reveal.

Belgium's program for its new fighter—the Air Combat Capability Successor Program—began last year when officials carried out a survey of Western fighters. But instead of approaching the manufacturers, Belgium went to the lead government procurement agencies for each aircraft—including the Joint Program Office for the F-35, Navair for the F/A-18 Super Hornet, France's DGA for the Dassault Rafale, Britain's Defense Equipment and Support agency, (DE&S) for the Eurofighter Typhoon and Sweden's FMV for the Saab Gripen.

Details of the questions sent to those agencies were published on Jan. 8 as the Belgian authorities prepare to start the F-16 successor program in the coming months. This should lead to a governmental approval process during mid-2016 and the beginning of the procurement phase, which should last into mid-2018 when the next Belgian

government is expected to approve the procurement.

Belgium is the last of the original four European F-16 operators—the so-called European Participating Air Forces—to start the hunt for a new fighter to replace the Viper. So far, both the Netherlands and Norway have already selected the F-35A, while Denmark—also a signatory to the F-35 program—is currently in the process of examining other options.

Belgium wants to start replacing its F-16s in 2023 and wants to achieve full operational capability in 2029. These timescales are considerably later than for its counterparts to the north, and could potentially ease out both the Super Hornet and the Typhoon, as production of both aircraft is likely to cease well before the end of the decade unless new orders emerge.

The same will be true for the Dassault Rafale unless it can finally secure the long-negotiated deal with India and possible rumored sales to Qatar and Egypt.

This scenario could potentially leave only the F-35 and the Gripen in the running. Both types meet Belgium's need for partnerships and both are more than capable of meeting the envisaged mission set, including defensive and offensive counter-air, air interdiction and close air support, and potentially the emerging missions as well. Brussels wants to carry out non-traditional intelligence, surveillance, and reconnaissance (NTISR), such as the use of targeting pods for target acquisition, and also strike coordination and reconnaissance, although the

F-35 currently does not have a high-definition electro-optical sensor that would enable the NTISR mission; but one may be defined in future development.

The F-16 has served Belgium well and will have to soldier on into the 2020s before it is replaced.

ment blocks by the time Belgium needs the aircraft.

A significant factor in the F-35's favor may be Belgium's dual-key arrangement for U.S. B-61 nuclear weapons located at Kleine Brogel AB in the east of the country. Any desire by Belgium or the U.S. to retain this capability will mean a U.S. platform would have to be selected.

Belgium's F-16s have served it well, and commanders want to continue what is a strong track record of successful support to NATO and international operations with its future fighter fleet. Right now, Belgium has aircraft deployed in Jordan to support the U.S.-led coalition against Islamic State fighters in Iraq, sending jets to the area just days after aircraft deployed in Afghanistan to support the NATO mission there returned home.

And Belgium wants to be able to deploy as many as 10 fighters for a sustained period of undetermined duration or "execute a one-time participation in a multinational operation with a maximum engagement of 30 aircraft." However, defense officials insist that the number of aircraft for such an operation should not suggest the number of aircraft Belgium will want to purchase, adding "the current level of ambition will be used as a baseline."

Belgium currently has around 50 F-16s in operation, split between two bases. All have been through the European Mid-Life-Update program. But it seems unlikely that the future fighter selection will replace the F-16s on a 1-to-1 basis, although Belgium's buy could be greater than the number planned by the Netherlands, which has so far committed to 37 F-35s. Of these, the Netherlands believes it will be able to commit just four aircraft to international operations.

By 2016, Belgium and the Netherlands will take turns guarding each other's airspace, and the Benelux relationship is likely to be a major influence in Belgium's defense thinking in the future. ☼

Three More Years



U-2 gets a stay of execution, though Air Force still pursues Global Hawk improvements

U.S. AIR FORCE

Amy Butler Washington

The Pentagon is, once again, reversing its own position on which platform to use for its high-altitude reconnaissance mission—the venerable U-2 or the new Global Hawk unmanned aircraft.

The Office of the Secretary of Defense (OSD) has directed the service to restart modest funding not only for operations of the high-flying U-2 but also to invest in research and development and procurement, according to industry sources. And the money is coming from a topline increase for the service, meaning OSD has provided the cash in the fiscal year 2016 budget going to Congress next month.

The roughly \$150 million in investment spending over three years is a signal that the proposal last year to retire the U-2 fleet and quickly transfer the high-altitude collection mission to the new Northrop Grumman RQ-4B Global Hawk was a bridge too far. It shows that the service will not only operate the fleet it has but pay for some upgrades to keep the U-2 relevant. Funding for U-2 operations will be restored for three more years—fiscal years 2016-18, the sources say. Though operations at the height of the Iraq and Afghanistan wars ran about \$400 million annually, the service is now targeting about \$350 million a year for the U-2.

A congressional staffer says that keeping the U-2 and Global Hawk will “please everyone” on Capitol Hill.

The Air Force declined to provide a rationale for the move. “All this is pre-decisional until the president’s budget is signed,” said a service spokeswoman.

This is the latest twist in 15 years of tit-for-tat funding raids between the

Lockheed Martin U-2 and the Global Hawk. Less than three years ago, the Air Force offered up Global Hawk for termination; the plan was to kill the Block 30 version. This is the variant capable of collecting imagery as well as conducting radar and signals intelligence. The Block 40, outfitted with a large radar to monitor ground traffic, was expected to be axed once the Block 30 termination was approved.

But Northrop Grumman lobbied hard for the aircraft; the Air Force Global Hawk is the foundation for the U.S. Navy’s Triton program as well as the foundation for international proposals. Pentagon officials said last year that the company substantially improved the Global Hawk’s operating cost, convincing them that the system should be retained over the U-2.

This new decision to keep the U-2 looks like a last-minute shift in the budget. Only last November, Pentagon procurement chief Frank Kendall said the choice between the two was settled. “It was settled by Northrop Grumman getting the sustainment costs of the Global Hawk below what some people thought they were going to be. And that made Global Hawk a better business case than the U-2,” he told Aviation Week.

The Air Force will spend \$1-3 billion for Global Hawk upgrades designed to achieve parity with the U-2, adding an all-weather capability, improvements to the ground station and addressing obsolescence issues.

Once the Pentagon decided last year to mothball the U-2 in favor of giving the high-altitude mission to the Global Hawk, combatant commanders complained. The Global Hawk is the only

UAV specifically assigned to take over the role of a manned aircraft. Waffling at such senior levels shows that while leaders want to embrace the persistence of a UAV, it comes at a cost of unpopular operational drawbacks.

Though a capable platform, the

Among the upgrades being eyed for the U-2 are improvements for the Asars radar, carried on the nose.

Global Hawk carries a 3,000-lb. sensor payload, much less than the U-2’s 5,000 lb. It typically flies at 55,000 ft.; the U-2 flies well above 70,000 ft., offering a substantially better field of view. Despite major improvements in processing imagery from Raytheon’s Enhanced Integrated Sensor Suite on the Global Hawk, some intelligence officials say commanders still prefer the U-2’s imagery.

This infusion of development and procurement dollars for U-2 likely will support sensor work.

U-2 advocates hope to improve the Advanced Synthetic Aperture Radar System (Asars), made by Raytheon. Though updated, program supporters hope to add an improved ground moving target indication capability.

The program is also using two new Senior Year Electro-optical Reconnaissance Systems (Syers) in the fleet; these offer improved spectral diversity by collecting imagery in 10 bands rather than six. Syers is produced by United Technologies Aerospace Systems, and the additional collection bands are optimized for use in the maritime environment. The hope is to buy six more upgraded Syers, the industry source says.

The U-2 has also been used to carry the “Dragon Fly” communication gateway to relay full-motion video out of Syria and Northern Iraq. A more advanced version of this system has been developed by L3 Communications and could be added to the platform, the source says. Work could also restart on upgrades for the U-2’s defensive suite, which is developed by BAE. The Global Hawk lacks its own defensive system.

Meanwhile, the Air Force is planning to field the RQ-180, a stealthy, penetrating intelligence-collection platform. Developed under a secret contract with Northrop Grumman, it could be operational this year. It is possible that once the RQ-180 is fielded, the service might have a better argument to mothball the U-2 or Global Hawk. ☼

Weighty Matter

Terrafugia wants FAA to waive limits so its flying car can still be called a light sport aircraft

Graham Warwick **Washington**

Designing a flying car capable of meeting both aviation and highway safety requirements is proving a weightier challenge than imagined by startup Terrafugia when it launched development of the Transition roadable aircraft in 2006.

The company has petitioned the FAA for a waiver of the gross-weight and stall-speed limits on the light sport aircraft

“The Transition was designed to be very simple to operate, in the spirit of the LSA rule,” he says. “In my view, it would be silly and unfortunate to allow an arbitrary weight number associated with a category to inhibit meaningful improvements in safety and technological advancement.”

Established in 2005 in a bid to revitalize general aviation by lowering

more compelling than Icon’s in terms of improving safety and the clear connection between the safety improvements and weight requirements.

“I believe it would be a mistake for the FAA to prevent this product from coming to market as an LSA. With LSA treatment, we will be able to bring our safety improvements to more people faster, so this exemption request should be in line with the high-level mission of the FAA.”

The Transition is being designed to meet federal safety standards for multi-purpose passenger vehicles, and as a result “will set the highest bar for occupant safety in general aviation,” Terrafugia states in its petition. But occupant-protection features add 121 lb.



The need to fold the wing for road driving means Terrafugia cannot increase the Transition’s wingspan to maintain stall speed at an increased weight.

(LSA) category, arguing the design’s automotive crashworthiness features and ability to land and drive through bad weather will increase safety.

Terrafugia is requesting permission for the two-seat Transition to have a takeoff gross weight of 1,800 lb. and stall speed of 54 kt., yet still be treated as an LSA that can be self-certified by the manufacturer against industry standards accepted by the FAA.

LSA rules limit landplanes to a maximum weight of 1,320 lb. and stall speed of 45 kt. In 2010, to accommodate road-safety features such as airbags, Terrafugia successfully petitioned the FAA to certify the Transition with a gross weight of 1,430 lb., the limit for seaplane LSAs.

“We now have quite a bit more information about what it will actually take to meet the level of safety that we believe is appropriate for this type of vehicle, and it simply takes more weight than we were previously allowed,” says CEO Carl Dietrich.

the cost of aircraft ownership and pilot training, the LSA rule defines a simple, low-performance aircraft that the manufacturer can self-certify at a significantly lower cost than for FAA Part 23 certification.

Terrafugia states that even at a higher weight, the Transition “still belongs in the LSA category. It is easy to fly, maintains a comfortable stall margin and benign stall characteristics, and embodies the original intent of LSA as a means to encourage innovation and growth in the aviation industry.”

Since 2010, the FAA has granted Icon Aircraft an exemption to LSA rules to increase the maximum takeoff weight of its amphibious Icon A5 by 250 lb. to 1,680 lb. to accommodate, among other features, a spin-resistant airframe design.

“In 2010 the FAA did not want to set a precedent beyond 1,430 lb. They have now broken that rule and set a new precedent with Icon at 1,680 lb.,” says Dietrich. “In my view, our case is even

A ballistic recovery parachute for improved flight safety adds 36 lb., while the aircraft’s roadability features, including the ground drive system, add 266 lb.

“The primary driver for the additional weight is the incorporation of the systems and structure necessary for safe road use in general and crashworthiness in particular,” says the petition. Meeting frontal-impact standards requires a safety cage that adds 44 lb. to the composite structure, and a crumple zone and bumpers that add 25 lb. Airbags, knee bolsters, head-impact protection, self-tensioning and load-limiting seatbelts, and other features together add 52 lb.

Explaining the request to increase stall speed, the petition states: “Due to the dimensional constraints of road use . . . it is not feasible to simply increase wing area proportionally to the increased weight. Based on a spectrum of pilot experience, Terrafugia believes the necessary stall speed increase will not affect the underlying safety intent of an easy-to-fly LSA.” ☛

Brace Position

Testing keeps truss-braced wing configuration in running for energy-efficient airliner designs

Graham Warwick **Orlando, Florida**

After wind-tunnel tests showed that the flutter weight penalty of a long-span, low-drag truss-braced wing (TBW) is small enough to make the configuration feasible for energy-saving airliners, NASA and Boeing are planning additional tests to assess the design's aerodynamic performance.

Aeroelastic analysis of the TBW design was conducted under Phase 2

showed that using a strut to brace the long-span wing provides a significant benefit by reducing the weight of the wing inboard of the strut attachment point. Phase 2 showed the weight penalty for keeping the slender wing flutter-free is hundreds not thousands of pounds, says Chris Droney, BR&T deputy principal investigator for Sugar Phase 2.

The study examined two truss de-

small penalty from flutter." Wind-tunnel data were used to update Boeing's FEM, reducing estimated wing weight. "The conclusion is the TBW configuration remains viable," says Robert Scott, a research engineer in NASA Langley's aeroelasticity branch.

"Most of the uncertainty was in the wing structural weight as opposed to other parts of the aircraft structure. They had an initial wing weight estimate with uncertainty that might be a little lower or a lot higher. In the end it was toward the low end," Scott says. "Post-test design used the lessons learned from the scale-model predictions and experimental data and applied them to the full-scale design. The pre-test aeroelastic penalty was around 346 lb., and was updated to 809 lb. after the test."

The revised wing weight estimate was still at the low end of the uncertainty range and allowed the Sugar High TBW to achieve a lower fuel burn than the Refined Sugar conventional configuration developed by Boeing using the same 2030-timeframe technologies.

Now with more confidence in its weight, NASA and Boeing plan to obtain a better definition of the truss-braced wing's drag under a "Phase 3" of the Sugar study. "This is a smart task order to build and test a transonic wind-tunnel model of the TBW to assess the interference effect of the strut," says Droney.

Testing of the 4.5%-scale model is scheduled for the end of this year. Sugar High was designed to cruise at Mach 0.7, slower than the reference 737-800, to save fuel. "We would like to push the TBW to higher speed, but we are after [Mach] 0.7 for this test," Droney says. The model will be tested with and without the strut to measure the aerodynamic penalty from interference drag.

"The TBW configuration remains a viable concept for reducing transport aircraft energy consumption. The validated detailed FEM enables credible weight and fuel-burn estimates that justify further investigations of the TBW concept," concludes NASA. "Based on these results, an aerodynamic performance test and evaluation is going forward that will show that high-order aerodynamic design and analysis tools can be used to predict the performance of a low-interference truss-braced wing." ✎



Built by NextGen Aeronautics, Boeing's Sugar High truss-braced wing model has a 12.75-ft. half-span.

of Boeing Research & Technologies' (BR&T) NASA-funded Subsonic Ultra Green Aircraft Research (Sugar) program to identify and investigate configurations and technologies for 2030-timeframe fuel-efficient airliners.

Phase 1, completed in 2010, showed that a high-aspect-ratio truss-braced wing could reduce fuel consumption by 5-10% over a conventional cantilevered wing. But the study highlighted the large uncertainty in the weight penalty incurred to ensure the slender wing is free of flutter.

Under Phase 2, Boeing received funds to develop a finite element model (FEM) of the wing, working with Virginia Tech and Georgia Tech, and to wind-tunnel-test a dynamically scaled model of the Sugar High TBW configuration to validate the structural model and obtain a more accurate weight estimate. Wingspan for the 180-seat Sugar High is 170 ft., compared with less than 120 ft. for the baseline Boeing 737-800.

Increasing wingspan reduces lift-induced drag, and the Sugar study

signs. One comprises a single strut and jury member, both of which attach to the front wingspar. The other is a V-shaped strut that splits along its length to attach to both front and rear spars. "The V-strut showed better than the single in weight, but was not addressed from an aerodynamic standpoint. Our focus is primarily on the single strut," says Droney, speaking at the American Institute of Aeronautics and Astronautics' SciTech 2015 conference in Orlando on Jan. 5.

A 15%-scale half-span model of the single-strut Sugar High TBW configuration was tested in NASA Langley Research Center's Transonic Dynamics Tunnel. In addition to validating that the flutter weight penalty predicted by the FEM model was accurate, wind-tunnel tests also looked at active flutter suppression using inboard and outboard ailerons, says Tim Allen, BR&T principal engineer.

"Inboard wing stiffness for TBW is a lot lower than for a conventional wing," Allen notes, adding, "We see a benefit in weight from truss bracing and a

March 5, 2015 • The National Building Museum • Washington, DC

AVIATION WEEK *Laureate Awards*

Finalists Announced for the 58th Annual Laureate Awards!

Civil Aviation

- Airbus A350 program head Didier Evrard
- Boeing 787-9
- Federal Aviation Administration in collaboration with the National Air Traffic Controllers Association, Mitre Corp. and other aviation stakeholders
- Southwest Airlines Chairman, President and CEO Gary Kelley

Defense

- BAE Systems
- Northrop Grumman
- U.S. Army and Boeing
- U.S. Ground-Based Missile Defense team

Space

- European Space Agency
- European Union
- Indian Space Research Organization
- NanoRacks CEO Jeff Manber

Business Aviation

- Robert Bass
- Embraer
- Nextant Aerospace
- Pilatus Aircraft CEO Oscar Schwenk

Technology

- GE Aviation head of additive-manufacturing strategy Greg Morris
- Mitre Corp., working with the U.S. Air Force and others
- U.S. Naval Air Warfare Center Aircraft Division and Qinetiq
- Rockwell Collins

Innovation

- Paramount Group
- Raytheon and Saab
- Rockwell Collins
- Textron

Lifetime Achievement Awards will be presented to David Thompson, Chairman and CEO of Orbital Sciences, and John Leahy, Airbus Chief Operating Officer - Customers.

Learn more and purchase tickets to attend at www.aviationweek.com/laureates

PRODUCED BY



PREMIER SPONSORS



OFFICIAL PUBLICATION



MEDIA SUPPORT





The Putin Effect

Russian actions
are rippling through
the aerospace and
airline industries

ERA/LANDOV FILE PHOTO

Jen DiMascio **Washington**, Tony Osborne **London**, Amy Svitak **Paris** and Jens Flottau **Frankfurt**

In the months leading up to the Winter Olympics in and around the port city of Sochi, the world's gaze shifted to Russian President Vladimir Putin. The goodwill carried by the international symbol of sportsmanship evaporated quickly, however. For it was just one month after the closing ceremonies, that Russia unilaterally annexed Crimea, Ukraine's strategically useful Black Sea peninsula.

The move was shocking in the West, but less so in Russia, where the former KGB agent's popularity and national pride surged. Moscow contends that feeling has led ethnic Russians in Eastern Ukraine to fight to rejoin the Russian fold. But NATO, whose Eastern members watched Russian tanks assemble on the border, and who have seen the military's increasingly aggres-

sive military exercises—some of which simulated the use of nuclear weapons against them—had other opinions.

Putin's actions, followed by fighting in eastern Ukraine, undeniably altered the geopolitical landscape. Less visible are the ripples affecting the defense, space and commercial aviation realms. But Putin's Russia was destined to upset all those sectors significantly in 2014.

Russian President Vladimir Putin walks with top advisers Dmitry Rogozin, deputy prime minister and a leader of Russia's military industry matters (left) and Foreign Minister Sergey Lavrov (right).

Before the year was out, NATO had directed its member nations to spend 20% of their military budgets on new equipment. France had refused to deliver a high-priced warship it was under contract to build for Russia. Eastern European nations especially felt the chill. But nations throughout the West found themselves once again in the cat-and-mouse military games with Russian forces that seemed to have faded with the end of the Cold War. Decades before.

WorldMags.net

In the space sector, Canada pulled a satellite from the launch manifest of a Soyuz rocket variant. Manufacturers began stockpiling titanium, fearing troubles in obtaining the important metal from Russian suppliers. And the U.S. moved to develop a big new rocket engine to replace a Russian powerplant used on vehicles that launch military and intelligence satellites.

In commercial aviation, Malaysia had one of its airliners shot out of the sky. The Netherlands lost hundreds of its citizens. Airlines around the world lost confidence in the intelligence they receive regarding the safety of overflights. And individual air carriers became political weapons.

In 2014, no other person has had such a sweeping impact on aerospace and aviation—for better or worse. And for all but the most cynical of observers, Putin's far-reaching impact has definitely been for the worse. Because of this, he is the 2014 Person of the Year.

MILITARY

Russia's military claims that the thousands of militants who took control of large swaths of Eastern Ukraine during the spring and summer of 2014 were not actually working with Russian forces. Moscow also denies that its forces supplied the militants with high-tech weaponry. Rather, leaders contend, the militants acted independently, calling for the same rights as those in now-annexed Crimea.

Yet NATO says several hundred Russian combat troops are inside the region advising and training separatists, and that several thousand more Russian personnel equipped with heavy weaponry are sitting on the Ukrainian border and are, according to the alliance, "capable of destabilizing the situation at very short notice."

Russia's ability to rapidly deploy forces was perhaps not well understood before this year, but it is a capability—along with the modernization of its strategic and air forces—which Putin has been building since he first became president in 2000 (see page 40).

These actions have reverberated across Europe, dramatically altering the posture of European military forces and the defense industrial outlook.

Ukraine is woefully underequipped to fight the most significant conflict on European soil since the wars in the Balkans during the 1990s. Almost a quarter of a century after indepen-



Video See an overview of some of the actions and events that led Aviation Week to choose Putin as Person of the Year—tap here in the digital edition, or go to AviationWeek.com/POY



Check 6 *Aviation Week editors discuss Putin's military transformation and NATO's response:*
AviationWeek.com/podcast

dence, its armed forces are still using the aircraft, helicopters and vehicles Russia left it with in 1991. And its personnel lack the experience for a conflict against well-armed insurgents who raided army depots and government buildings, helping themselves to weaponry that included man-portable surface-to-air missiles.

Ukrainian military officials say their country is in a condition of war with the Russian Federation. "We cannot politically declare [war] against it," said one Ukrainian officer in London in November. "We cannot win it, and no one will support it."

Russia's ambiguous use of "little green men," during its annexation of Crimea was a masterstroke. Wearing green fatigues and often black masks but no national insignia, these Russian soldiers could secure key locations across the Crimean Peninsula and paralyze Ukrainian command and control.

The region was already home to a significant Russian military presence, including the Black Sea fleet in Sevastopol and several naval airbases. That presence has grown. Intelligence reports suggest that Russia may have deployed short-range ballistic missiles; strategic aviation units may follow in the near future.

Since the beginning of 2014, the Ukrainian air force lost 10 helicopters—five Mil Mi-8 Hip transport and five Mi-25 Hind attack types. It has also lost five Sukhoi Su-25 "Frogfoot" fighters, a pair of Mikoyan MiG-29 "Fulcrums" and a Su-24 "Fencer." Shoulder-launched weapons also downed transports—an Antonov An-26 and an An-30, along with one of three Il-76s flying a supply mission into Lughansk. In the last attack, missiles were fired from two different sites as the transport aircraft made its landing approach.

Now five months into a nearly nonexistent cease-fire, Moscow's motives for military action in Eastern Ukraine are far from clear. If anything, damage

to East-West relations may actually be growing; a palpable strain is fraying the business ties forged between Russia and the West in recent years.

That change is particularly apparent with France's deal to sell two Mistral-class helicopter assault ships to Russia. In late November, despite threats of contractual retaliation from Moscow, French President Francois Hollande indefinitely postponed delivery of the first Mistral-class helicopter assault ship to Russia, citing the Ukraine conflict. But since suspending the 2011 contract in September, Hollande has been loath to cancel the €1.12 billion (\$1.32 billion) Mistral deal with majority-state-owned shipbuilder DCNS, which has suffered anemic growth in 2014.

Russia's buildup along the Ukrainian border—coupled with the decade-long transformation of its military fueled by the nation's oil boom—has also forced NATO and European states to take heed. At a time when NATO members were hoping their tempo of military operations would slow with the withdrawal from Afghanistan, a resurgent Russia throwing its weight around at the alliance's eastern borders has provided new urgency to NATO's call for its members to spend more than 2% of GDP on defense. They are being urged to spend at least 20% of their defense budgets on modernizing equipment.

Russia's long shadow on the border also prompted an increase in multinational exercises in Poland and Romania, while enhanced deployments of fighters to the Baltic states have helped to reassure those nations that cannot afford fighters of their own.

Despite the declared cease-fire in Ukraine, the level of Russian military activity outside the country's borders has risen dramatically.

To allay fears in Estonia, Lithuania and Latvia, Baltic Air Policing (BAP) fighter detachments have been tripled. NATO aircraft are now also based at Amari in Estonia as well as at the usual air-policing base at Siauliai, Lithuania.

Eastern European fighters have been scrambled hundreds of times to intercept Russian aircraft operating in Baltic airspace. In just one day in early December, BAP fighters intercepted 28 Russian aircraft, which were apparently a part of a large naval exercise.

Meanwhile, the Royal Norwegian Air Force, which has a standing NATO mission to intercept military flights

over the Norwegian Sea in the far north has seen a modest increase in the number of scrambles carried out in response to Russian military flights, although the number of aircraft intercepted has increased from 58 aircraft in 2013 to 80 during 2014. Russian aircraft have also been intercepted by Turkish F-16s over the Black Sea and in one incident by Portuguese F-16s over the Atlantic.

NATO has stepped up surveillance flights using its E-3 Sentry airborne early warning aircraft over Romania and Poland to monitor Russian air activity; the U.S. Air Force has increased its own surveillance flights with missions by RC-135 Rivet Joins flying daily from the U.K. to mission areas in the Baltic, the Norwegian Sea and into Eastern Europe.

The increase in Russian flights has drawn the attention of aviation safety regulators. Europe's skies are considerably busier with commercial air traffic than they were during the '60s and '70s, yet many Russian military aircraft flying through international airspace do so without radar transponders, responding to radio transmissions or filing flight plans. In December, the European Commission primed the European Aviation Safety Agency to investigate several near mid-air collisions between commercial and military aircraft.

The most significant was an apparent near-collision between a Russian reconnaissance aircraft—believed to be an Ilyushin Il-20 “Coot”—and a Boeing 737 operated by Scandinavian Airlines, off the coast of Sweden last March. The incident was not investigated by safety authorities, but the European think-tank European Leadership Network report describes the incident as one of the most provocative between East and West since the Cold War. A similar incident was reported in mid-December.

Naval activity has also been on the rise. Russian submarines are at the heart of one highly publicized hunt in the territorial waters in the Stockholm archipelago wherein Swedish naval forces searched, unsuccessfully, for what was said to be a minisubmarine.

Further hunts, first revealed by

Aviation Week in mid-December and then January have taken place off the west coast of Scotland. The incidents are believed to have involved a Russian hunter-killer submarine attempting to track one of the U.K.'s Vanguard-class ballistic missile submarines. And in an embarrassing sign of how budget hawks in London may have mortgaged essential military capabilities, the U.K., without an anti-submarine warfare wing, had to call in maritime patrol aircraft from Canada, France and the U.S.

SPACE

Despite cooperation in civil space efforts that overcame Cold War political differences and the increasing space collabo-



Moscow launched an internal PR campaign against sanctions by selling T-shirts that read: “Topols aren’t afraid of sanctions,” in reference to Russia’s mobile ICBM.

ration between Russia and the West, the global space industry has encountered myriad impacts over the past year. Putin’s reach disrupted U.S.-Russian talks on extended use of the International Space Station (ISS) and has intensified political debate in Washington as to the future of U.S. launchers.

In recent weeks, Russian space agency Roscosmos has even suggested it could develop an alternative to the ISS, the massive orbital outpost led by the U.S. and Russia that is arguably the world’s most politically complex space program. In a year-end news conference, Roscosmos chief Oleg Ostapenko said the agency is considering station options in support of Moscow’s broader manned spaceflight ambitions. He said the project would be part of the nation’s forthcoming 10-year space roadmap for 2016-25.

“This is an ambitious project which will allow us to keep track of more than

90% of the territory of Russia,” Ostapenko said of the initiative. “It [could become an] outpost for lunar exploration and deep space.”

The 10-year plan had been expected to address Washington’s proposal for extending the ISS four years beyond its planned retirement in 2020, though geopolitical tensions have for the moment frozen any talk about extended Russian participation in the program.

As relations between Moscow and the West erode, Putin is highlighting prospects for increased high-tech cooperation with China, including defense and space collaboration.

And in January, Roscosmos deputy chief Sergei Savelyev said development of a national space station, if it were to go forward, would be tied to continued use of the ISS and furthering cooperation with China, which is constructing its own manned outpost in low Earth orbit.

In Washington, the Ukraine situation has reset the debate over the future of U.S. launchers, accelerating protests in the U.S. Capitol against using Russian-made engines to lift U.S. payloads to space, notably the RD-180 that powers the first stage of the United Launch Alliance (ULA) Atlas 5 rocket.

So far, Moscow has not cut off supply of the NPO Energomash-made engines,

although U.S. lawmakers recently approved legislation that seeks to gradually wean the Pentagon from its reliance on the RD-180 and other Russian space hardware.

Buried in the 2015 omnibus spending act that became law in December, Congress appropriated \$220 million to find an alternative rocket propulsion system. A report accompanying the omnibus gives the Air Force six months to draft a technology maturation program for the new development, dubbed the Competitive Rocket Innovation Motor/Engine Arrangement (Crimea) by lawmakers. The effort is expected to culminate in a demo by 2019—the deadline Congress has given for ending use of the Russian propulsion system.

In parallel, political vulnerability to the RD-180 has prompted ULA to co-fund development of a replacement engine with Blue Origin, an entrepreneurial space venture. Known as the

BE-4, the propulsion system would be fueled by liquefied natural gas and could be ready for a demonstration flight by 2019.

The pressure to reduce U.S. reliance on Russian rocket technology is playing to commercial interests in the U.S. Space Exploration Technologies Corp. (SpaceX) is using anti-Russian sentiment in an attempt to unseat ULA's virtual monopoly in U.S. Air Force launches, asserting its new Falcon 9 rocket is the only politically, technically and financially sound option for lifting national security missions.

However, Orbital Sciences Corp., has announced plans to use a Russian-made variant of the RD-180 to replace the updated Russian NK-33 engines that currently power the medium-class Antares launcher. Orbital argues the so-called RD-181 is the only viable near-term alternative to the NK-33, which is modified by Aerojet Rocketdyne and designated AJ26 for Antares. However, Orbital says it will purchase the powerplants directly from NPO Energomash, rather than through its U.S. subsidiary, a joint venture with Pratt & Whitney known as RD Amross.

The company's procurement plan could make the RD-181 more palatable to key lawmakers, notably Arizona Republican Sen. John McCain, who has criticized ULA and the Air Force for wasting taxpayer money by purchasing RD-180 engines at a steep markup through middleman RD Amross.

More broadly, satellite operators have felt the chilling effect Putin's annexation of Crimea had on the commercial launch industry in 2014. Earlier this year, the U.S. government slowed awards for space-hardware export licenses to Russia, although there has been no specific impact to commercial launches of Russia's heavy-lift Proton rocket, which are managed by Virginia-based International Launch Services.

In June, however, the Canadian government—with its large Ukrainian diaspora—pulled one of its satellites from launch on a European variant of the Russian Soyuz rocket. And visas for Russian engineers and space technologists seeking to attend the annual International Astronautical Congress, which was held in Toronto last fall, were more difficult to obtain.

In May the Moroccan government nixed Soyuz as a candidate backup launcher for the country's two new remote-sensing satellites, a move in-

2014: A New Cold War?

Declaration of Intent

In outlining his rationale for annexing Crimea on March 18, 2014, Putin linked the move to another step in a long Russian history. By doing so, he both helped to bolster Russian identity and strike out at the U.S. The event marked a return to chilly relations between Russia and the West that has had significant ramifications for the A&D industry.

Fighting in Ukraine

In late February, after the departure of Ukrainian President Viktor Yanukovich, Russian troops began massing along the border with Ukraine. Though Russia denied involvement in subsequent fighting that brought down many Ukrainian military aircraft, the rebels have confirmed Russian involvement. Unrest there has put Ukraine's neighbors, Poland and the Baltic Republics on high alert.



REUTERS/LANDOV FILE PHOTO

MH17

On July 17, a surface-to-air missile (SAM) brought down Malaysian Airlines Flight 17, killing 298 people. The West suspects a Russian SAM and responded with increased economic sanctions.

Overflights

In addition to expanding its military modernization program, Russia has stepped up its use of air patrols, sending fighter and bomber aircraft in all directions, including as far away as Portugal. The aircraft fly with transponders off, relying on NATO escorts to alert commercial airlines about the presence of aircraft in crowded European airspace.

Rocket Reaction

A frosty political landscape forced the U.S. to confront the fact that its national security space assets are launched into orbit with Russian rockets, and although it has a stockpile, replacement remains years away. Congress is now involved in supporting a U.S.-developed engine by 2019. Despite ongoing tensions between the U.S. and Russia, cooperation on the International Space Station remains strong.



UNITED LAUNCH ALLIANCE

tended to avoid potential complications down the road.

In addition, at least one Western satellite manufacturer has shifted gears in response to troubled U.S.-Russian relations. Thales Alenia Space of France and Italy, which uses some U.S. components in its commercial communications satellite bus, said it felt compelled to find a European supplier for parts on the Yamal-601 satellite it is building for Russian fleet operator Gazprom Space Systems, owing to a recent State Department ban on some technology exports to Russia.

"There have been some new rules

concerning U.S. export regulations toward Russia," Thales Alenia Space CEO Jean-Loic Galle said in September. "It was not clear, I have to say, but we prefer to be cautious and anticipate risks."

Russian actions in Ukraine have also complicated the return to regular activity of Sea Launch AG of Switzerland, a majority Russian-owned company which launches large commercial telecom satellites atop the Russian-Ukrainian Zenit 3SL rocket from a platform in international waters in the Pacific.

In September, Sea Launch CEO Sergey Gugkaev said tensions between

Russia and Ukraine had the company “closely watching what is going on because we have production sites in both countries.” But he noted a May mission that lifted an Airbus-built communications satellite to geosynchronous orbit for Paris-based fleet operator Eutelsat went smoothly. “For the time being, we are not affected by these tensions.”

In December, however, Moscow signaled plans to take over the Sea Launch program and use it to collaborate with Brazil or other so-called BRICS countries, an acronym for five major emerging national economies in Brazil, Russia, India, China and South Africa.

“A very interesting dialogue on the level of experts is taking shape,” said Russian Deputy Prime Minister Dmitry Rogozin—a Kremlin insider who has been the target of U.S. Treasury Department sanctions—in a Dec. 24 interview on the Rossiya 24 news channel.

“The idea of joint launches may be generated in the BRIC format or in bilateral relations with Brazil,” he said, noting that the Sea Launch floating pad built specifically for the Zenit rocket is based in California.

“Now, after the latest events in

Ukraine, one may forget about industrial production [there], let alone high-tech manufacturing. It’s dead,” he said, citing the Sea Launch platform’s proximity to the U.S. coast near Los Angeles. “Naturally we will take it away for our own use.”

COMMERCIAL AVIATION

Similarly, the events in Ukraine set in motion by Putin changed civil aviation in a way that could hardly have been imagined one year earlier. On July 17, 2014, at 1:30 p.m. UTC, a Malaysia Airlines Boeing 777-200ER from Amsterdam to Kuala Lumpur with 298 people on board was in cruise over eastern Ukraine when a surface-to-air missile—fired from an area near a village controlled by Russia-assisted rebels—shot it out of the sky.

The exact circumstances of the attack remain shrouded. Recovery of wreckage, luggage and human remains is still subject to the goodwill of local warlords and has been suspended for months, long enough for crucial evidence that would shed light on events to be removed. The indications are that pro-Russia fighters were behind the shoot-down. Where the equipment

came from—whether it was stolen from Ukrainian forces or brought in straight from Russia in support of the allies in the neighboring country—is not known.

Those details do not change much, and neither does it much matter whether the attack on Flight 17 was a cruel mishap from a missile actually intended to hit Ukrainian military aircraft. Civil aviation has been, if not a target, then certainly a victim of a war fueled and directly supported by Putin’s Russia.

MH17 was not the first instance in which civil aviation has been unwillingly involved in military conflicts. In fact, it often is. What makes MH17 so different is that a civil aircraft was caught up in a war that had nothing to do with the origin of its flight, its destination or its home country. The aircraft just happened to be in the wrong place at the wrong time.

The attack has destroyed the industry’s confidence in a somewhat improvised reporting system that alerts airlines about conflict zones, one heavily dependent on a carrier’s home nation’s capabilities. MH17 was also flying at 33,000 ft., an altitude that seemed safe from ground attacks because the kind

Out of the Shadows

Russia’s ongoing military transformation became apparent in 2014

Maxim Pyadushkin **Moscow**

Although the threat of global conflict seemed to dissipate with the end of the Cold War, the restoration of Russia’s military might have been on Vladimir Putin’s agenda from the very beginning. He came to power in 2000, when the armed forces relied on the remnants of Soviet arsenals due to the sharp decrease in military expenditures in the 1990s.

But Russia faced regional threats to its national interests in the post-Soviet era as well as challenges from insurgents on the North Caucasus. The successful second Chechen War in the early 2000s lent vast public support for Putin’s rule.

At the same time, it showed that the country’s armed forces—a Cold War-

era mobilization giant—could not respond quickly to local threats. The initial plan called for two different forces—troops constantly at the ready along with traditional mobilization units. But in 2008, the mixed results of the five-day war with Georgia over the breakaway republics Abkhazia and South Ossetia triggered the more radical transformation of the Russian military into a smaller, but more effective force.

The reform of Russia’s military, officially launched in October 2008, downsized the armed forces. The structure shifted from four tiers to three. In 2010, Russia reduced the number of military districts to four



U.K. ROYAL AIR FORCE

A member of the U.K. RAF, flying in a Quick Reaction Alert Typhoon, snapped a shot of this Russian Tu-95 “Bear” in international airspace north of Scotland.

from six, with their planned transformation into strategic commands: west, south, central and east. And lean units, intended to be fully deployed only during wartime, were merged into full-size constant-readiness formations. Concurrently, Russia’s major rapid deployment force—airborne troops—

of heavy weaponry necessary to reach a target that high would typically be controlled by military forces that aim at military targets flying much lower.

What the case did highlight is that the current reporting system is imperfect. As Malaysia Airlines itself criticized, some airlines, but not all, were warned of security risks in overflying Eastern Ukraine and thus avoided doing so. This fact alone is cause for an investigation.

Ever since MH17, airlines are struggling with how to deal with the new world of aviation security. Problems have escalated beyond security lines and passenger ire over screening procedures. Cognizance of conflict zones was always in play, but airlines must be even more vigilant now. For example, after Hamas attacks on Ben Gurion Airport, many international carriers temporarily suspended service to Tel Aviv. Several international airlines are pondering requesting an integrated international pre-warning system. Most experts are skeptical because a lot of the intelligence comes through informal channels that cannot easily be opened to other recipients.

The International Air Transport As-

sociation has been active in the background, organizing working groups and debates among airlines. But will an integrated, harmonized, coordinated approach really help? Those questions have taken on new urgency post-Ukraine incursion.

The damage to commercial aviation extends far beyond the MH17 tragedy. The devastating state of Russia's economy and the fall of the ruble, caused by cheap oil and international sanctions, have forced its airlines into survival mode. Transaero, one of the country's largest carriers, received a state-sponsored bail-out tied to conditions that force the airline to fly more to southern resorts, in other words Crimea.

And of course cooperative projects between Western aircraft manufacturers and Russia's aerospace sector are on shaky ground. Airbus and Boeing have engineering centers in Russia, but Bombardier has shelved its plan to establish a final assembly line for its Q400 turboprop there. And although Ukraine's Antonov aircraft continue to be assembled in Russia, this relationship is understandably fraught.

Russia holds a trump card as a source of metals vitally important to

aerospace. Companies in the West have been stockpiling titanium and other rare materials, to the benefit of RTI International, a U.S.-based rare metals company.

Whether Russia will continue on the antagonistic course Putin has set depends not just on reaction from the world community but perhaps from disension within. Already protests have been staged, prompted by the deteriorating national economy. Whether the average Russian connects this to Western sanctions or just chalks it up to bad luck with plunging oil prices could be key to Putin's next move.

Despite the cease-fire in Ukraine, skirmishes remain frequent. But even with new domestic challenges, Putin's rhetoric indicates he regrets nothing. Asked at his Dec. 18 press conference whether the current economic problems were the price the country had to pay for Crimea, Russia's three-term president took a more expansive view.

"This is actually the price we have to pay for our natural aspiration to preserve ourselves as a nation," Putin said. "It is not about Crimea but about us protecting our independence, our sovereignty and our right to exist." ☛

were strengthened both in numbers and with new equipment. They were complemented by a special operation forces command founded in 2012.

The new look of Russia's military might became visible in spring 2014 when the armed forces managed to very quickly and secretly move troops to Crimea; later they would concentrate about 80,000 troops on the border with Ukraine. Another example of quick operational deployment is in the Arctic, where Russia has restored a military base. Its air force has also undertaken worldwide strategic deterrence missions, flying over the North, Norwegian, Mediterranean, Baltic and Black seas as well as over the Atlantic, Pacific and Arctic oceans.

Increased military spending accompanied the organizational transformation. Profits from oil prices enabled the Russian government to quickly increase the military budget in the second half of the 2000s. The defense ministry budget increased nearly four-fold—from 574 billion rubles (\$9.1 billion) in 2007 to 2.1 trillion rubles in 2013.

Russia's 10-year rearmament pro-

gram through 2010 was estimated at 2.4 trillion rubles; the current procurement plan for 2011-20 has a budget of 19 trillion rubles. The defense ministry is asking for 30 billion rubles for rearmament through 2025, a plan expected to be approved this year.

Along with improved training and remuneration, the expanded budgets allowed the military to replenish their arsenals. As a result, the Russian defense industry began to concentrate on deliveries for the national armed forces, in contrast with the 1990s and early 2000s, when export contracts provided the major source of income for the defense manufacturers here.

Strategic forces are a major focus area. In 2014, they received 38 intercontinental ballistic missiles, including 22 submarine-launched types. The defense ministry deployed three new regiments armed with Yars mobile ICBMs, one Borei-class nuclear-powered ballistic missile submarine and seven modernized Tupolev Tu-160 and Tu-95MS strategic bombers.

The air force received 142 new fixed-wing aircraft in 2014, reports

the defense ministry. This figure includes 53 Sukhoi Su-30 and Su-35 multirole fighters, 16 Su-34 bombers, 28 transport and training aircraft and 18 upgraded MiG-31BM interceptors. The force also received 135 rotorcraft including 46 attack helicopters and 72 transports as well as seven S-400 long-range air defense systems. The ministry also reported deliveries of 179 unmanned aircraft.

Development of future weapons that can bring the armed forces to a new level of quality is being financed. This includes the new Sarmat heavy ballistic missile, a future strategic bomber designed under the PAK DA program, new transport aircraft and airborne weapons. This year the air force has started evaluation tests of the fifth-generation Sukhoi T-50 fighter developed under the PAK FA program. The first order for this type is expected to be placed this year after procurement plans through 2025 are approved. By 2020, air defense is expected to incorporate an S-500 surface-to-air missile system that will have anti-ballistic defense capabilities. ☛

Defensive Exports

Despite real reforms, U.S. A&D exports are slow to benefit as the world changes quickly

Michael Bruno **Washington**

No White House administration has been more effective in reforming U.S. defense export controls or shepherding change than Barack Obama's. In just over four years, more progress in this area has been achieved under his tenure than by the previous four administrations in as many decades.

But it all just might be too little, too late.

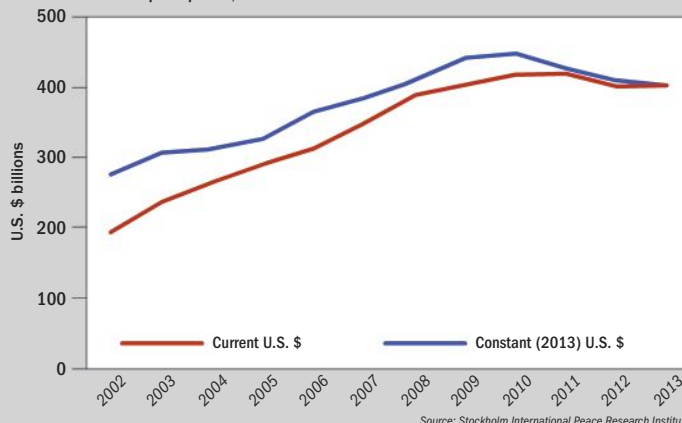
"A lot of change has occurred, which is really good," Gibson LeBoeuf, vice president for Washington relations at Raytheon International, said at a recent conference. "There's still room for more improvement," he added.

The irony that Washington has come so far in improving defense export controls, yet has so far to go, quickly emerges during any discussion these days about U.S.-based aerospace and defense (A&D) companies selling abroad. To be sure, industry does not want to do anything to discourage officials and lawmakers from continuing to make changes to the outdated Cold War-era licensing system.

Executives also cheer victories such as the Senate's 2010 ratification of two defense trade treaties (DTT) that President George W. Bush signed with Australia and the U.K., which obviated the majority of U.S. defense licensing. In 2012 Congress also gave Obama authority to loosen control of certain commercial satellites and related items, reversing what is widely considered a mistake lawmakers made in the 1990s. Above all, in 2010 Obama said he would try to double U.S. exports in five years and to bring licensing into the 21st century.

There has been growth, but also a

Total Arms Sales of Companies
in the Sipri Top 100, 2002-13



dawning realization that exports are no panacea. The Aerospace Industries Association said 2014 aerospace exports did maintain their upward trend of recent years, improving by nearly \$8.1 billion, with growth mainly in the civil sector. Overall, the favorable balance of trade in aerospace products was a \$61.2 billion surplus.

But defense exports grew just 9.2%. "Foreign sales will continue to be a key area of focus for defense companies, but defense export growth will not offset declines in domestic procurement spending," the trade group said last December, referring to U.S. defense budget cuts.

Meanwhile, the world of defense exporting is changing rapidly, challenging the post-Cold War paradigm of Western dominance. The Stockholm International Peace Research Institute's latest report on annual trends



Data For more on recent U.S. aerospace exports and the Sipri Top 100 arms-producing companies, tap here in the digital edition or go to AviationWeek.com/DefenseExportTrends

and data in worldwide arms production and sales—excluding China, due to a lack of data—shows that while the top 10 largest arms-producing and military services countries have not changed, Russian and emerging market-based companies are surging.

Indeed, in the 2013 rankings released last month, Russian anti-aircraft weapons maker Almaz-Antey became the 12th-largest arms producer and crept closer to Sipri's top 10, which otherwise has been exclusively the domain of U.S.

or Western European companies since the Soviet Union dissolved. Last year also saw the introduction of a 10th Russian arms company—communication and electronics manufacturer Sozvezdie—to the Sipri Top 100.

The number of American companies as a whole dropped 4.5%, with the number listed in the Sipri Top 100 declining from 42 to 38, which the institute attributed to corporate divestitures and business portfolio reductions. French companies boosted sales year-over-

year, while British companies stayed at the same level. Italian and Spanish companies' sales continued to decline.

Worldwide, the shift in growth and size continues to favor non-NATO players, especially those in developing nations. Registering 15.5% of Top 100 arms sales for 2013, their share is at its highest point in the history of the institute's post-Cold War rankings. But overall, arms sales appear to have peaked in 2010 and have dropped in total, inflation-adjusted amounts since then (see chart).

Back home, the U.S. industry has been slow to utilize new exporting tools and allowances due to unfamiliarity or confusion. Also, U.S. Foreign Military Sales (FMS) appear to have lost some luster, both because they are too expensive and because potential customers are suffering their own spending constraints, as in the West.

It also is becoming a smaller world, with more companies going after the same foreign customers and projecting international sales growth that cannot come true for everyone. At the same time, many countries increasingly want to develop, produce and export their own products (see pages 44-49).

"Unfortunately I don't think we're ever going to win and get to that perfect end-state of export controls," said Nancy Ziuzin Schlegel, Lockheed Martin's director for global security policy. "We're going to continue to work on it and the demand is going to continue grow."

Bill Greenwalt, an analyst at the conservative American Enterprise Institute think tank, echoed that sentiment during the ComDef 2014 conference last fall. "It's one of those issues where we've been trying to reform it for 20 years and the difference here is that... the administration started off early and that's good. But the reality is we're still probably 20 years behind."

Indeed, every administration since the 1970s has tried to overhaul and improve the way the U.S. regulates and facilitates selling defense-related items abroad. As with promises to reform entitlement programs or to streamline government, most administrations have only made a dent in the bureaucracy. Lobbyists and analysts got their hopes up for genuine export-control reform in George W. Bush's second term, only to be humbled by a limited—albeit significant—cut in the backlog and license-processing time for applications at the State Department.

Then in April 2010, Defense Secretary Robert Gates unveiled the Obama administration's Export Control Reform Initiative (*AW&ST*, May 6, 2013, p. 38). Beyond permanently cutting backlogs and wait times, it sought dramatic rewrites to the two lists of controlled items and, ultimately, convergence around a single list, a single licensing agency, a single enforcement office and a single application system—the "four singles."

It astonished Washington. "A common refrain heard around town was we've all seen this movie before and we know how it ends," said Brian Nilsson, director for nonproliferation and export control at the National Se-

curity Council. But this time the "stars were aligned" with players like Gates, and "we had a plan," he said.

It revolved around a "transparent process" to systematically move items from the U.S. Munitions List (USML), the basis for International Traffic in Arms Regulations (ITAR), to the Commerce Control List (CCL). Fifteen of 21 USML categories have been translated, with the electronics category moving over Dec. 30. More are planned to be finalized this year.

Better yet, most "600 series" items—named for their new part of the CCL code—are eligible for so-called strategic trade authorization license exceptions, which means license-free exports and reexports to and among 36 allied countries and NATO members.

The 10 Largest Arms-Producing and Military Services Companies excluding China, 2013

RANK	COMPANY	ARMS SALES, 2013 (\$billions)	% COMPANY SALES
1	Lockheed Martin (U.S.)	\$35.49	78
2	Boeing (U.S.)	30.70	35
3	BAE Systems (U.K.)	26.82	94
4	Raytheon (U.S.)	21.95	93
5	Northrop Grumman (U.S.)	20.20	82
6	General Dynamics (U.S.)	18.66	60
7	EADS (Europe)*	15.74	20
8	United Technologies (U.S.)	11.90	19
9	Finmeccanica (Italy)	10.56	50
10	Thales (France)	10.37	55

*EADS was renamed Airbus Group in January 2014
Source: Stockholm International Peace Research Institute

At ComDef 2014, Nilsson and other officials claimed the administration was well into the second phase of its three-phase reform implementation plan, including drafting language and beginning to shop it around Capitol Hill, which will have to bless the consolidation of the four singles. No one from industry disputed the milestones.

Then again, no one was claiming great gains, either. For starters, as much as processes have become easier or quicker, industry is demanding more at the same time that the federal government is shrinking and limiting resources because of austerity measures.

Christopher Tucker, a retired U.S. Army one-star general who is now vice president for international business at Exelis, agreed that steps and processing times in FMS cases have been reduced significantly, for instance. But FMS sales also have grown in the five years

of the reform effort, and with companies chasing direct commercial sales as well, the workload on government officials has increased even more, he said.

"We've gotten through what I call the easy stuff—process timelines and [getting the] right people in the right place," he said. "But contract completion in the case of FMS [is] still a demanding workload on contracting officers... and the technology security foreign disclosure process is still very complex and very lengthy, and it's going to take some time to work through the rest of that."

At a separate but related Center for Strategic and International Studies conference in November, Bill Lynn, the former deputy defense secretary who is now chief executive of Finmeccanica's North American businesses,

opined that the trade treaties also have not produced the desired benefit.

The DTTs "took an enormous lift through Congress and the [Defense] Department to move [them] forward and you can't think of an easier situation," Lynn said. Australia and Britain are some of America's closest allies, there was no security threat impeding the negotiations, and officials were not including sensitive technologies.

While Lynn admitted he has not followed results closely since leaving office in 2011, he said he has not heard of much improvement. "I don't think it is being heavily used right now. We

spent a lot of effort to get something in theory that was absolutely right [and] in practice should have been easy, and it was neither. It wasn't easy, and it hasn't been used," he said. "It doesn't serve as a great example of the highway we ought to be going down."

In fact, it could well be that too much change has occurred for industry to absorb. "Some of the observations that we're seeing in the international community are that the delays are not necessarily in the licensing processing times, but perhaps are [caused by] people who are a little uncertain how the reform effort operates," said Dan Fankhauser, counselor for defense materiel at Australia's embassy in Washington. They are "seeking that assurance or surety when they don't actually need to and reaching out to Commerce that they can utilize an exception."

For their part, administration offi-

cials suggest all they can do is try to help industry understand what is possible. Kevin Wolf, assistant secretary of commerce for export administration, told Aviation Week how the number of people the Commerce Department has trained in the new rules has doubled

each year from fiscal 2011 to 2013. It should show continued growth for 2014 once final data is available, as Commerce officials have hosted scores of opportunities like webinars.

But at some point, all officials can do is reach out. "I often refer to the five

stages of export-control acceptance where it starts off as denial—"this won't actually happen"—and then to curiosity, then to panic, and then intense focus, and then acceptance," Wolf said.

"There are some companies that waited, thinking that it was never go-

Balancing Act

Brazil weighs autonomy and affordability

Bill Sweetman **Washington**

BRAZILIAN AIR FORCE



Brazil faces a complex and unique set of defense, security and economic challenges and opportunities, including a 10,500-mi., ten-nation land border and a large exclusive economic zone (plus interests in the South Atlantic). It has a powerful aerospace and defense industry, but also some major internal development needs, and its diplomacy is oriented toward regional and even hemispheric influence.

The nation's defense trade is consequently complex. A 2014 study published by the U.S. National Defense University refers to Brazil's "trilemma"—a problem for which the solution can be optimized for any two of three desired outcomes. In the defense world, those outcomes are autonomy and national development; affordability; and military capability. For example, direct importation is often the least costly way to acquire hardware. Alternatively, technology and systems can be developed indigenously within a fixed budget, but that is a long process that may involve accepting and mitigating military risk.

Brazil's major defense programs strike a balance among the three points of the trilemma, but the balance point differs from one project to another. This strategy will be tested over the next ten years and beyond, because a number of ambitious long-term programs are now reaching the big-money stage.

Some defense projects sit at opposite extremes of the autonomy-versus-import spectrum. Brazil's P-3AM Orion maritime patrol aircraft were modified in Spain by Airbus Defense after being acquired from the U.S. Navy. (Retired long ago as P-3As, they had flown fewer hours than the U.S. Navy's own P-3Cs.) Likewise, Brazil's most advanced unmanned air vehicle is the Elbit Hermes 900, acquired off-the-shelf with industrial participation via AEL Sistemas.

In contrast, the Embraer KC-390 tanker-transport is one of two modern-technology single-nation airlifter programs, the other being Japan's C-2. The differences between these programs are that the KC-390 matches Embraer's proven ability to build transport aircraft and has a large potential domestic, regional and worldwide market, while the UAV and maritime aircraft are small-number systems in markets already dominated by powerful incumbents.

Other programs are being pursued through partnerships, the largest involving the Saab JAS 39E/F Gripen. The 36 aircraft ordered so far make up the first of three tranches that will replace all the air force's current tactical jets by the early 2030s. The first 21 aircraft will be built in Sweden and the remainder in Brazil, while Embraer leads development of the two-seat

JAS 39F and leads Brazilian industry participation in the manufacture of all Gripens. Embraer will build later Gripens for Brazil and other customers—likely including, but not limited to, Latin America—and it is also probable that Embraer will play a major role in developing a carrier-based Gripen.

The Gripen is a major focus of business and technology for other Brazilian

Importing and upgrading 11 F-5s from Jordan allowed Brazil to stretch out its Gripen acquisition to reduce risk.

companies, such as Odebrecht—a \$43 billion conglomerate that has diversified into defense, including the acquisition of radar and missile developer Mectron—and Elbit subsidiary AEL Sistemas. The Brazilian aircraft are expected to feature a panoramic-display cockpit using AEL hardware, and will be armed with the Odebrecht Defense & Technology MAR-1 anti-radar missile and the Denel/Odebrecht A-Darter air-to-air missile.

The first-batch deliveries continue until 2024, controlling expenditure and mitigating risk. All the companies involved, along with the air force, have gained experience with avionics and weapon integration through three deep upgrade programs—the air force's F-5EM/FM and Embraer-Alenia A-1IM, and the Navy's AF-1IM Skyhawk—which use a mix of Elbit and Odebrecht avionics and weapons. (The A-1IM has Brazil's first indigenous fighter radar.) As a further hedge against military risks, the air force has acquired 11 more F-5E/Fs from Jordan.

Naval modernization programs are taking a similar approach to schedule and indigenous capability. Three projects are underway: Prosub (submarines), Prosuper (surface combatants) and Pronae (aircraft carrier capability). Under Pronae, Brazil plans to operate 1950s hardware, including the carrier Sao Paulo—formerly France's Foch—AF-1Ms and KC-2s (modernized Grum-

ing to happen, and waited until the last minute before they started paying attention, and they are in the panic stage. They have to reclassify and re-mark and rethink. But the companies that have gone through all of that, that are in the acceptance stage—particularly

with respect to trade by and among the close allies—are finding really dramatic efficiencies. To the extent it's with the rest of the world, it's a little bit better," Wolf continued. "And to the extent their intent is trading by or with countries of concern, it is just

as illegal today as it was yesterday, and they're getting no assistance and that, of course, is deliberate. So it just depends on where a company is in those five stages of acceptance."

The next Commerce webinar on export reform for industry is Jan. 29. ☛

man Traders), into the late 2020s, to develop its carrier-aviation expertise, with the ultimate goal being a new carrier, probably with Sea Gripen.

Prosub is being carried out by a joint venture between Odebrecht and France's DCNS, which will first build four Scorpene-class submarines with air-independent propulsion systems at a purpose-built base and shipyard at Itaguaí. This is planned to be followed by Brazil's first nuclear-powered sub-

marine. Much bigger than the Scorpene, the 5,600-ton vessel will combine Scorpene know-how with a propulsion system developed under a government-controlled nuclear program.

In this case, the need for autonomy is absolute because no nation will export nuclear propulsion technology. Brazil's government, via a navy research center in São Paulo, has sponsored a long-running nuclear program that has developed a complete fuel

cycle, from mining to disposal. Work is underway on an experimental land-based system comprising a 48-megawatt pressurized-water reactor and generator. This development is driven by perceived strategic need: A 2009 briefing by Nelson Jobim, then the nation's defense minister, refers extensively to the 1982 Falklands war and the degree to which a single British nuclear submarine was able to paralyze Argentina's navy. ☛

Baby Steps

Turkey is maturing its products with the goal of becoming a major defense exporter

Tony Osborne **London**

Turkey's grand ambitions see it becoming one of the world's biggest exporters by 2023, and the country hopes that its defense sector will help it achieve that goal.

After decades of technology sharing and offsets—some of which continue today—Turkey is in the comfortable position of having a well-developed defense industry with indigenous products that are gaining significant traction in the market thanks to heavy government support and proactive promotional campaigns and activities.

But 2014 was not as strong a year as officials perhaps would have liked. According to figures released by Turkey's Exporters Council, defense exports bought in \$1.2 billion dollars in the first nine months of the year, up from the corresponding period of 2013, but slightly below Turkish ambitions of achieving \$1.8-2 billion of sales.

However, the country's Undersecretariat for Defense Industries (SSM) is conservative about its approach to exports and has stated that the \$2 billion benchmark could be reached in 2016, and that defense equipment could

represent as much as 5% of Turkish exports in a decade.

Turkey has been working hard to build international bridges in recent years. Unable to fully benefit from trade links generated by its neighbors in the European Union, Turkey has been focusing its attentions on Central Asia, Africa, the Middle East and Latin America. In the Middle East, Turkey represents a

friendly face, a supplier that is not limited by the tough U.S. International Traffic in Arms Regulations (ITAR). Nor is it trading with Israel, despite the close ties the two countries once had. Of course, these soured when Israeli Special Forces attacked a Turkish aid flotilla in the Mediterranean in 2010, and the relationship has so far failed to recover; both Turkey and Israel officially severed defense ties as a result.

Unlike Europe, Turkey was not badly affected by the economic downturn and has been able to keep spending, making it an attractive target for investment by Western companies looking to offer their wares beyond Europe. In fact, one of the main tenets of Turkish success has been developing

The TAI Hurkus trainer is the first indigenous aircraft to emerge from Turkey since the 1930s, coming as a direct result of TAI's work on F-16s during the 1980s and 1990s.



TRUTH AEROSPACE INDUSTRIES

partnerships between Western companies and their local counterparts. One place where this has occurred has been in the local development of armored vehicles, initially for domestic use, but which have been subsequently exported widely. Companies such as FNSS Savunma Sistemleri, a joint venture of Nurol and BAE Systems, developed wheeled and tracked armored personnel carriers.

Another beneficiary of this approach has been state-owned aero-

space company Turkish Aerospace Industries (TAI), which was born out of Turkey's need to modernize its air force. TAI and similarly named TEI, Turkish Engine Industries, license-produced F-16 Fighting Falcons and the engines for the Turkish air force. TAI's experience grew to the point that the company is now producing entirely indigenous products for the Turkish air force, while also generating interest from abroad.

The TAI Hurkus turboprop training

aircraft and the TAI Anka medium-altitude long-endurance unmanned aerial vehicle are being actively promoted to the international market. TAI's experience, along with Turkey's trade connections, has meant that TAI has taken over development and marketing of the AgustaWestland AW129 Mangusta attack helicopter, which TAI is now developing as the T129 ATAK. Italy has struggled to export the aircraft since it was developed in the 1980s but now the

New to the Game

For Japan, making weapons is one thing. Learning to export them is another.

Bradley Perrett Sydney

Around 1900, the Royal Navy had a problem with boilers. Unusually, it had adopted a French design, which was performing poorly, even though it worked well in French ships. Part of the problem turned out to be that, in building these Belleville boilers, British licensees had not followed all the French procedures.

So the challenges of technology transfer are hardly new. Both sides need to be on their toes: The technology recipient needs to follow instructions, and the transferor needs to know what information to give. It is not always obvious what a customer does not know; foreigners may well be used to doing things differently.

This presents a clear challenge to

Japan, which decided last year to end a decades-old ban on arms exports. Japan is really well practiced at one side of the technology transfer process, receiving, and not at all on the other side, giving. It also seems likely that Japanese industry, having worked for decades on developing and building military systems for only domestic customers, has many idiosyncratic processes and standards. But it may not realize that some are idiosyncratic.

Accentuating the problem, Japan already has a wide range of products that it can conceivably offer, from aircraft to radars and warships. Other countries gain experience in dealing with customers as they build up their arms industry. To exploit its prod-

uct range, Japan needs to learn fast.

The Society of Japanese Aerospace Companies says it has begun investigating "rules and regulations on joint development and procurement in foreign countries, analysis of success and failure cases and so on." It is doing that by working with foreign counterpart associations, the society's president, Kosuke Imashimizu, tells Aviation Week. The society declines to say which foreign groups it is working with, but British industry association ADS should be high on its list, since Britain was the first country with which Japan agreed to undertake joint arms development, though Tokyo already had limited collaboration with the U.S.

Japan agreed in July to collaborative research with Britain on improvements to the MBDA Meteor air-to-air missile, to which it would contribute seeker technology. Japan has also reportedly proposed that Britain buy the Kawasaki Heavy Industries (KHI) P-1 maritime aircraft.

In the case of the missile seeker, the customer came to Japan. London asked for the technology, according to Japanese media. That is not typical. Usually, defense sales come from winning competitions. Experienced arms manufacturers such as Dassault and Raytheon have large teams of people who know how to promote weapons to a diverse range of governments. Japanese companies know how to promote to Japan.

The biggest early prospect for a Japanese defense export is the sale of submarines or submarine technology to Australia, with which Tokyo has also signed an arms cooperation agreement. But that question of Japanese

Japan is reportedly proposing that Britain buy the KHI P-1 maritime aircraft.



KAWASAKI HEAVY INDUSTRIES

aircraft—modernized with Turkish avionics and weapons—is being offered to customers with which Turkey has favorable export relationships, such as Pakistan and Azerbaijan.

A similar principle has been applied to Alenia's conversion of ATR 72 turboprop airliners into maritime patrol aircraft, while the T-70 program to build a Turkish adaptation of the Black Hawk helicopter for domestic use could open new international markets for that aircraft, allowing Sikorsky

to sell it again in markets where Turkish products have an advantage. Furthermore, the experience garnered in the type's development will help TAI's work on an indigenous utility helicopter. The company's experience on the F-16 allowed it to recently carry out upgrades on Vipers operated by Pakistan.

Turkey also wants to develop a potentially exportable indigenous fifth-generation fighter to fly by 2023. However, politics have already delayed the development process considerably, as have

issues surrounding the selection of a development partner for a new long-range surface-to-air missile system, dubbed T-Loramids. The initial choice—China's Precision Machinery Import-Export Corporation (CPMIEC)—and its HQ-9 system prompted concerns from NATO members about the integration of the Chinese system into the wider NATO air and missile defense network. Consequently, Turkey has begun negotiations with the Eurosam consortium of MBDA and Thales. ☛

inexperience in transferring defense know-how is a key concern of analyst Andrew Davies of the Australian Strategic Policy Institute, who also points to potential language difficulties.

The Australian submarine project highlights the issue of production technology. In some areas, such as warship construction, Japan appears to have an unusually efficient industry. Two Japanese shipbuilders, running almost like clockwork, alternate in commencing construction of one submarine a year, enjoying an unusually fast order rate by modern standards. They consistently deliver each boat three years later at a cost, recently, of about \$600 million. Australian govern-

ment estimates suggest that building similar subs at Adelaide would cost five times as much.

Conversely, Japanese build military aircraft at painfully low rates, with the aim of sustaining the industrial base rather than holding down costs. Most Western programs are set up for fairly fast production runs. For example, the Japanese defense ministry plans to stretch the building of about 150 army utility helicopters over 20 years, which no U.S. or European procurement agency would consider.

Lifting the export ban will help Japan avoid that sort of arrangement. For the rotorcraft program, Airbus is offering its forthcoming X4 helicopter and pro-

poses that KHI build not the whole aircraft for Japan but the drive train and rotor for, presumably, all buyers. Given the chance to build fast, Japan's aircraft industry achieves world-class efficiency, as shown by its enduring major role in Boeing commercial aircraft programs.

Then there are opportunities in license production of equipment that the licensor is no longer making. In 2013 it turned out that Japan, with its habit of making things for itself, was manufacturing Rolls-Royce marine engine parts that the British company had stopped making. Tokyo let KHI supply the parts to the Royal Navy—which, in contrast with its experience with Belleville boilers, appears to be satisfied. ☛

Seoul's Success

South Korean exports—from ground equipment to ships and aircraft—widen

Bradley Perrett **Sydney**

South Korea is becoming a player in defense exports. In eight years since 2006 its annual foreign sales have grown relentlessly from an almost negligible \$250 million to a far-from-negligible \$3.6 billion.

The weight of those exports is also moving from army equipment, which South Korea at first found easiest to develop, to warships, propeller training aircraft and, most recently, light supersonic combat aircraft. The defense ministry, which collates the export figures, is forecasting a further rise in sales to more than \$4 billion this year.

Yet from an aircraft manufacturing

South Korea's ability to move into defense export markets is based on large domestic demand

standpoint, defense sales are still far too low, says Cho Jinsoo, an aeronautics professor of Hanyang University. Boeing and Airbus dominated aircraft manufacturing by KAI and Korean Airlines. And although the KAI's T-50 family, which includes the FA-50, has enjoyed export success, Cho and others in the industry note that its sales are subject to a U.S. veto, because the air-

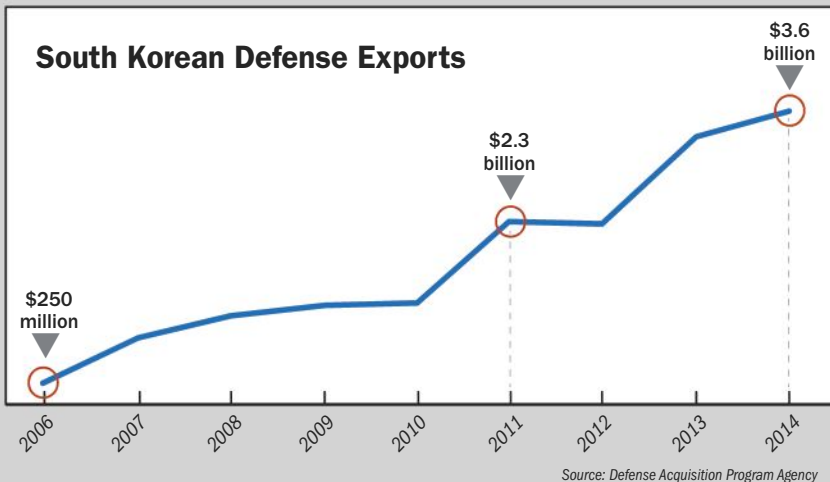
craft, developed with help from Lockheed Martin, has much U.S. equipment.

Balancing aircraft manufacturing requires much larger military sales, and to achieve them South Korea must develop its KF-X indigenous fighter, says Cho, who serves on government advisory boards.

The T-50 family, combining the aerodynamics of the F-16 with the size of the Saab Gripen but lacking the air-to-air capability of either, has become an industry highlight. KAI has now booked export orders for 52 of the supersonic type: 16 TA-50 armed trainers for Indonesia in 2011, 24 FA-50 light strike aircraft for Iraq (but called T-50s) and 12 FA-50s for the Philippines.

Thanks to the exports and a top-up order from the South Korean air force, KAI has been able to boost production. At the earlier rate of one a month, labor costs had already fallen from 59,000

South Korean Defense Exports



worker hours for the 26th T-50 to 30,000 for the 82nd, says an industry official.

No direct evidence of T-50 production subsidies is apparent, although government funding in the South Korean aerospace industry is murky. The industry ministry paid for an upgrade to the KAI KT-1 propeller trainer so the type could be sold to Turkey and Peru.

According to Cho, South Korea's ability to move into defense export markets is based on its large domestic demand, because it faces North Korea, and its ability to produce near-high-end equipment.

That has been most obvious in the ground systems market, which not only presented lower technical challenges than warships and aircraft but is built on South Korea's need for large

Branching Out

India is slowly building its export capacity

Bindiya Thomas **Bangalore, India**

After becoming known as the world's most aggressive importer of weapons, India is slowly building its ability to export indigenously developed weapons systems to its Asian neighbors. Although the move to exports has been national policy for some time, Prime Minister Narendra Modi is giving the push additional steam, even drawing the attention of Chinese security analysts.

In 2014, India agreed to supply four offshore patrol vessels and possibly the BrahMos missile to Vietnam as part of a \$100 million line of credit for military goods offered by New Delhi. India is also interested in selling indigenously developed hull-mounted sonars to three or four friendly nations of which Vietnam is one. India has sold its Barakuda warship to Mauritius, and plans to export two more to Sri Lanka.

Avinash Chander, the head of the Defense Research and Development Organization (DRDO), has said that India has a "list of equipment," including long-range missiles and the domestically developed Tejas light fighter, that could be "sold as exports in direct competition with countries like China."

Chander is promoting the idea that India could be a low-cost supplier of weapons. He has noted that strategic

missiles such as the long-range versions that China sells to Saudi Arabia could be produced at one-third or one-fourth the cost by India.

But the transition is moving slowly because long-standing collaborative export projects continue to inch forward. To build its export portfolio while simultaneously strengthening

Leaders here note that

India could produce long-range

missiles similar to those

China sells to Saudi Arabia, but much more cheaply

its air force fleet, India has teamed with Russia to develop the Multi-Role Transport Aircraft (MTA), worth approximately \$600 million.

The project, designed and developed by India's Hindustan Aeronautics Ltd. (HAL) and Russia's United Aircraft Corp. (UAC), will be suitable for military and civil operations, according to N.C. Agarwal, the chief executive officer of the joint venture company, Multirole Transport Aircraft Ltd. This too

has been proceeding at a glacial pace. The first test flight had been scheduled for 2014, but that has been pushed toward the end of 2017. The aircraft is scheduled to enter service in 2018.

According to the terms of the agreement, a total of 205 Ilyushin Il-214 aircraft will be manufactured; the Russian air force will order 100 and the Indian air force will take 45 (to replace aging Antonov An-32 aircraft). The remaining 60 will be offered for export.

"Considering the high export potential of the aircraft, its design ultimately meets the requirements not only of both Russian and Indian air forces

but of potential customers as well," UAC states on its website. "It is expected that in 2015-2020 a number of developing countries can consider the new transport aircraft as an alternative not only for An-12 and C-130 Hercules but to a smaller An-26. The strong advantage of the MTA in comparison

with its rivals is its relatively low price," the website description trumpets.

HAL will build the front fuselage, wings and avionics while partner Irkut Corp. will develop the aft and center fuselage sections.

According to UAC, the MTA can transport "a wide range of cargoes up to 12,000 kg [26,455 lb.] over a range of 4,700 km [2,920 mi.] and up to 20,000 kg over a range of 2,000 km around-

numbers of good quality tanks and self-propelled guns. Export growth there came sooner. And while naval and war-plane sales are still focused on Asia, Samsung Techwin last year received a \$300 million Polish order for 120 hulls for self-propelled guns.

Also last year, Daewoo Shipbuilding and Marine Engineering won an order for six corvettes from Malaysia, which has previously relied mostly on European shipbuilders.

A rising challenge for South Korean weapons development, and therefore exports, is the increasing cost of engineering. South Korean engineers are no longer inexpensive. But this is probably an inevitable problem: As a country advances economically and its technology improves, people are paid better.

And South Korea, unlike most Western countries, is training plenty of aerospace engineers—so many, according to Cho, that half of them cannot find aerospace jobs on graduation.

The military aeronautics subsector where South Korea has had the greatest industrial opportunity has been rotorcraft, because its armed forces have so many: 22 in the air force, 59 in the navy and 464 in the army. Assuming an average unit life of 25 years, the country needs to buy about 22 military helicopters a year, which could eventually be the basis for an independent domestic industry.

With that in mind, South Korea is aiming at two helicopter production lines that would fill the great majority of domestic demand. KAI's 8.7-metric-

ton (19,200-lb.) Surion entered service in 2013 as a battlefield utility aircraft and is adaptable to other uses. The same company has been chosen to build a helicopter of about 4.5 tons for armed reconnaissance and civil sales under the LCH-LAH program.

The industrial result of this domestic demand looks a good deal less than ideal, however. The Surion lacks civil certification, so its export market is limited to military and paramilitary functions. Moreover, it faces stiff competition from new and forthcoming aircraft from experienced manufacturers. And there is neither time nor money to build an all-new helicopter for LCH-LAH. Instead, KAI will build an adapted Airbus EC155 or AgustaWestland AW169. ☛

the-clock in any geographic areas and under any climate and meteorological conditions.”

The aircraft can carry up to 140 military personnel or 90 paratroopers and transport cargo and equipment. It will

also be capable of parachuting cargo and equipment.

The MTA will be capable of airlifting up to 80% of all existing weapons and military equipment.

This capacity is mainly determined by three key features: the MTA's design dimensions, its cargo department's size and volume, and its power plant. The size of the MTA's airtight cargo compartment's cross section is identical to that

of the heavy Ilyushin Il-76MD military transport aircraft, according to UAC.

The high thrust-to-weight ratio ensures the MTA's operability from airfields in high mountains (i.e., an altitude of up to 3,300 meters above the sea-level) both from paved and unpaved runways (capable to sustain pressure up to 8 kg/cm² (114 psi), which allows its operations on more than 90% of the Russian airfields). ☛

The first flight of the Multi-Role Transport Aircraft is planned for 2017.



JINU RAGHAWAN

the first in the world!!

Wide field of view with flat surface

KomyMirror PAT.



Passenger Convenience



Shorten Aircraft Turns

Cost Savings !!



Saving Non Productive Hour



737BSI Stowage Bin

Komy Co., Ltd.

www.komy.com

Reaping Repairs

MRO decisions for the F-35 are a step forward for the controversial fighter program

Amy Butler **Washington**



LOCKHEED MARTIN PHOTOS

Within the next three years, six of the nine partner nations in the F-35 development program are scheduled to begin substantial maintenance, repair, overhaul and upgrade (MRO&U) work on the single-engine, stealthy fighter.

The Pentagon announced late last year that Australia, Italy, Japan, the Netherlands, Norway and Turkey were assigned work associated with heavy repair of airframes or engines for the fighters that will operate in or near those countries.

This is a major step forward for the controversial international fighter program that has lately battled to right itself after years of delays to in-service debuts and billions of dollars in development setbacks. It signals a path for financial return to these partner nations investing in the program as well as progress in its maturity. However, much work must be done to meet the 2018 date for early MRO&U operations in Italy, Turkey, Japan and Australia.

Italy will be the primary location for heavy airframe maintenance for F-35s operating in and around Europe. Turkey will initially handle heavy engine maintenance there for the Pratt & Whitney F135. Both countries are

Italy plans to roll its first F-35A assembled in Cameri, Italy, off the line by March.

expected to stand up operations by 2018. Norway and the Netherlands will provide additional heavy engine MRO capability by 2021, and the U.K. will be the site of heavy airframe maintenance should additional capacity be required for fighters in the region, says U.S. Air Force Lt. Gen. Christopher Bogdan, F-35 program executive officer.

The Pentagon unveiled the assignments for Europe Dec. 11 and those for the Pacific region a week later.

As expected, Japan and Australia were assigned MRO&U work for the airframe and engines for the F-35s operating in the Pacific region; the two will split the work between jets operating in the North and South Pacific.

The only other current Pacific region customer is South Korea; it would be unusual for Seoul to have its aircraft maintained in Japan. It is unclear whether South Korea will rely on Australia.

The great distance to transit jets there played a unique role in the Pacific decision. Airframe work for both countries will begin in 2018, and heavy work

on the F135 engine will start in Australia no later than 2018, with Japan's engine capacity standing up within five years, Bogdan says.

Italy and Japan won the airframe work largely due to indigenous spending for specialized facilities to host it. Without providing details, Bogdan acknowledges that not all proposals were accepted, so there were, in effect, some losers.

The work assignments were based on data provided by F-35 partners on their indigenous companies and capabilities as well as practical regional considerations, such as forward-basing, aircraft-phasing and transportation. The decisions will be reassessed in five years. The choices are not exclusive. Should additional work be required, partners and Foreign Military Sales customers can vie for tasks as the fleet grows.

Bogdan says more assignments for supply warehousing, component work and maintenance of the support equipment are expected next year. "There is much work still to be had on the F-35 global sustainment posture," he told reporters last month.

The repair centers are likely to be a boon for local industries in these areas, but countries offering to do the work had to ensure it would not add cost to the program, which could include more than 3,000 fighters operating globally for more than 50 years. Italian defense officials estimate the airframe repair facility alone will generate \$18.6 billion in MRO work for industry there in the decades to come.

Bogdan says Italy should expect to receive at least \$35 million worth of work through 2022. Each country providing maintenance facilities is guaranteed work commensurate with the jets it is purchasing in the program. Assignments to nations above the baseline amount will be decided based on a "best-value" approach, Bogdan says, noting that repair centers could eventually compete for work.

This workshare for Italy is about 150,000 hr., or 40-50 airframes inducted in 2018-22, he says.

Thus far, indigenous spending appears to be a discriminator. Italy has spent about \$1 billion for its final assembly and checkout (FACO) plant at Cameri AB in the north of the country; the preponderance of the funding came from the government. Japan's spending has not been disclosed for

Alenia employees use an EMAS station that replicates those used at the primary assembly site in Fort Worth to mate F-35 structures at Cameri.

its FACO in Nagoya in the center of the island chain.

The foreign facilities include the same electronic mating and assembly (EMAS) tooling—only in fewer numbers—used by prime contractor Lockheed Martin at its final assembly plant in Fort Worth, and they were designed with maintenance work in mind. Four EMAS stations are at the Cameri site, but the facility includes 11 workstations, at least five of which are initially configured for MRO work.

The first Italian-assembled F-35A is slated to roll off the Cameri assembly line by March.

Much of the work in Italy will be managed by Alenia, which is owned by Finmeccanica, a company lately embroiled in controversy. Company CEO Mauro Moretti says the work will have “significant technological content and will generate sizable economic and occupational returns.” He sees the work as part of a larger strategy as the company works to overcome a severe dip in stock value in the wake of corruption probes that landed Moretti’s predecessor, Giuseppe Orsi, in jail in 2013. “Today’s acknowledgment is the result of an effective strategy at the national level. It stands out as a key factor in the path to relaunching the group with a focus on enhancing its core business areas of excellence,” Moretti says.

Work on the Japanese FACO in Nagoya began last May, and the first major subcomponents are slated to be loaded into the EMAS tooling there in December 2015. The first Japanese-assembled F-35A is slated to roll out of the facility in 2017.

Design of the Nagoya site was driven by the constraints of its location in a densely developed area. A small physical footprint forced planners to design a “vertical” FACO, Bogdan says, noting that it will incorporate elevators to move aircraft among various floors for different workstations. Tokyo’s first four jets will be assembled in Fort Worth. Bogdan, who visited Nagoya about six months ago, says he is “amazed” at the pace of work to build the facility up there. He provided no economic impact data for Japan.



Turkey was not a surprise choice for the engine work in Europe. F135 manufacturer Pratt & Whitney has agreed with the Turkish military to build an engine facility there, and the company has arrangements with local companies to build parts for the propulsion system.

Norway’s state-owned AIM Norway will oversee its work eventually.

The three engine facilities in Europe—in Turkey, Norway and the Netherlands—were selected because the program required at least three separate engine test cells to service the number of fighters expected to operate in the region. No single country was able to spend millions of dollars to house multiple test cells, driving the partners to establish multiple plants.

The Pentagon plans to use these facilities around the globe for repair of its aircraft to avoid having to transit fighters to and from the continental U.S.

Meanwhile, the U.S. is planning for F-35A and C repair at Hill AFB, Utah; the Marines’ F-35Bs will be overhauled at MCAS Cherry Point, North Carolina.

As the maintenance footprint for the F-35 takes shape, the Pentagon also announced late last year that Lockheed Martin’s F-35 facility in Fort Worth in 2014 met its goal of delivering 36 F-35s—the most in a single year. This batch included the first Marine Corps F-35C as well as six other Cs for the U.S. Navy, four F-35Bs for the Marines and 25 F-35As (including the first two for Australia). ☒

Staying Alive

Germany may revive Euro Hawk program with U.S. Navy’s Triton

Angus Batey **London**

Germany may turn to the U.S. Navy’s Northrop Grumman MQ-4C Triton to resurrect its Euro Hawk program and claw back some of the nearly €600 million (\$750 million) invested in the project. The May 2013 cancellation resulted from concerns about the system’s ability to satisfy airworthiness regulations necessary to permit flight in civil airspace.

However, another Northrop Grumman Global Hawk derivative—the U.S. Navy’s MQ-4C Triton—may enable

the German defense ministry to restart the airborne signals intelligence capability, filling a gap left since the German navy’s fleet of five Br.1150 Atlantique aircraft were retired in 2010.

According to Lt. Col. Roland Runge, the Luftwaffe’s unmanned air system (UAS) tactics and air reconnaissance branch head, and the former lead officer on Euro Hawk, a similar platform offers one of only two possible options to deploy the Euro Hawk’s sensor package. With investment in the pay-



Germany may adapt the U.S. Navy's MQ-4C Triton to conduct aerial surveillance.

load accounting for roughly half of the money spent so far, and an increasing need for ears in the sky to Germany's east, a compelling case is emerging to get the sensor in the air.

"Around €300 million has gone into the sensor, and it cannot be fully developed or improved without this thing flying," Runge told the Defense IQ UAS Training and Simulation conference in December.

The signals intelligence payload for Euro Hawk is split into two parts—electronic intelligence (elint) and communications intelligence (comint)—each placed in gondolas hung under the wings. This limits the options for a follow-on platform.

"Most civil aircraft have engines under the wings," Runge notes. "If you have the sensor gondolas next to the engines it creates lots of problems with reception, and you could create structural problems on board."

The Bundeswehr (German defense department) considered deploying the system on another unmanned platform—it also operates the Israel Aerospace Industries (IAI)-built Heron under a leasing agreement, and is due to transition to the larger Heron TP in 2015—but this option has been ruled out.

"We would have had to split the sensor load, but it is designed in a way that interacts," says Runge. "You cannot have a comint aircraft and an elint aircraft not communicating, and you would have to always have two airborne, [which is] very complicated."

The choice has narrowed, therefore,

to an unspecified business-jet platform or the Triton, which has been designed with civil certification in mind and carries subsystems to deal with icing and lightning-strike protection. It is this issue—certification of the safety of the airframe to fly over inhabited areas of Europe—that, Runge says, "broke the back of the Euro Hawk program." Specifically, he cites NATO's Standardization Agreement (Stanag) 4671, on airworthiness of unmanned aircraft, as the document that led to the program's cancellation.

"In 2007, when we closed the contract, there was no Stanag 4671," he says. "But it was in force in 2010 when we brought [Euro Hawk] over. This is what it was tested against, and obviously it was not up to the high standards that were required. We were already thinking about how to bring [lightning protection and anti-icing systems] into the program anyway, but the MQ-4C now is a somewhat complete package. We would recognize the [U.S.] Navy as an airworthiness authority that we could base our own airworthiness certificate on."

"A lot" of the initial cadre of 11 pilots were trained to fly Euro Hawk during courses at Beale AFB, California, Runge says, three of them to instructor-pilot level. Three will be transferred to

NATO's AGS (Alliance Ground Surveillance) program, another Global Hawk-based system; five are currently undergoing conversion to the Heron.

Germany's Heron program—initially envisioned as a short-term stopgap ahead of procurement of a planned European medium-altitude, long-endurance UAS—is "a success story, but there are some drawbacks connected with it," Runge says. "It's done missions of 96 hr.-plus, and right now it flies about as many hours per year as a full wing of tactical aircraft, so it is comparatively cheap."

The platform has flown over 20,000 hr. since it was deployed in March 2010. There have been some losses, which Runge ascribes in large part to issues around training, and the speed with which the system was deployed.

"We had 11 weeks training with IAI [in Israel], and after that there's no follow-on training," he says. "So you directly deploy into the area of operations, and at that time there's zero operational experience. It's easy to understand that this creates problems." ☒

NORTHROP GRUMMAN

Cleaner Rotors

Reducing emissions and noise are goals for European rotorcraft research program

Graham Warwick **Washington**

Airbus Helicopters has begun ground tests of a diesel-cycle piston engine in an EC120 light helicopter, with the goal of demonstrating a 30% reduction in specific fuel consumption over the existing turboshaft engine. Flight tests are planned for the second quarter of 2015.

Testing is being conducted under the High-Compression Engine (HCE) project within the European Clean Sky research program's Green Rotorcraft (GRC) integrated technology demonstration. The 330-kw (440-hp.) HIPE-AE440 engine has been developed by AustroEngine and TEOS.

Diesel-cycle engines are more fuel-

Ground tests of AustroEngine's diesel-cycle HIPE-AE440 in an EC120 begin this month at Airbus Helicopters in Marignane.

efficient than gas turbines and can burn the same kerosene jet fuel, but they are heavy and have previously been unable to achieve the power output required at a weight low enough for use in a light helicopter such as the EC120.

The HIPE-AE440 has been designed using technologies from the motor-racing sector. The core engine weighs 197 kg (434 lb.) dry and 249 kg as an installed powerpack, including cooling, clutch, harnesses and other ancillaries. This gives a weight-to-power ratio of 0.8 kg/kw.

"This is the first time a piston engine delivering 330 kw with a weight-to-power ratio of 0.8 is being developed. This was made possible thanks to proven car-racing technologies; otherwise it probably would have taken twice as long," says Sebastien Dubois, GRC project officer.

"Engines with the power range to replace the turbine did not exist with the mass required for the EC120, but there has been tremendous progress in automobile racing, particularly Le Mans," he says.

Started two years ago, the €9.3 million (\$11.4 million) HCE program was

planned to last 39 months. After some problems with parts breaking in preliminary testing, the project will now run for 42 months. Typically, developing a new engine takes around five years, says Dubois.

The HIPE-AE440 is a V8 with four valves per cylinder with common rail high-pressure fuel injection and two turbochargers with air-to-air intercooler. Its design combines Austro-Engines experience producing turbodiesels for aircraft with TEOS's race-car engine expertise.



CLEAN SKY JOINT UNDERTAKING

The project will enable direct comparison between the EC120 with turbine and diesel power. In addition to lower fuel consumption, reductions of 40% in carbon dioxide and 50% in nitrogen-oxides emissions are expected and up to 30% lower direct operating costs.

Ground tests are being performed at Airbus Helicopters' Marignane plant in France. Some 15 hr. of flight testing is planned. This will take the high-compression engine to a technology readiness level (TRL) of 6—the objective for Clean Sky—ready to be used in product development.

Other Green Rotorcraft projects are entering the hardware demonstration phase, including separate efforts looking at actively controlled and passively optimized rotor blades and an electric tailrotor drive.

Under the active Gurney flap project led by AgustaWestland, model rotor testing is planned for the second quarter of 2015, followed by full-scale whirl-tower testing in the third quar-

ter and flight tests on an AW139 in the fourth quarter.

A small surface that deploys vertically upward from the trailing edge of the mid-blade section on the retreating side of the rotor, the Gurney flap increases lift on the retreating blade and reduces the power required to maintain forward speed.

Airbus Helicopters, meanwhile, is leading the passively optimized blade project, which promises power reductions of 5% in hover and 2% in cruise—and 4-5-db lower approach noise—through optimization of blade chord, twist and other features, such as anhedral.

Aerodynamic and acoustic design is to be finished in January, says Dubois, with manufacture of the blades to begin in the second half of 2015. Whirl-tower testing is planned for January 2016. Flight tests on an EC135 in the early summer of 2016

are not yet funded, but a decision will be taken in mid-2015, he says.

AgustaWestland is leading the electric tailrotor drive (Eletad) project, working with Bristol University in the U.K. The project is developing a high-power-density electric motor with high integrity and reliability. The first prototype motor and an alternative solution have been delivered for evaluation.

The drive motor and control algorithm will run on a tailrotor test stand in 2015-16. The motor will be integrated into a helicopter tailboom and drive a complete AW139 tailrotor. System power will come from aircraft air-cooled electrical generators to provide a fully integrated system.

The rig will evaluate system dynamic operation while powering the rotor through mission-representative tail load cycles. "We will completely simulate the working conditions of the tailrotor with a complete system inside a tail. The objective is TRL 5 through ground test," says Dubois. ☛

Shortlisted

European manufacturers are lined up for South Korea's LCH-LAH

Bradley Perrett **Sidney**



AIRBUS HELICOPTERS

The U.S. may underwrite the security of South Korea, but European manufacturers have put up the most persuasive offers for the country's next battlefield utility helicopter and civil derivative.

Korea Aerospace Industries (KAI) has shortlisted Airbus Helicopters and AgustaWestland for the LCH-LAH (Light Civil Helicopter and the Light Armed Helicopter) civil and military rotorcraft program, for which production is planned for at least 200 units for the army alone. KAI, the intended prime contractor, may select between the two of them as early as the first quarter of 2015, but the choice will need approval from the defense ministry.

The candidate base designs are the Airbus EC155 B1 and the AgustaWestland AW169. KAI has been in intensive negotiations with the two European companies, says a South Korean industry official, confirming their selection.

Sikorsky appears to have failed in offering the S-76—though the U.S. company remains interested in the program—while Bell, after suggesting it might bid, seems not to have done so. KAI declines to confirm that Sikorsky was the rejected third bidder. Airbus stands a chance of winning both of Northeast Asia's main utility helicopter programs, since it also is bidding for the Japanese army's UH-X requirement.

KAI is faced with a choice between the modernity and probable economy of the AW169, which AgustaWestland is still flight-testing, and the larger industrial and engineering development opportunities of the EC155, which was certified in 1998 and is based on the Dauphin of the 1970s.

Airbus is also better placed to give commercial aircraft production work to KAI to offset the value of the parts that South Korea imports, not to mention its reported offer to cease building the EC155 in France. Although AgustaWestland parent Finmeccanica may be able to let a contract for parts for the ATR 72 turboprop, KAI does not see much production work in the AgustaWestland offer, says an industry official.

The LCH-LAH program appears to be making slow progress, according to another industry official, who believes

that KAI is distracted by the much larger (and seemingly interminable) proposal to build the KF-X indigenous fighter.

The Ministry of Trade, Industry and Energy (Motie) is overseeing the export-oriented civil side of the program, focusing on the business plan, while the defense ministry's acquisition office, the Defense Acquisition Program Agency (DAPA), has control over the army's version.

The army requires at least 200 helicopters of this type.

The government has specified a gross weight of about 4.5 metric tons (10,000 lb.), though the EC155 weighs 4.9 tons.

Three foreign companies proposed base designs for the technology develop-

In the LCH-LAH program, Airbus is reportedly offering to shift EC155 production to South Korea.

ment phase; KAI has now narrowed the selection to AgustaWestland and Airbus. Sikorsky still expresses interest, saying LCH-LAH is an ambitious program "that would benefit from the proven capabilities of our S-76 helicopter platform." Bell says it is not participating. From the two U.S.

companies' statements, it appears Bell was the one that decided not to bid. It had considered proposing a new helicopter using the drivetrain and rotor system of the Bell 430, which is out of production.

South Korea has adopted peculiar bidding arrangements for this program. KAI and Korean Airlines were required to compete for the prime contract, offering a price for development, before receiving proposals from the foreign partners—proposals that would affect the cost of development. Only after it was selected as the preferred prime contractor could KAI invite those proposals. Choosing the one that involves the least development cost should now be in its interest, but the choice also needs approval from DAPA, which, conceivably, may prefer the more costly proposal.

The AW169 should be the least expensive, since, as a new helicopter, it should need little or no improvement for its civil version.

KAI plans to choose a foreign partner in the first half of 2015, says the South Korean industry official, adding that the company "is in technical negotiation with DAPA for the LAH contract, while maintaining close communication with Motie for the LCH agreement." Airbus is expecting the final selection to be made in the first quarter, says a spokeswoman for that company, declining to comment further.

The European company is in the unusual position of having two products to offer for two quite similar requirements—and to two customers that are next to each other geographically but do not get along well. While Airbus proposes the EC155 to South Korea, it is urging Japan to choose the forthcoming X4 helicopter for that country's army UH-X program.

Proposing the more advanced product to Japan will ruffle feathers in South Korea, but Airbus should have several strong reasons to offer the EC155 to KAI and DAPA for that decision: the X4 is probably much too big for the South Korean requirement; it probably cannot be available in a military version soon enough for the army's demanding schedule; and the EC155, unlike the X4, can be transferred to South Korea for sole-source production. ☛

X4 on Offer

Japan may help build Airbus's next helicopter

Bradley Perrett **Sydney**

Airbus is urging Japan to base its next army utility helicopter on the X4, an advanced rotorcraft that the European manufacturer is developing for the civil market. If the offer is accepted, the army UH-X program could be a breakthrough in Japan's process of entering into the global arms market, since the military X4 would become a partly Japanese product offered for international sale.

Because Japan is now willing to consider arms exports, Airbus Helicopters and long-time partner Kawasaki Heavy Industries (KHI) do not have to consider the old, inefficient Japanese industrial practice of complete or near-complete license production of foreign aircraft at extremely slow rates. Instead, they have discussed the possibility of the Japanese company building the drive train and rotor for all X4s, says an industry official who is closely watching progress in the program.

Joint production would fulfill the Japanese defense ministry's hopes that the army UH-X would support a civil export program. Conceivably, KHI could also handle final assembly of X4s for the Asian civil market, especially since the company would probably need an assembly line for those delivered to the Japanese army.

The ministry intends to order about 150 army UH-X helicopters over 20 years. An unrelated Japanese navy helicopter program is also called UH-X.

A team comprising Bell and Fuji Heavy Industries (FHI) appears to be the other main contender for UH-X, probably offering a version of the Bell UH-1, such as the 412 or UH-1Y Viper. Sikorsky says its S-76D would suit the requirement, but industry officials say its only possible Japanese partner, Mitsubishi Heavy Industries, may not be interested.

Like Bell and Sikorsky, Airbus confirms its interest in the army UH-X program, but it does not name the aircraft it proposes as the basis for development. Its alternative offering was the EC155 but Airbus has proposed that helicopter for South Korea's similar LCH-LAH program.

The X4 could prove to be a risky choice for Japan, since the type is not even expected to fly until sometime this year. But it would also simplify the allocation of manufacturing work, because Airbus cannot have decided yet on the production set-up for the type. Also, at this early stage in the program there should still be opportunities to tailor the design to suit Japanese military requirements, although this could undermine civil competitiveness.

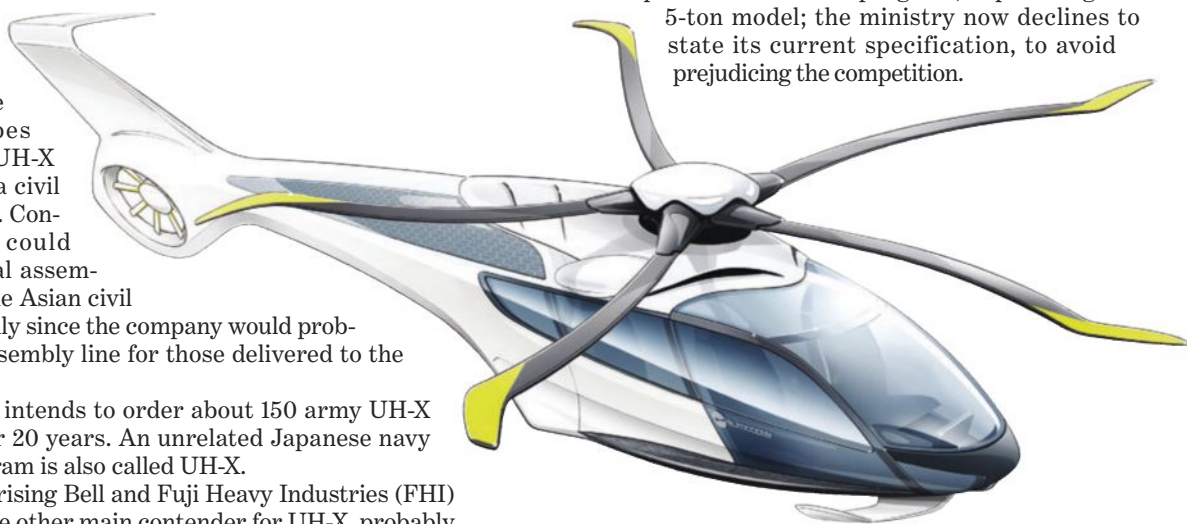
The Japanese army is worried that it will be forced to operate a basically civilian, and thus not battle-worthy, utility

helicopter, says an industry official. The UH-1Y, used by the U.S. Marine Corps, would not present that problem, although it could have a very small civil market. The X4, UH-1Y and Bell 412 would all meet Japan's requirement for two engines.

The defense ministry's development budget for the army UH-X, ¥23-26.3 billion (\$193-220 million), looks about right for developing a military version of the X4, say industry officials.

Armies sometimes need more powerful engines than civil operators do, because military versions of helicopters are fitted with more equipment, may have to carry heavier loads, and should have more maneuverability. But even substituting an engine with greater output than the X4's planned Turbomeca TM800 and Pratt & Whitney Canada PW210, both about 820 kw (1,100 hp), may be possible within the Japanese budget, says an industry official. But Airbus is aiming at an unusually efficient drive and rotor system for the X4, so the type may be able to cope with higher power loading than is usual, says the official.

The mass of the X4 is unknown. Airbus refers to it as a successor to the AS365, which has a gross weight of just 4.3 metric tons in its current version, and the EC155, of 4.9 tons. However, it is also meant to compete with the highly successful AgustaWestland AW139, which, with a normal maximum weight of 6.4 tons, is in quite a different class. In an earlier phase of the UH-X program, Japan sought a 5-ton model; the ministry now declines to state its current specification, to avoid prejudicing the competition.



Details of the X4 are closely held. Airbus is proposing that KHI help build it.

The UH-1Y, able to fly at 8.4 tons, would be even further from Japan's requirement, but the Bell 412, a civil derivative of the UH-1, has a gross weight of 5.4 tons. FHI built the UH-1Hs and UH-1Js that Japan is seeking to replace, which enhances the industrial appeal of Bell's offering.

Indicating the power requirements for a modern battlefield utility helicopter in this class, the British Army's AgustaWestland AW159 Wildcat, of 6 tons gross weight, has two CTS800 engines, each with a maximum continuous output of 955 kw, from LHTEC, a joint venture between Rolls-Royce and Honeywell. Its power loading is therefore 3.1 kg per kw.

The ministry hopes to launch UH-X development by March 2016. Bidders are awaiting a request for proposals, but the ministry may first issue a request for comment to the industry, seeking guidance on how it should proceed. ☐

Revenue Boost

Arianespace tallies 12 launches in 2014, predicts same this year

Amy Svitak **Paris**

European launch consortium Arianespace expects to post record revenues of €1.36 billion (\$1.62 billion) in 2014, a year in which the company lifted 23 spacecraft to orbit on 11 rockets and won half of the world's commercial launch business with signatures for nine new contracts.

Expected earnings make up for a disappointing turnover in 2013, when the Evry, France-based company reported a slight loss—just €989 million in annual revenue—after launching fewer satellites than forecast.

In 2014 the company launched six Ariane 5 heavy-lift rockets, four European Soyuzes and one Vega light launcher from its South American spaceport in Kourou, French Guiana. Arianespace also signed 14 launch contracts, including nine for geostationary satellites slated to ride in the upper and lower berths of the Ariane 5 ECA. In addition, two dedicated launches of European Galileo navigation spacecraft on the Ariane heavy-lifter were signed—bringing the total to three—along with two Soyuz missions and one Vega.

“For us, 2014 was a great year, one that really demonstrates our ability to deliver on our manifest,” Arianespace Chairman and Chief Executive Stephane Israel told reporters during an annual press briefing here. Israel said the company could have launched a 12th mission—Europe's Intermediate Experimental Vehicle (IXV)—in November, if the European Space Agency (ESA) and French space agency CNES had not postponed the mission in order to reevaluate its trajectory.

Now slated for Feb. 11, IXV marks the first of what Israel says will be at least 11 launches for the company in 2015, more than half of which will be for European institutions and governments.

In addition to IXV, these include the Sical 2 military communications satellite owned by the French and Italian governments; the European Meteorological Satellite organization's MSG-4; the European Space Agency's Lisa Pathfinder astronomy mission and Sentinel-2A Earth-observation spacecraft; and a still-to-be-determined number of Galileo navigation satellites for the European Commission (EC).

Arianespace says the EC has until the end of January to decide whether to launch the Galileo satellites in pairs on two Europeanized Soyuz rockets in the first half of this year, or wait to lift all four using a new dispenser being qualified for the Ariane 5 by prime contractor Airbus Defense and Space.

In addition to European government missions, Arianespace plans to lift a dozen commercial communications satellites to geosynchronous orbit (GTO) this year, including spacecraft for DirecTV, Intelsat, Star One Arabsat, Eutelsat, the Indian Space Research Organization and NBN Co. of Australia.

The company boasts a backlog of 29 customers and 38 launches worth more than €4.1 billion over the next three years. A total of 22 Ariane 5s have been booked to lift 35 satellites to GTO across 18 launches. Another four are dedicated Ariane 5 missions. Arianespace also has six Soyuz and nine Vega launches in the pipeline, with a total of 58 rockets on order to cover anticipated business to 2019.

Israel said he expects 2015 to be a busy year for booking new orders. By his count, a total of 28 commercial satellites were ordered last year, only 18 of which have booked launchers.

“That leaves 10 coming on the market,” he said, in addition to new satellite orders expected in 2015.

Israel said that not long ago small satellites were the focus of future business as the company struggled to fill its lower berth position on the Ariane 5 ECA. However, “we predicted a lot

Forging Ahead

Bid-protest loss will not stop Dream Chaser, Sierra Nevada says

Frank Morring, Jr. **Washington**

Sierra Nevada Corp. (SNC) says it “plans to further the development and testing of the Dream Chaser and is making significant progress in its vehicle design and test program,” despite its failure to overturn NASA's selection of its two competitors—Boeing and SpaceX—in bidding for NASA's planned commercial crew vehicles.

The Louisville, Colorado-based company says it plans to propose the reusable lifting-body vehicle for the second-round NASA competition to deliver cargo to the International Space Station (ISS), and will continue to develop domestic and international partnerships to further the development without federal funding.

“SNC remains fully committed to being a part of returning [U.S.] world-class human spaceflight and enhanced cargo capabilities to low Earth orbit,” the company stated Jan. 5 after Government Accountability Office (GAO) attorneys rejected its bid protest in NASA's Commercial Crew Transportation Capability (CCtCap) decision.

SNC had argued that NASA overemphasized the development schedule in its selection of the Boeing and SpaceX capsules for the flight phase of its public-private commercial crew vehicle development, but GAO allowed the selection to stand.

Lifting-body development of the Dream Chaser will continue without NASA funding.



NASA

of small satellite orders in 2014 and adjusted our pricing accordingly," he said.

At the beginning of 2014, the company's order book was dominated by large satellites; by year-end it was 55% large and 45% small spacecraft. Of the three large satellites ordered in 2014, Arianespace bid on—and won—just one. The company declined to bid on the others due to a lack of launch vehicle availability in the customers' specified timeframes.

Israel says in recent months Arianespace has been buoyed by a strengthening dollar, and the fact that technical troubles have sidelined two of its key competitors—ILS Proton and Sea Launch—over the past year. As a result, the company has reduced prices for launching commercial satellites in the lower berth of Ariane 5, while charging more for larger spacecraft that ride in the top position under the rocket's fairing.

Internally, Israel said Arianespace anticipates new cost efficiencies this year with the introduction of additional payload volume under the Ariane 5 fairing and a new refueling facility in Kourou that will provide more flexibility for the Soyuz and Vega launch campaigns.

However, the company still relies on annual subsidies from ESA member governments that amount to roughly €100 million per year, and Israel said 2015 and 2016 will see the company benefit from a total of €210 million in ESA price supports.



Airbus Defense and Space expects to qualify a new Ariane 5 payload dispenser this year that can orbit four Galileo navigation satellites simultaneously.

More long-term, ESA member governments have agreed to invest €8 billion in new launch vehicle developments to keep Arianespace competitive against emerging rivals in the U.S., China, Russia and India. Approved at ESA's ministerial meeting in Luxembourg last month, the modular successor to the Ariane 5—known as Ariane 6—is designed to match government requirements for continued autonomous space access while meeting future needs of the commercial market.

Meanwhile, the company awaits details of a merger between the space units of Airbus Defense and Space and France's Safran, a joint venture set up to oversee Ariane 6 development while reorganizing Europe's sclerotic launch vehicle industrial base. Israel said it remains to be seen where Arianespace will fit into this new company, dubbed Airbus Safran Launchers, though he said in the near-term the merger will facilitate a 5% reduction in Ariane 5 and Vega

costs before the more affordable Ariane 6 and Vega C come online later this decade.

Addressing concerns over potential job cuts, Israel said Arianespace plans to add five new posts in Kourou. However, he said the greatest threat to jobs is stagnation, not change.

"Ariane 6 is good for Arianespace, and with the merger of Airbus and Safran, there will be more career opportunities in both companies," he said. ☼

"GAO disagreed with Sierra Nevada's arguments about NASA's evaluation, and found no undue emphasis on NASA's consideration of each offerer's proposed schedule, and likelihood to achieve crew transportation system certification not later than 2017," said Ralph O. White, managing associate general counsel for procurement law at GAO, in announcing the watchdog agency's decision on the bid protest filed by Sierra Nevada. "GAO also noted that, contrary to Sierra Nevada's assertions, the [request for proposals] clearly advised offerers that their proposals would be evaluated against the goal of certification by the end of 2017."

Sierra Nevada had proposed the reusable lifting body as one of the two commercial crew vehicles NASA is helping industry develop as a post-space shuttle route to the ISS for its astronauts. The company says its vehicle's cost to NASA was \$900 million less than Boeing's figure, and argued that NASA changed its evaluation criteria to give more weight to the schedule for getting to first flight than to the cost the U.S. space agency must pay.

In his statement, GAO's White cites prices of \$3.01 billion for Boeing, \$2.55 billion for Sierra Nevada and \$1.75 billion for SpaceX. He also reveals that Sierra Nevada charged that NASA's review of "SpaceX's price and overall financial resources" was "inadequate," along with the agency's evaluation of mission suitability for the winning

vehicles and the winning companies' past performance.

"Based on our review of the issues, we concluded that these arguments were not supported by the evaluation record or by the terms of the solicitation," White says, adding that GAO would wait to release its decision document until the companies have a chance to suggest redactions to protect proprietary information.

"GAO expects to publish a public version of the decision as soon as possible; however, the release of a public decision may take a few weeks," he adds.

The prices White cites apparently do not reflect the per-flight cost the companies bid to deliver four-person crews to the ISS. In announcing the contract award last fall, NASA said Boeing's contract would be worth as much as \$4.2 billion, and SpaceX would receive as much as \$2.6 billion for flight test and up to six crew-transport missions each. After SNC's protest failed, the space agency said only that it had been notified of the GAO decision and was "pleased" that work on the commercial-crew development effort can continue.

Late last year, the agency released funds to Boeing and SpaceX to continue the development work, but citing the protest, it has declined to say exactly how much each received. "The case remains under the protective order and blackout until the GAO releases its decision," the agency says. ☼

The Lone Ranger



Air Astana intends to continue implementing its extended home-market strategy, though growth will slow

Cathy Buyck Almaty, Kazakhstan

Air Astana has carved out a unique niche as Central Asia's leading airline, but the deceleration of Kazakhstan's oil-fueled economic boom, the devaluation of the country's currency and the lack of modern airport infrastructure might impede its future growth.

The airline had planned a 14% capacity hike measured in available seat kilometers (ASK) for 2014, in line with prior years, but the devaluation of the Kazakhstani tenge prompted the carrier to review its plans. The tenge, which is pegged to an amalgam of the U.S. dollar, the euro and the Russian ruble, was devalued by 19% last February. Up to 65% of Air Astana's revenues are in tenge; 65% of its expenses are in U.S. dollars.

"About \$48 million was wiped off our balance sheet in less than an hour," sighs Air Astana President/CEO Peter Foster. "We were worried that the plunge in value of the tenge would result in a drop in demand, so we took immediate action." By the end of February, management had put a cost-savings plan in place and had started adjusting its network. Several routes were suspended, frequencies were reduced, some services were downgraded to smaller aircraft and plans to increase capacity on routes to Russia were put on hold. Unit cost was reduced by 8% over 2013's.

The capacity decrease resulted

in a reduction of fleet utilization. To compensate, Air Astana initiated a seasonal charter program to Rhodes and Heraklion in Greece as well as to Barcelona. "I'm not sure whether we will do it again, but it offered revenue opportunities for unused metal," says Richard Ledger, vice president for worldwide sales.

Air Astana was able to start operations to additional European destinations after the European Union (EU) eased restrictions to expand flights into the EU in April 2014. The airline is still banned from operating Embraer E-190 jets to airports in the 28-nation bloc, even though its E-jets are deployed only on its regional network.

Air Astana operates a Western-built fleet with an average age of 5.8 years and has repeatedly passed the International Air Transport Association's International Safety Audit.

The fleet consists of 30 aircraft: three factory-new Boeing 767-300ERs, five Boeing 757s, 13 Airbus A320-family aircraft and nine Embraer 190s. In December, the carrier took delivery of its first two new 767-300ERs, which were ordered together with three Boeing 787-8s in 2012. A third new 767-300ER arrived last July. As part of its revised business plan, Air Astana has postponed introducing its first two 787s until 2019.

It will decide on a new narrowbody order in 2015. The carrier will pur-

chase 11 A321neos or Boeing 737 MAX-9s, in part to replace its five 757-200s and older A320s and also to support growth. Like other 757 operators, Air Astana faces some hard choices in replacing its 757 fleet. Boeing has no concrete plan for an upgraded 757, and the A321neo and 737 MAX-9 do not of-

Air Astana's deploys its Embraer E-190s on regional routes in a two-class configuration; it has nine business-class seats.

fer the same unique payload/range capabilities as the 757-200. However, Airbus's proposed A321neoLR with a maximum takeoff weight (MTOW) of 97 metric tons and extra fuel tanks "is right up our alley," Foster says. "If we can get the aircraft, we can reach all of Europe from our hub in Astana, most of Southeast Asia from our Almaty hub and the whole of China from both Astana and Almaty," he says. Airbus notes that if the type is launched, it would not enter service until 2019, whereas leases for two of Air Astana's 757s end in 2017. Leases for the other three expire in 2019.

A potential solution would be to extend the leases of all 757s until 2019, Foster indicates. The average age of Air Astana's 757 fleet is 17.5 years; the interiors recently have been refurbished, including 16 angle-flat seats in the business-class cabin. Next year, the carrier will take delivery of its 10th E-190 jet and a new A320 that is replacing an older A320.

Air Astana operates its whole fleet in a two-class configuration, and Foster vows the airline will not evolve toward a hybrid model and "never ever" implement a zero-service model, despite the emergence on the Kazakh market of low-cost carriers (LCC) such as Air Arabia, which connects Sharjah (UAE) International Airport with Kazakhstan's Almaty International, and Flydubai, which serves Almaty and Shymkent International in the southern part of Kazakhstan from Dubai. Full-fare business-class traffic is "very substantial" and load factor is 75% in business class compared to an average overall load factor of 64%, Foster says. "We have never been a load-factor-driven airline."

The flag carrier, which launched in 2002 as a joint venture between Kazakhstan's sovereign wealth fund Samruk-Kazyna (51%) and BAE Systems

(49%), has posted annual profits every year since 2004; it expects the same for 2014. "Our operating profit will be by far the best we ever returned. However, our net profit will be down. Without the devaluation, reaching a \$100 million net profit for 2014 would have been possible," asserts Foster, who was appointed CEO in 2005.

Although Foster notes that the risk of further devaluation looms, he is adamant that the airline will not ask for state aid in case the tenge devalues further. "We would rather die before asking to get subsidized," he avers.

Revenues for 2014 are expected to be down 2% compared with 2013, while passenger numbers should be up 8% to 4 million on a 2% increase in ASKs.

Air Astana has posted a strong 13% compound annual growth rate in recent years, and passenger count rose to 3.7 million in 2013 from 1.5 million in 2006. Growth rate measured in seat capacity, passengers and revenue is slated to slow to 7% for the next five years. "We have expanded quite rapidly, so growth will slow a bit," says Foster, noting that growth will come mainly from extra frequencies on existing markets. The airline operates, on average, 770 legs a weeks on a network spanning 59 routes and 38 destinations in 18 countries in Asia, Central Asia/Commonwealth of Independent States/Caucasus, Europe and the Middle East in the current winter schedule.

About 55% of its operations are out of its historic base at Almaty Airport and 45% are from Astana, compared to a 75/25% ratio 10 years ago. A potential handicap for growing Almaty as a hub is the lack of modern infrastructure; its "transfer facilities are wholly inadequate," Foster contends. Airport

expansion plans have been delayed for years and there is no solution in sight.

In contrast, Astana International is planning to expand its passenger capacity and build an additional three air bridges as well as a fully automated baggage handling system for transfer traffic.

To increase load factor and become less dependent on local demand—which could contract as the country's gross-domestic-product growth rate slows further—Air Astana has been increasing network traffic. Connecting and sixth-freedom-rights traffic now accounts for 13% of the airline's total business, says Ledger. Most of the transfer traffic is on regional-to-regional and regional-to-intercontinental routes. "What we do not want to do is to get in the big mega-transfer business. Every single airline does that, and yields are very low," Foster notes.

The airline will continue to foster an "extended home-market strategy" that stretches to a 200-km (125-mi.) radius around Kazakhstan, to include Uzbekistan, Kyrgyzstan and Turkmenistan, Tajikistan and parts of Russia and China.

"A home market of 17 million people becomes a market of 60 million," explains Ledger. Its largest foreign market is Russia, where it serves seven destinations. Air Astana is looking to increase capacity on these seven cities but might also add new routes to cities with populations of 2-5 million. Kazakhstan was the last of the Soviet republics to declare independence following the dissolution of the Soviet Union in 1991, but relations with Russia are good, says Foster.

Kazakhstan is on an economic liberalization trajectory, so companies that are entirely or partially owned by the

state, such as Air Astana, must deliver a profit. "We have a clear mandate to be profitable, and we regard this as an unshakable mantra," Foster says.

The carrier still hopes to launch an initial public offering (IPO), Foster says. Initially, an IPO was pondered in 2012, but plans were deferred due to market conditions and internal issues at BAE Systems. Although BAE Systems no longer has a strategic interest in the country or the aerospace industry, the U.K. company is an effective board member, Foster notes. He points out that Air Astana is a "cash cow" for BAE Systems.

"They paid £5 million [\$7.8 million at the current exchange rate] for their stake, and we have been paying [them] dividends since 2006, about \$50 million. I would say Air Astana is not a bad investment," Foster adds.

Tokyo is among the new destinations being considered for 2016 via the carrier's 767-300ERs. Talks are ongoing with Japan's two leading carriers, All Nippon Airways and Japan Airlines. If all proceeds well, service with Boeing 757-200s will roll out three times weekly to Paris's Charles de Gaulle Airport starting on March 29, although there is an active dispute about the allocation of terminals.

Despite its ambitions, Air Astana views joining an alliance as too restrictive. The airline is more interested in forming route-specific joint ventures and is in talks with Etihad Airways on a full cost- and revenue-sharing arrangement covering the Astana-Abu Dhabi route, Foster confirms.

Air Astana is not a candidate to become a partner in Etihad's equity alliance, however, because "the agendas are extremely different, and we do not need their money," Foster says. ☐

Kazakhstan's flag carrier deploys a Western-built fleet across its entire network. The average age of its Boeing 767-300ERs is one year.



New Beginnings



Etiha Airways has big plans for eternally loss-making Alitalia

Cathy Buyck **Brussels**

At first glance, the tie-up of Alitalia and Etihad Airways seems like the perfect partnership. The multimillion-euro funding package, led by Abu Dhabi-based Etihad, saved Italy's long-suffering flag carrier from bankruptcy and gave Etihad increased access to the European Union (EU)—one of the world's largest and most affluent air travel markets, with a population of 507.5 million. Etihad must now prove it can restore its new equity alliance member to profitability, revitalize the brand and reinstate a service culture at Alitalia. Furthermore, Etihad must convince the European Commission (EC) it has no effective control over the Italian airline.

The EC approved the Etihad-Alitalia deal under the EU's merger and competition regulations in November 2014. However, the ownership and control investigation by the EC's directorate general of transport, DG Move, is still ongoing. For Italy's civil aviation authority ENAC, the new organization conforms to EU rules on ownership and effective control. ENAC last month concluded that, based on the documents submitted by Alitalia-Compagnia Aerea Italiana (CAI) and Etihad, the so-called "New" Alitalia will continue to be under Italian control because 51% of the capital remains in the hands of the Italian nationals. ENAC also stated "it finds no evidence that there are any agreements between the shareholders of Alitalia CAI and Etihad that may affect and influence the decisions to be taken by the New Alitalia."

The EC has received documentation from the Italian authorities and will assess whether reality matches the paperwork and whether control of Alitalia remains in the hands of Italian nationals now that the financial transaction is completed and the new company has begun operations. There is no set deadline for the EC's analysis and no time limit for the legal decision.

The "new" Alitalia—named Alitalia SAI-Società Aerea Italiana—began operating on Jan. 1.

A new airline board and management team has been named. Silvano Cassano became Alitalia's CEO, taking over after Gabriele del Torchio's resignation. Cassano is the former CEO of Benetton, an Italian clothing, manufacturing and retail group. He still has close ties to the Benetton family, which holds shares in Alitalia and Aeroporti di Roma, the management company for Rome Fiumicino and Ciampino airports. Cassano also worked at Hertz with Etihad Airways CEO James Hogan.

The new chairman is Luca Cordero Di Montezemolo, the former Ferrari chairman. Di Montezemolo was nominated to the board by Alitalia, and is closely connected to the ruling family of Abu Dhabi. Hoping to avoid protracted discussions

The "new" Alitalia will get a new livery, and its current long-haul fleet of Airbus A330s will expand as it adds intercontinental destinations.

with the EC regarding who effectively controls Alitalia and to deflect suspicions that the United Arab Emirates shareholder is in command, Etihad has carefully selected its representation on the board, appointing former Alitalia CEO and IATA Director General Giovanni Bisignani as one of its three board members.

Since its 2009 bailout and full privatization, Alitalia has posted losses of over €1.1 billion (\$1.3 billion). But Hogan is confident he can build the Italian airline "as a competitive, sustainable and profitable business that can operate successfully in the global air travel market." For Alitalia, Etihad is targeting "sustainable

profitability from 2017," he adds.

"We know we have much work to do, and we will move quickly," Cassano says. "We will develop a range of new destinations, new services and a fleet with more long-haul aircraft, a new livery and new refurbished aircraft interiors. And our customers, who from now on will be our guests, will be our inspiration," he vows. Staff also will have new uniforms.

As part of its new focus on long-haul destinations, Alitalia will resume service to China in the spring, and increase service to North America and Latin America. Services to Beijing, Shanghai, Seoul, San Francisco, Santiago and Mexico City are under consideration. In the current winter season, the Alitalia Group is operating 3,850 weekly flights to 83 destinations, 26 of which are in Italy.

Though declining oil prices and support from the Italian government may be a boon for the "new" Alitalia, the carrier must still contend with Europe's ongoing economic crisis and fears of a "triple-dip" recession due to deflation. Under the €1.76 billion rescue deal signed in August, Etihad is investing €560 million in Alitalia: €387.5 million for a 49% stake in the airline; €112.5 million for a 75% shareholding in Alitalia's loyalty program, MilleMiglia; and €60 million to buy five slot-pairs at London Heathrow Airport to be leased back to the Italian carrier. The remaining 51% shareholding is held by Alitalia CAI through holding company MidCo, which has assumed the agreed assets and liabilities necessary to continue the airline.

Etihad Airways' investment is complemented by a further equity investment of €300 million from several existing core Alitalia shareholders, including Intesa San Paolo (€88 million), Poste Italiane (€75 million), UniCredit (€63.5 million), Atlantia (€51 million), Immsi (€10 million), Pirelli (€10 million) and Gavio (€2.5 million). The Air France-KLM group, which became a core shareholder with a 25% stake during Alitalia's first rescue in January 2009, did not participate in the latest capital increases to save the troubled Italian airline.

Up to €598 million in additional financial restructuring of short- and medium-term debt has been provided by financial institutions and existing-bank shareholders. Another €300 million of new loan facilities have also been extended by Italian financial entities.

Alitalia is Etihad's seventh equity alliance member, and its fourth in Europe after Air Berlin (of which it holds 29%), Air Serbia (49%), and Aer Lingus (4.99%). Etihad has signed an agreement with Darwin Airline to purchase 33.3% of the Swiss regional airline, which was rebranded to Etihad Regional in January last year. Approval by Swiss authorities for Etihad's proposed investment is pending. ☼

Radar Diversity

Rockwell Collins tests radar as a runway-finder

John Croft Washington

Rockwell Collins is cautiously optimistic that its commercial aviation weather radar can map the physical environment around a runway. This capability could help boost pilots' situational awareness so they can independently verify a synthetic-vision landing aid for low-visibility operations.

In a series of flight tests in a company-owned Bombardier Challenger 601 business jet over the past two years, engineers have been able to verify that the radar—using modified software algorithms—can consistently detect reflective airport light structures, including approach lights and runway edge lights at airports in the Midwest, Northeast and Southern U.S. In terms of a visual image, the radar return infers the location of the runway by mapping the lighting systems that lead to—and outline—the runway surface.

The finding could help the company develop and certify a synthetic-vision guidance system (SVGS) that qualifies for FAA approval for lower landing minimums for instrument approaches, a key NextGen capability for increasing airport capacity without installing and maintaining new airport lighting and precision landing infrastructure. The modified MultiScan weather radar ideally will complement the company's head-up display-based synthetic-vision system that includes input from a new tri-band uncooled infrared enhanced vision system (EVS). The first certified application of the EVS-3000 sensor—which is being tested in parallel with the runway-seeking radar—is on Embraer's Legacy 500 business jet, which is also the launch platform for Rockwell Collins's new lightweight, compact HGS-3500 head-up guidance system. Embraer plans to certify the HGS-3500 with infrared cameras this year.

While the infrared sensor adds a real-time imaging capability to the static, database-derived synthetic vision scene, its visible, mid-wave and long-wave cameras can have limited forward visibility due to attenuation by the water content in rain or fog. Enhanced flight vision systems (EFVS)—which use cooled infrared sensors and head-up displays to boost performance in those conditions—can be used to gain landing “credit,” although at a steep cost: about \$500,000 per installation for the EVS alone. For Category-I instrument approaches, the credit allows a pilot to use the EFVS in lieu of natural vision down to 100-ft. above the ground, rather than the typical 200 ft.

Avionics manufacturers, however, are seeking a middle ground with SVGS, where a validated synthetic-vision representation might be used to gain a lesser amount of landing credit—down to 150 ft.—at least initially. Honeywell is actively pursuing one version using an independent database and other onboard precision guidance to validate synthetic vision. Rockwell Collins may opt to use weather radar, which at 10-GHz operating frequency, is not impeded by haze, rain, snow, fog or clouds, and may be an ideal synthetic vision verification tool. John Borghese, vice president of the Rockwell Collins Advanced Technology Center, says the company investigated 94-GHz millimeter-wave radar several years ago, but the price was too high and there were technical issues.

Engineers have overcome several hurdles, not the least of which was taking a weather radar built to “kick out” ground clutter and reconfiguring it to image the ground. Borghese says the system needed more accuracy in azimuth “to pick out” the reflective lead-in approach lights and runway edge lights. An air transport weather radar beam is generally about 4 deg. wide, and Borghese says that number had to be reduced by “close to an order of magnitude.”

Matt Carrico, senior engineering manager and fellow of advanced concepts at Rockwell Collins, says engineers have been studying the topic since the early 2000s. A key issue had to do with physics: The lower frequency (compared to infrared sensors) meant lower resolution of the image, but the trade-off was better weather penetrability. “We knew we’d have to come up with ways to enhance the resolution,” he says. “That has been the focus of the research.”

Carrico says the company is making “significant progress in getting enough resolution for the pilot or the automation to recognize the landing environment,” in terms of the reflective properties of the approach and runway lights. “We still have a decision to make as to what we do with image data we get back from the radar. Do we process it and, based on how the return looks, determine if there’s a runway environment in front to confirm synthetic vision, or do we further process and present

the image to the crew?” He says the pictures are “very compelling” so far, but engineers are not yet convinced “the image will look that good under all conditions.” He says there is also a latency associated with presenting the picture that “may not make it presentable.” Another issue Borghese is studying is whether the radar can both image the lights and look out for weather threats, particularly wind shear. Currently the system can do either one or the other.

Borghese says flight testing will wrap up by this fall, but there is no firm schedule to introduce the capability as a product. If a product does result, he says, it will likely come to the business aviation market first. ☐



Modified MultiScan weather radar that reveals approach light structures may be part of Rockwell Collins's low-visibility landing aids in the future.

Beyond NextGen

NASA builds tech ladder to ATM technologies post-2040

John Croft Mountain View, California

In 2040, air traffic controllers will “team” with their computer systems to safely and efficiently manage highly automated passenger aircraft that dynamically collaborate with the air traffic management system to optimize routing, capacity and fuel savings while maintaining safe separation.

That vision of an air traffic management future—along with many other advances—is soon to be tested in the laboratories of NASA’s Ames Research Center in Mountain View, California, where research is underway as part of the agency’s newly established Airspace Operations and Safety (AOS) program.

AOS is divided into three main projects created to address air traffic management (ATM)-related aspects of three “mega-drivers” that NASA believes will shape the future of aviation—the need for global mobility, environmental challenges and technology convergence.

For its part, the AOS is tackling the drivers through a series of ATM demonstration projects that individually address the issues in the near-term (next five years), the mid-term (2025-30) and the long-term (2040 and beyond). The projects often result in the delivery of algorithms or methodologies to the FAA to complement or evolve its en route, terminal and tower software platforms. NASA recently handed the FAA a software package that will provide terminal controllers with user-friendly tools that can help guide an aircraft on an energy-efficient idling approach from cruise altitude all the way to the runway. The software is set to become operational at a to-be-announced first airport in 2018. In other cases, the FAA may not be able to use the product, but NASA can license the intellectual property to industry-related entities. An agreement with Boeing allowed the company to deploy a speed and route advisory tool that it built into a subscription service that allows airlines to fly shorter routes and save fuel.

NASA’s vision of the future is based in part on its independent assessment of the FAA’s plans for the near- and mid-term, and how it can bundle or modify certain existing technologies to increase the holism of the system. In the long-term there are no such constraints, and that is where researchers expect that the role between controllers and their automation will fundamentally change. “We can see it coming on the horizon for controllers,” says research engineer, Tom Prevot, of automation that will be designed so humans will not have to second-guess the results. “If there is a system failure, you can’t throw the human back in the loop and expect him to figure it out,” says Prevot. “We see that as our charter, to look at how operators can safely interact with increasingly autonomous and more automated systems.” The long-term research will be part of AOS’s Safe Autonomous Systems Operations (SASO) program to explore post-NextGen technologies for implementation beyond 2030.

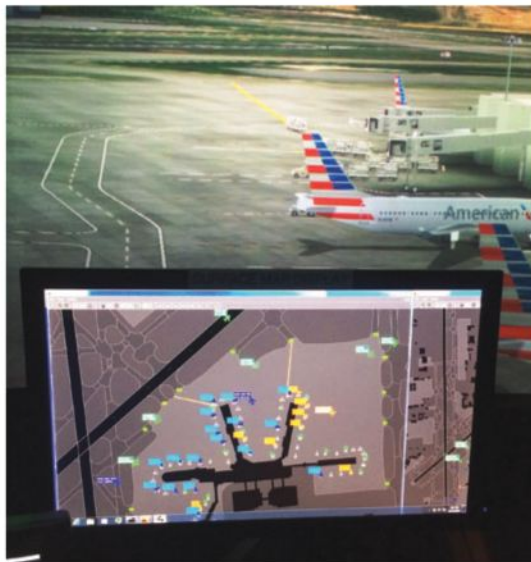
“Foundational” technology development to prevent misreading to reach that state, which NASA defines as the “ATM+3” package of integrated systems capabilities and generations, is in the planning stages. ATM+1, an ongoing program that demonstrates enhancements to the existing ATM system using

technologies already developed, will run through 2020; ATM+2, which aims to optimize the fully functioning NextGen system by extending existing methods while researching new technologies, is ramping up now and will run through 2030.

Prevot says some of NASA’s research shows that a “middle ground,” where automation augments a traditional design but the overall operation remains the same, is to be avoided, as it is the most complicated and dangerous. “It becomes so complex that you increase the risks and don’t get the benefits you are looking for,” he says. “I’m convinced at some point there will be a role change for [monitoring all aircraft and alerting]. As long as one person is watching all the aircraft, we won’t be able to add many more aircraft to that piece of sky.” From a human-factors standpoint, the goal will be to design an ATM system using a human-automation

“teaming” concept as a fully integrated operation. Researchers keep the National Air Traffic Controllers Association informed and involved in their work at an early stage, says John Robinson, Airspace Technology Development 1 (ATD-1) project chief engineer at NASA Ames. “As long as we don’t go crazy, they kind of trust us,” he says. “They know we are not going to cut their pay and just want to make the National Airspace System (NAS) operate better.” NASA uses a cadre of retired controllers for its ATM simulations.

That coordination is most critical for near-term projects that will be transferred over to the FAA to implement. As part of the ongoing ATD-1 simulations, NASA switches its retired controllers with active FAA controllers at certain times to verify a project “is going in the right direction,” says



American Airlines' ramp controllers at Charlotte (North Carolina) Douglas International Airport will begin operating a NASA-developed gate-to-runway tool, shown in a simulation, that minimizes takeoff waiting time.

JOHN CROFT/AMAST

Robinson. ATD-1, originally launched in 2011, explored technologies to increase the efficiency of arrivals, from just prior to top-of-descent down to the runway, using a suite of existing controller technologies, including traffic management advisor with terminal metering and controller-managed spacing tools. NASA will integrate those technologies and others, including the efficient descent advisor and dynamic weather routes, into a broader suite of controller tools to simulate over the next two years the holism of linking together the arrival, departure and surface operations tools into a combined scheduler as part of the ATD-2 project. Leighton Quon, the ATD project manager, says NASA will focus its efforts on certain key areas of the broader arrival-departure-surface domain. “We’re going to address some aspects that we think are sticking points up front,” he says. “The team is nailing down the details of what we’re going to do in the next five years.”

Individually, the component pieces of ATD-2 are already making a difference. TSS, which NASA Ames transferred to the FAA last year, is expected to save airlines \$200-400 million per year when rolled out at 35 major U.S. airports in 2018 and beyond. The tool gives terminal radar approach controllers a “slot marker” visual cue onscreen to keep aircraft centered on optimal descent profiles from cruise to the terminal area, with speed advisories to be radioed to the crew as opposed to the traditional fuel-inefficient method of vectoring. NASA Ames completed 20 high-fidelity human-in-the-loop simulations in the past 2.5-year, multi-week activities with dozens of pilots and controllers partici-

pating. Quon says NASA continues to work with the FAA “to further define requirements for implementation” to roll out the tools at the first radar facilities in 2018. “They’ve been very happy and categorically stated that these efforts will be an unprecedented contribution to NextGen technology,” says Quon.

Another likely component of the ATD-2 toolbox will be the Spot and Runway Departure Advisor (Sarda), a ramp control tool that manages the departure queue to predetermined levels by modeling all the activity at the airport. US Airways, now American Airlines, signed a Space Act Agreement with NASA in April 2013 to use the application at its Charlotte, North Carolina, hub where the carrier represents nearly 90% of the daily operations, in order to keep the runway queue size to a maximum of five or six aircraft to minimize idling time and passenger annoyance. Running on a set of four terminals in the ramp control tower, one for each departure sector (North, South, East and West), the application provides ramp controllers with a wait time in minutes when the pilot calls in asking for pushback to depart. The software takes input from the sequence of runways in use, taxi routes, arrivals and departures (in part to factor in taxi time when crossing

active runways) and other constraints to “come up with the best scenario and best schedule for every individual aircraft movement,” says Yoon Jung, technical lead for Airport Surface Research at NASA Ames. Jung says the team plans to install Sarda in the ramp control tower in July and run the system in “shadow mode” with the carrier’s existing ramp control software through September 2016.

Another possible addition to the integrated arrival departure scheduler is the en route descent advisor, a tool that gives controllers at air route traffic control centers strategic speed and course modification guidance to help pilots fly an optimal descent profile from the enroute segment to the terminal area boundary (about 50 nm from the airport).

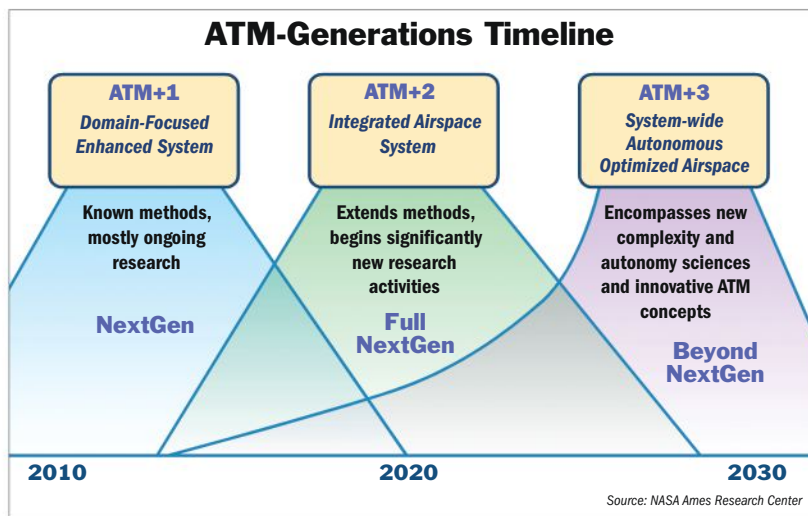
ATD-3 demonstrations will feature technologies to optimize the en route portion of a flight, a program that NASA is formulating in parallel with ATD-2. Quon says the idea is to remove barriers to domestic and ocean flight through “applied” traffic flow management that takes into account better weather planning and avoidance. “On the domestic side, many times [the barrier] is the weather,” says Quon. “How do you get an efficient route around that?” For oceanic routes in the North Atlantic, there is a need to optimize the track system

with wind-optimal user-preferred routing for best efficiencies. Included in the demonstrations will likely be an evolved version of NASA’s dynamic weather routes (DWR) program, which today can give airline dispatchers a proposed rerouting around weather to save time and fuel.

Dave McNally, a NASA ATM engineer, says American Airlines has been using DWR in trial

mode since July 2012 and has saved 3,200 min. of flight time by 520 aircraft over a 21-month period. The ground-based system computes new routes around weather every 12 sec., taking into consideration air traffic congestion, radar-track and flight-plan information and hourly weather updates from the National Oceanic and Atmospheric Administration. The software alerts American’s ATC desk coordinator with a “kaching” sound every time a new flight can save 5 min. or more flight time with a reroute. The desk coordinator sends the request to dispatchers who, if they accept the request, send the crew a message over the Aircraft Communications Addressing and Reporting System, better known as ACARS. The crew then has to ask ATC for the changes over the radio. McNally says NASA estimates that 40% of reroutes “accepted” by dispatchers will then get approval for course changes.

For ATD-3, McNally says, researchers would like to identify common routes around weather for groups of flights, an option the FAA could use to determine “playbook” routings around bad weather, and methods for using the software for merging and arrival metering, a process that is generally discontinued. ☐



Long-Distance Relationship

'Super dispatcher' fills in for a dozen first officers in NASA studies

John Croft Mountain View, California



NASA is advancing an airliner flight deck of the future that features one seat in the cockpit for a captain and one on the ground, occupied by an operator filling the role of either "super dispatcher" or first officer. The research, while rife with political and public ramifications that could far outweigh the technical challenges, is far less science fiction than it was three years ago.

At NASA's Ames Research Center, where researchers are unencumbered by present day mores, a third major study (SPO-3) since the research began in earnest in 2011 did not reveal any showstoppers. The project gained new momentum in May, when the center awarded a one-year contract to an industry team led by avionics and data link provider Rockwell Collins to further the concept.

Under the single-pilot understanding for distributed simulations program, the team will research the crew capacity, ground and flight deck resource management, physiological monitoring technologies and automation needed to make SPO viable, in addition to addressing technical, certification and policy issues that will

emerge. Rockwell Collins will also use its live, virtual and constructive technologies to enable distributed simulations of SPO, in which participants will use a mix of simulators—and potentially, in five years, live aircraft—in dispersed geographic regions to test a scenario. The company will also experiment with its voice input and synthesis technologies for the workstation.

The state of the art in SPO is a product of nearly 20 years of foundational research on distributed flight deck operations work begun in the mid-1990s with NASA's advanced air traffic management concepts for "Free Flight," a system that would allow airlines to choose their own flight paths. Research was directed at "human-centered, error-tolerant automation" to enable decision-making between pilots, controllers, and dispatchers for gate-to-gate planning.

Although Free Flight in the early 2000s evolved into the FAA's NextGen program, ideas developed in that era on how to better share workload between the air and the ground directly contributed to NASA's latest generation SPO concept of operations (conops), which 30 commercial airline flight crews eval-



Video See NASA researchers discuss the latest evolution of single-pilot operations conops—tap here in the digital edition or go to:

AviationWeek.com/NASASPO

uated during a one-month simulation at NASA Ames in July and August 2014.

In SPO-3, the conops revolved around a specialized two-position operator when sitting in the right seat fills the role of "super dispatcher" for as many as 12 single-pilot airliners in cruise flight. If one of the 12 aircraft enters an "off-nominal" state due to an issue or anomaly, the ground station operator moves to the left seat and becomes a ground-based first of-

NASA's SPO ground station includes a super dispatcher position on the right and a first officer position on the left.

ficer dedicated to that aircraft. NASA's Langley Research Center is focused on the airborne solutions for SPO. NASA decided to keep the ground station separate from air traffic control. "We conceived this as a way of supporting operations from the airlines' perspective," says Walt Johnson, research psychologist and lead for the flight deck display research laboratory at NASA Ames. "Everything that we are doing is trying to keep this as transparent and seamless to air traffic control as possible. It's a big challenge to try and add or change air traffic control roles."

Why 12 aircraft per super dispatcher? Johnson says researchers arrived at that number by visiting airline operations centers and talking to dispatchers, watching the number of aircraft they handle on a daily basis. An important part of the SPO-3 study was to find out "whether we should start out with pilots or whether we should start with dispatchers (for the ground operator) and what are the required skills," says Vernel Battiste, a senior research psychologist with San Jose State University working on the project. Pilots in the previous study, SPO-2, made their desires clear. "I need someone on dedicated support that has been where I've been, that can feel what I feel and know what the issues are," says Battiste of the pilots' input. "We decided to go with pilots initially and train them to be dispatchers." Battiste says the amount of dispatcher knowledge needed for the study was "relatively modest."



Attend the Airline Industry's Premier Awards Event!



ATW'S 41ST ANNUAL AIRLINE INDUSTRY ACHIEVEMENT AWARDS

Established in 1974 to recognize excellence in the air transport industry, the ATW Airline Industry Achievement Awards are the most coveted honor an airline or individual can receive.

They are bestowed upon individuals and organizations that have distinguished themselves through outstanding performance, innovation, and superior service.

**LEARN MORE AND RESERVE
YOUR PLACE NOW**
www.atwonline.com/awards

For single seats, tables, sponsorships and advertising sales contact Beth Wagner at beth.wagner@aviationweek.com or call +1.703.997.0261.

February 25, 2015
Omni Shoreham Hotel
Washington, DC

Categories include:

- Airline of the Year
- Airline Market Leader of the Year
- ATW Leadership Award
- Regional Airline of the Year
- Value Airline of the Year
- Eco-Airline of the Year
- Eco-Company of the Year
- Airport of the Year
- Aviation Technology Achievement

PLATINUM SPONSORS



Honeywell

SUPPORTING SPONSORS



Engine Alliance



Pratt & Whitney
A United Technologies Company



UATP



The NASA SPO ground station provides the connectivity, tools and situational awareness aids that allow the operator in the super dispatcher role to manage the same number of aircraft as today but with value-added functions during normal operations. By having an aircraft's flight plan, weather and other data feeds, the super dispatcher can use the workstation tools to suggest route changes to gain more favorable upper atmosphere winds or avoid turbulence, and send the suggestions directly to the aircraft in a format for direct insertion into the flight management system (FMS) upon the captain's concurrence.

A key element of the ground control station enabling the new functionality is the NASA-developed cockpit situation display (CSD), a multi-function screen that depicts aircraft positions, routes and hazards, including terrain, predictive weather, hazard advisory areas and traffic in 2-D or 3-D on the screen. The CSD also includes a "pulse predictor," light pulses along the routes of nearby aircraft that show the position of each going forward in time, an indicator of potential traffic conflicts on a new route the super dispatcher might be contemplating. The pulse predictor also shows the movement of weather to determine if a reroute will remain clear of storms.



JOHN CROFT/AM&ST

The NASA-developed Cockpit Situation Display provides a 3-D graphic of current and future weather, traffic and obstacles along an aircraft's route.

In addition to contingencies, the conops calls for a ground operator to take the first officer role during certain portions of a flight where teamwork is critical, including arrivals, departures and taxiing. Given the variety of local terrain, weather and airspace issues, NASA is also considering a "harbor pilot" ground controller who would take over from the super dispatcher at the top-of-descent point down to the gate.

In normal operations, the super

dispatcher is there to watch the operations and offer advice or help for the pilot. In a contingency, which has to be triggered by the captain, the super dispatcher transitions into dedicated support mode as a first officer in the left seat of the ground station; the pilot and first officer then conduct a briefing over an open microphone loop to assign duties, including who will fly the aircraft (the first officer flies via inputs to the autoflight system in the mode control panel representation in the ground control station). The super dispatcher can then brief the captain about information available in the ground station, including the most viable diversion choices given the environmental conditions and aircraft's physical state.

A new ground station capability introduced in SPO-3 is the emergency landing planner (ELP). Originally designed by the Intelligent Systems division at Ames as an emergency landing spot finder for an aircraft that had been damaged, ELP will recommend the best diversion airport given the weather and the conditions at the various candidate airports. "It's not going to land the aircraft for the pilot," says Johnson, "but it will optionally devise a flight plan for them and

Agents of Reuse

Airbus and Boeing repurpose and bundle existing ATM technologies to boost capacity and efficiency

John Croft Washington

Winning at technology does not always require developing new products or services from a clean sheet of paper. The air traffic management (ATM) arms of Airbus and Boeing have proven this by creating viable businesses by advising airlines and air navigation service providers on how to take existing products for the ground or the flight deck and repurpose or bundle the technologies for an end-product the operators are willing to buy for cost-saving, safety and environmental reasons. New or ongoing projects for the companies include performance-based navigation solutions, methods to reduce separation for arriving aircraft, real-time wind updates for more efficient operations and

parallel runway operations. The concept that more efficient ATM—typically the end product of the work—will help both aircraft makers with sales in the future, leads to products that work across aircraft platforms even as the companies compete for new business.

Airbus's ATM subsidiary, Airbus ProSky, recently launched a new program in partnership with the European Union to demonstrate better schedule predictability, efficiency and safety for operations at 10 vacation destinations in Europe by implementing performance-based navigation (PBN) technologies that are available but not in widespread use. The project, which will include more than 160 flight trials in visual conditions at 10 airports over a two-year period starting in mid-2015, is meant in part to demonstrate to European airlines and airports the benefits of equipping for PBN. Airbus ProSky has about 200 employees, about 75% of whom are located at the company's Metron Aviation division in the U.S., with the others primarily in the company's headquarters in Toulouse, near the parent company.

Under the RNP Implementation Synchronized in Europe (RISE) program, Air France, Novair and TAP Portugal will gain access to new PBN procedures at 10 airports in France, Portugal, Greece and Cyprus, with Airbus and

can send an FMS update.” One issue pilots in SPO-3 noted about ELP was that the software did not indicate its logic in selecting the best alternative. Johnson says NASA is working with the Air Force Research Laboratory on a new version that will generate an explanation of its choice for the pilot or ground operator.

The latest conops pedigree comes from lessons learned in the earlier SPO-1 and SPO-2 studies. As part of SPO-1, which used only desktop simulators, NASA separated the captains and first officers with nothing but an open microphone for coordination. “We flew them through some highly challenging off-nominal scenarios—weather, wheel well fires and diversions,” says Johnson. “We saw how well two people could manage one aircraft when they weren’t sitting right next to each other. We didn’t put any technologies in to make it easier, because we wanted to see where the problems were.”

Researchers determined that there were crew resource management (CRM) issues when the pilots were separated—for instance, there were times of momentary confusion about who was the pilot-flying. “We designed a set of CRM tools and other mitigations to try and address this,” says Johnson. Along with those CRM tools, SPO-2 featured the first-generation ground control station, with separated pilots flying more challenging scenarios.

One aid gives the captain or the ground-based first officer a dedicated display for recognizing new inputs to the aircraft’s heading, speed and altitude through a mode control panel, which either pilot can perform in a dedicated mode. When the captain inputs a speed change, for example, the equivalent field on the first officer’s display flashes the new information. In a two-pilot cockpit, the first officer would point to the information to confirm the change. In this case, the first officer uses the open microphone to confirm along with touching the field on the screen, which the captain would do as well on a dedicated display in the cockpit. “In SPO-2, they found that by putting in the checks, the frequency of verbal communications went up,” says Johnson. Researchers also found during that experiment that an aircraft in trouble required a dedicated ground operator. “They belong to the captain; they can no longer support those other aircraft,” says Johnson.

SPO-3 investigated two concepts related to the roles of the ground operator. In one scenario, the super dispatcher managing 12 aircraft transitioned into dedicated mode as first officer for a problem aircraft, passing off the others; and in the other scenario, the super dispatcher kept the 11 nominal aircraft, passing off the problem aircraft to a specialist. Input from pilots showed the two scenarios to be

roughly equivalent, which surprised Johnson. “We thought that holding on to the original aircraft and handing off the rest, you would have more situational awareness and that would be better,” he says. “To the extent we found anything, we found that when they (went into dedicated mode with one aircraft), they had a hard time forgetting about the other 11, especially if there was an impending task.”

In future studies, NASA is planning to investigate some type of physiological monitoring of the captain, along with the video feed already installed for SPO-3. Ground operators found the video, showing the captain’s seat and the control panel in dedicated support mode, to be “somewhat useful” for inferring the pilot’s actions. A similar video feed on the super dispatcher position was “totally useless,” as that operator uses a mouse.

Monitoring for the captain would include alerting for non-responsiveness; however, the threshold for the ground controllers taking over the aircraft when not in dedicated mode would be necessarily high, as the captain remains in charge of the safety of the flight in the SPO conops. “Is he sleeping, is he dead, or has he gone into oxygen deprivation and he thinks he’s fine and blue birds are flying around the cockpit?” says Johnson. “The person on the ground, if he sees these monitors going off, he can hook in and say, how are you doing?”

the EU—through the Sesar Joint Undertaking—picking up the tab for the ground portion of the work. Implementing the procedures, which include Required Navigation Performance (RNP) approaches and arrivals, as well as RNP-to-ILS (instrument landing system) transitions, will be the air navigation service providers for the four countries, with Airbus ProSky coordinating the implementation and training the air traffic controllers.

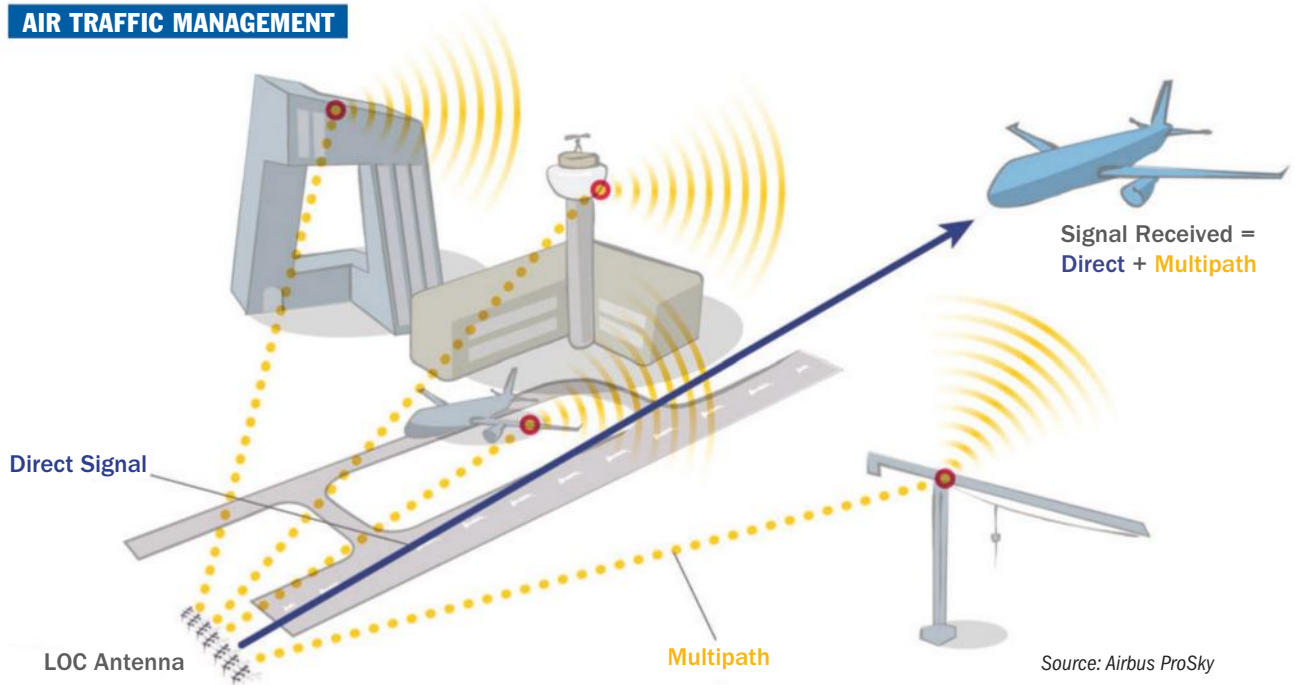
RNP-to-ILS transitions are an ongoing research area in terms of developing processes to smooth the connection between satellite-based RNP procedures that are based on barometric pressure for altitudes (pressure, hence instrument altitude, varies with temperature) and the ILS, which has a geometric beam that is indifferent to temperature. The goal is to implement a single procedure that handles all aircraft, minimizing work for controllers.

Of particular interest with the RISE program is eliminating ground-based non-precision instrument approaches that terminate in a “circle-to-land” state that requires crews to

**“This is a way to make
the wake issue on a
single runway go
away completely”**

then establish a landing pattern different from the approach. An RNP arrival, in contrast, uses satellite-based guidance to place the aircraft directly in front of the runway at a lower altitude at the termination of the approach, while reducing track miles, altitude changes and avoiding noise-sensitive areas along the way.

A key part of the project is to offer airlines the ability to see the benefits of RNP equipage before paying for the necessary avionics upgrade, which in Airbus aircraft involves activating software already onboard. “It’s a chicken-and-egg story about equipage—ANSPs would not implement PBN because the critical mass airline participation is not met, and vice-versa with airlines not equipping because there are not enough aircraft in system to make it worthwhile,” says Paul-Frank Bijou, Airbus ProSky’s chief executive officer. “It’s a vicious circle that slows the system down.” Bijou says airlines accepting the package deal will pay a per-aircraft fee at the end of the calendar year. During the trials, the company will collect feedback from flight crews and controllers on the flyability, safety, workload, emissions and fuel-consumption reductions.



“As soon as we can make it a success and everyone is happy, we can begin to expand elsewhere,” says Bijou, adding that the U.S. “would be a good target” for the program.

Other key projects include the introduction of an instrument landing system (ILS) analysis tool known as the Exact Landing Interference Simulation Environment (Elise), which assesses the impact on the ILS signal transmission caused by structures around the airport, aircraft waiting for takeoff, and those on an approach. Airbus built the 3-D analysis tool in partnership with France’s civil aeronautics academy. Bijou says airports must assess the ILS signal when upgrading an ILS from Category 1 (200 ft. minimums) to Category 2 (100 ft.) and Category 3 (50 ft. or lower), a process many airports are undertaking to provide for more schedule reliability in bad weather. Traditional 2-D methods tend to be overly conservative, he says, which affects airport construction, holding positions for nearby aircraft, and in-trail separation for multiple aircraft on an approach.

Bijou says in-trail spacing on an approach is dictated first by wake separation constraints and second by the ILS signal-masking effects of the lead aircraft on those behind it on the approach. If wind conditions allow for closer separation, masking can become the primary constraint, leading to reduced separation with the Elise analysis. Bijou says testing has shown that in-trail separation can be reduced by 2 nm for some aircraft pairs compared to the existing constraints for ILS masking. “This is massive,” he says. Airbus ProSky will test an “optimized operation” concept of reduced ILS spacing behind medium-sized aircraft in low visibility conditions in Zurich, followed by tests at London Heathrow and Peking. Heathrow is already using an optimized approach with its microwave landing system, but not for the more common ILS.

Monte Belger, president of Metron, says the FAA is considering many of the concepts that Airbus ProSky is promoting in Europe, but under different names and formats. He says the FAA may not be “as far along as Europe” in the implementation of the projects due to the current high-priority focus on PBN, multiple runway operations, data communications and surface movement optimization.

Boeing’s ATM operation, run by the company’s flight services division, is immersed in similar consultation projects

Airbus ProSky uses a 3-D analysis program to better estimate the effects of structures and aircraft on precision ILS beams.

for PBN and advanced ATM both in the U.S. and abroad, including a dynamic tailored arrival project at Amsterdam Schiphol Airport within the next year. At the same time, it promotes subscription services to airlines for efficiency tools under its InFlight Optimization brand, including direct routes and wind updates. “We have research projects that couple-in things Boeing has already transitioned into use,” says Jere “Chip” Meserole, director of Advanced Air Traffic Management for Boeing. “We bring the next level of improvement to it.”

The impending Schiphol trial, in cooperation with Dutch air navigation services provider, LVNL, involves developing a trajectory predictor and automation on the ground that can be sent via data link to an aircraft for a dynamic tailored arrival. The system will consider all the required arrival procedures, up-to-date winds and other traffic constraints to create a path and speed schedule that optimizes the descent path to a merge point for each flight. The information will be sent to the pilot in cruise flight before top-of-descent. A button-push for confirmation will automatically enter the path into the flight management system (FMS).

Another research project, with the Dutch meteorological agency, will investigate the holistic benefit of receiving wind updates from one aircraft for the benefit of those behind it, particularly on a descent. Researchers are considering several methods for obtaining the data, including down-linked wind computations from the aircraft’s FMS, ADS-B or ADS-C avionics, and how each affects a forecast model that can then be sent up to other aircraft in the form of wind updates to the FMS.

For its subscription products, Boeing says it now has several unnamed U.S. airline customers for its Direct Route service, which helps airlines identify segments of a route where pilots can bypass a waypoint to cut track miles, fuel burn and flight time. Boeing originally licensed the software from NASA’s Ames Research Center and incorporated it into an application. The tool runs continuously in the background,

checking potential route changes with real-time traffic data to determine plausible routes. Positive results are then relayed to an airline's operational control center, which can then uplink the route change request to the pilots through the Aircraft Communications Addressing and Reporting System (ACARS). Pilots then ask air traffic controller for the "direct-to" route change using the normal process—over the VHF radio. "It saves a minute or two at a time," says Meserole, adding that the company is now talking to Canadian airlines about the product. American Airlines has been trying out a similar routing tool developed by NASA that identifies diversions around weather that save at least 5 min. compared to the clearance route.

KLM Royal Dutch Airlines was the launch customer and development partner for Boeing's wind updates subscription service, a feature that Meserole says "has more impact," as it allows the aircraft's FMS to fly an optimal path, particularly in descent. "We send in-flight updates to the wind profile, picking out wind information important to that specific flight as it reaches future points in time," he says. "It's a one-button load from the pilot to the FMS." Meserole adds that any time there's a wind change, the updates are sent up to the aircraft automatically via ACARS. He confirms that "several" U.S. airlines are now subscribing. Competitor AvTech has a similar subscription-based wind update service that Southwest Airlines is using for its entire fleet for descents.

Meserole says there is other research underway that will further optimize an FMS with real-time weather data, yielding "ways of meeting time objectives without taking the aircraft out of economy mode."

Boeing is also proposing to test a low-cost method to increase capacity at airports that host a mix of light, medium and heavy aircraft landing on the same runway. The company has a goal of beginning a trial on Runway 4R/22L at Newark Liberty International Airport (EWR) this year.

Called "Descent Angle to Displaced Thresholds," the technology includes creating a second threshold farther down a runway that will allow aircraft the size of a Boeing 737 or an Airbus A320 to follow heavy aircraft like the Boeing 777 or Airbus A330 at a distance as close as 3 nm, rather than the usual 5 nm, an in-trail distance designed to minimize wake-turbulence encounters.

The extended touchdown point for the lighter aircraft provides a higher glideslope that keeps the aircraft above the wake of the heavy aircraft ahead. Additional margin could be gained from using a steeper glideslope for the approach. "This is a way to make the wake issue on a single runway go away completely," says Meserole, adding that the process would work in visual as well as instrument flight rules (IFR).

Meserole credits German air navigation service provider DFS, the German aerospace center DLR, as well as Frankfurt Airport Service (Fraport) for completing

the original work on the concept in the mid-2000s. At the Frankfurt airport, the team tested a displaced threshold on one of the two parallel runways (25R and 25L) to decrease separation between heavy aircraft on one runway and lighter aircraft on the other.

The system was meant to allow for independent operations of the two runways, despite a lateral separation of only 1,700 ft. between the two. The airport renumbered 25L to 26L and moved the threshold 4,900 ft. inward, making the glidepath 300 ft. higher compared to the parallel runway, thereby avoiding the path of the vortices. A new lighting and instrument landing system was also installed. Meserole says the test was successful, but was discontinued due to complications that occurred when the tower had to change landing direction due to wind shifts. Frankfurt later built a third parallel runway for single-aisle aircraft to solve its capacity issues. Germany also studied single-runway displaced threshold operations with a controller- and pilot-in-the-loop simulation, showing that the concept would work, says Meserole. "What they didn't do was investigate all the safety issues," he notes. "That's what we're trying to do."

One of those safety studies will address the minimum runway length and maximum glideslope needed. Meserole says EWR's Runway 4R/22L, with 10,000 ft. available, could be "a little marginal," but that analysis has not yet been carried out. Another safety issue involves setting the glideslope angle for the lighter aircraft. Meserole says the angle would not likely be higher than the 3.5 deg. path the Boeing 737 can already fly.

Newark is an ideal location in one respect—it has a Honeywell-built SmartPath GPS landing system for which multiple glideslopes can be set up to the same runway. United Airlines is the initial user of that system and has more than 100 737s and 787s equipped to use the landing aids.

Meserole says Boeing has been discussing the project with the FAA since last year. "The next step is to define a statement of work for the study phase," he says, adding that the goal would be to develop a public-private partnership for the project. ☉

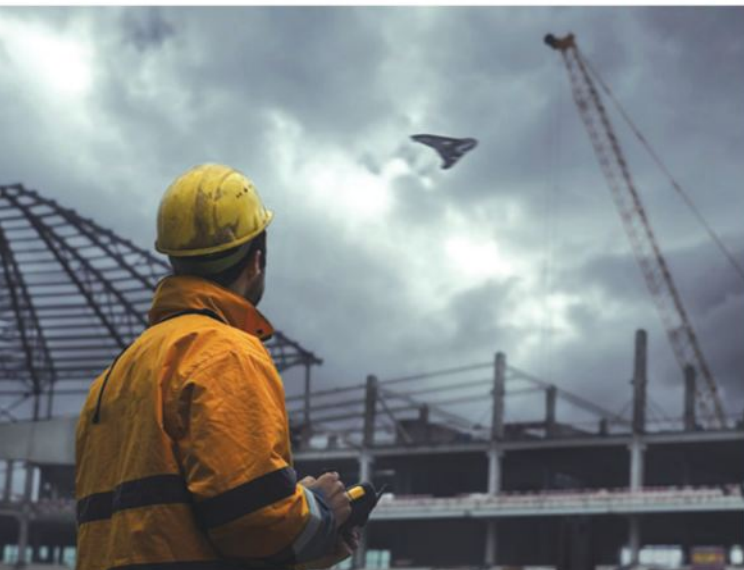
The NASA-developed Cockpit Situation Display provides a 3-D graphic of current and future weather, traffic and obstacles along an aircraft's route.



Managing Unmanned

Fast-paced project to open low-altitude airspace to small UAS set to take flight this year

Graham Warwick **Washington**



TRIMBLE NAVIGATION

NASA is moving quickly to develop a system to enable safe and efficient operation of civil unmanned aircraft systems (UAS) at low altitudes outside controlled airspace, under pressure from—and taking advantage of—entrepreneurs eager to develop commercial applications.

Flight experiments with commercial partners will begin this year under the UAS Traffic Management (UTM) project. Over a series of four increasingly capable software builds, NASA plans to enable safe low-altitude operations by unmanned and manned aircraft within five years, laying the foundation for what is expected to be a dramatic increase in the use of airspace now outside air traffic control.

Since unveiling its UTM concept early last year to an enthusiastic reception from a community frustrated by long delays in the development of regulations enabling commercial UAS use in U.S. airspace, NASA has aggressively pursued partnerships with industry and the FAA to develop the system. “We have more than 100 interested parties, and have formed a joint NASA-FAA research transition team,” says UTM principal investigator Parimal Kopardekar.

Partners range from consumer drone manufacturers DJI and 3DRobotics, through commercial UAS flight control system supplier Airware, to companies such as Drone Deploy, PixiePath and SkyWard, which already are developing cloud-based services enabling operators to manage fleets of unmanned aircraft flying in uncontrolled low-altitude airspace. Their uses range from crop monitoring to package delivery.

Kopardekar says testing is planned for the spring and sum-

mer at multiple sites. The first build, UTM1, will be focused on airspace design and trajectory management. Using a web interface, airspace managers will be able to geo-fence UAS operations, set up altitude “rules of the road” for procedural separation, schedule vehicle trajectories and decide whether to open or close airspace. Users will be able to create trajectories and check them against airspace constraints, wind and weather forecasts, an obstacle database and the plans of other operators. Later builds are planned to make the system more capable, dynamic and automated to handle higher traffic densities and manage increasingly complex contingencies.

Although the U.S. lags countries such as Australia, Canada, France and the U.K. in approving commercial UAS operations, industry sees the NASA program as a chance to jump ahead. “UTM is unique and visionary,” says Jesse Kallman, head of business development and regulatory affairs at Airware, which in December attracted strategic investment from General Electric’s GE Ventures arm. The company supplies autopilots for UAS used in commercial operations in France and elsewhere, and plans to bring its experience, and customers, into the UTM project through its cooperation with NASA.

UTM will allow airspace to be geo-fenced, for example, to keep a safety-monitoring UAS within the confines of a construction site.

“We understand what really provides safety for commercial small UAS operations and are bringing our feedback and experience from Europe back here,” Kallman says. “We provide a common interface, a way to operate vehicles safely and reliably. We can bring in multiple different types of aircraft from our customers, multi-rotor and fixed-wing, and it will be easier see how they respond—how long it takes them to land after an input, how to space them out—when they have that commonality.”

NASA’s willingness to work in partnership is being welcomed by an emerging industry. “A consortium of private companies has been working with NASA for several months. It’s a good forum for industry participation and to work on standards for how to interoperate, all in the name of safety and predictability,” says Bryan Field-Elliot, “serial entrepreneur” and founder of PixiePath, which is developing a cloud platform enabling operators to control fleets of UAS. “NASA is doing a good job.

“Our principal objective is to create a simple tool for software developers to build drone applications; allow users to simulate the operation of hundreds or thousands of drones, or just two or three; and enable them to connect their UAVs to the cloud and control them in real time,” he says. PixiePath plans to develop adapter “apps” for all major UAS types, beginning with DJI and 3DR, to connect them to the cloud for real-time data streaming and fleet management. “We will have a handful of early users by late January and select a few high-value users for a beta test in February,” says Field-Elliot.

Also developing a software platform to provide UAS operations management as a service, SkyWard has partnered with NASA to incorporate UTM research into its Urban Skyways Project, which is planned to involve demonstrations this year of commercial small UAS networks in Las Vegas, Vancouver, London, and Portland, Oregon, for package delivery, emergency response and infrastructure inspection missions. SkyWard is working with DJI and 3DR as well as specialists in cloud control, aerial surveys, image processing and industrial inspections. ☺

CLASSIFIED ADVERTISING

To Place Your Classified Ad Contact:

Diane Mason; Tel: 913-967-1736 Cell: 913-660-5130 diane.mason@penton.com

AIRPLANE DESIGN AND ANALYSIS



**Airplane Design
and Analysis**

Consulting Services
Preliminary & Detailed Design
Structural Design & Analysis
CAD & CFD
Wind Tunnel Testing
Aircraft Prototyping & Testing

Software & Books
Advanced Aircraft Analysis
Aircraft Performance
AeroPack-CAD
FAR 23 Loads

DARcorporation
1440 Wakarusa Drive, Suite 500
Lawrence, Kansas 66049 USA
Phone: (785) 832-0434
info@darcorp.com • www.darcorp.com

Penton Revised Privacy Policy

At Penton, we constantly strive to improve our products, including by changing our use of the information we collect from you. We now share information with other subscribers to our services and/or third party vendors who are our partners so that they can provide you additional opportunities and benefits. Some partners may analyze our sites to identify future improvements or to offer additional products you may want.

Visit <http://www.penton.com/privacy-policy/> to read our updated Privacy Policy.

NOTICE OF INVITING TENDER



STAR ALLIANCE MEMBER

NOTICE INVITING TENDER

Tender No.	Scope of work	Last Date for Submission
Tender Ref. No: MMD/ DEL/ PROV/14-15/ A320/WS Dated: 18.12.2014	Two Bid Tender For Procurement of Windshields Required For A-320 Aircrafts.	21.01.2015 (upto 1400 Hrs. IST) Technical bid opening- the same day at 1500 hrs. IST

For further details regarding pre qualification criteria, terms and conditions of the Tender, you may please download the tender document form our website www.airindia.in.

ADVANCED COMPOSITE TRAINING



ABARIS™

ADVANCED COMPOSITE
TRAINING & SERVICES

COURSES

Distance-Learning Course - Certificate
Program in Aircraft Stress Analysis
Tel: 1-208-772-7721 www.psa1.com

EQUIPMENT

**Ultrasonic Inspection C-Scan Systems
for your High Performance Structures**



- Automated Ultrasonic C-Scan Systems
- Multi-Axis Gantries and Immersion Tanks

Matec
Instrument Companies

(508) 351-3423

sales@matec.com

AVIATION WEEK
Recruitment Advantage

**Aviation Week's Recruitment Portfolio Provides Unparalleled Reach
into the Largest, Most Dynamic Market in the World.**

Build Your Recruitment Program Today! To Learn More, Contact: Diane Mason
Tel: 913-967-1736 Cell: 913-660-1530 • diane.mason@penton.com

WorldMags.net

CONTACT US

AVIATION WEEK

& SPACE TECHNOLOGY

ADVERTISING

President/Publisher: Gregory D. Hamilton;
+1 (212) 204-4368; hamilton@aviationweek.com

Managing Director, Global Media: Iain Blackhall (U.K.);
+44 (0)20 7152 4495; iain.blackhall@aviationweek.co.uk

U.S. Sales Offices

Director, Business Development: Matt Holdreith;
(646) 719-0767;
matt.holdreith@aviationweek.com

Strategic Account Manager: Tom Davis;
(469) 854-6717;
tom.davis@aviationweek.com

Strategic Account Manager: Tim Reed;
(949) 650-5383;
tim.r.reed@aviationweek.com

Northeast U.S.: Chris Salem;
(203) 791-8564; chris.salem@penton.com

Southwest U.S.: Sean Fitzgerald;
(202) 383-2417;
sean.fitzgerald@aviationweek.com

Northern Mid-West to Northwest U.S.: Leah Vickers;
(949) 481-4519;
leah.vickers@aviationweek.com

Southern Mid-West to Southwest U.S.: Miguel Omelas;
(818) 834-4232;
miguel.omelas@penton.com

Canada: Richard Brown;
(416) 259-9631;
r.brown@victorbrownmedia.com

International Regional Sales Offices

Publisher, Defense, Space & Security:
Andrea Rossi Prudente (U.K.): +44 (207) 176-6166;
andrea.rossiprudente@aviationweek.co.uk

Germany, Switzerland: Robert Rottmeier (Switzerland);
+41 (21) 617-44-12;
robert.rottmeier@aviationweek.co.uk

Europe: David McMullen; +44 (0)1925 596176;
david.mcmullen@aviationweek.co.uk

Strategic Account Manager: Ann Haigh;
+44 (0)1628 526324; ann.haigh@penton.com

Eastern Europe, India, Pakistan, Russia and the CIS, Middle East, Scandinavia, Africa, Mediterranean, Turkey and Asia
Vittorio Rossi Prudente (Italy): +39 0 (49) 723548;
prudente@aviationweek.co.uk

Japan: Yoshinori Ikeda;
+81 3 3661 6138; pbi2010@gol.com

United Kingdom, Ireland: Michael Elmes, Aerospace Media (U.K.); +44 1206 321639;
mike.elmes@aerospacemedia.co.uk

Israel: Tamir Eshel, Eshel Dramit Ltd. (Israel);
+972 (9) 8911792; eshel_tamir@yahoo.com

Business/Production

Group Production Manager: Carey Sweeten;
(913) 967-1823; carey.sweeten@penton.com

Production Coordinator: Donna Brown;
(913) 967-7203; donna.brown@penton.com

Production Coordinator: Kara Walby;
(913) 967-7476; kara.walby@penton.com

Advertising/Marketing Services

For Media Kits, Promotions or Custom Media:
www.aviationweek.com/mediakits or Elizabeth Sisk;
(860) 245-5632; elizabeth.sisk@aviationweek.com

Advertising Operations Manager: Casey Carlson;
(610) 373-2099; casey.carlson@aviationweek.com

SUBSCRIPTIONS & CUSTOMER SERVICE

Subscriber Service:

U.S.: (800) 525-5003

Outside the U.S.: +1 (847) 763-9147;
Fax: +1 (844) 609-4274

Outside the U.S. Fax: +1 (847) 763-9682

Email: awcustserv@halldata.com

Subscription Inquiries: Address all inquiries and requests to Aviation Week & Space Technology, P.O. Box 1173, Skokie, IL 60076-8173. Include address label from recent issue when writing. Allow three to six weeks for address change. Include both old and new address and zip or postal codes.

Manage your Subscription (and claim Digital Edition) at:
www.aviationweek.com/awstcustomers

Register & claim access to AWST Online at:
www.aviationweek.com/awstregister

Digital Editions

Support Service: (888) 946-4666

Email: Support@zinio.com

Web: www.zinio.com/help

Subscribe at: www.aviationweek.com/awstdigitalsub

Order single copies at: www.aviationweek.com/awstdigitalsingle

Manage your Subscription (and claim Digital Edition) at:
www.aviationweek.com/awstcustomers

Single Copy Sales

Toll-free (U.S. only): (800) 525-5003

Outside the U.S.: +1 (847) 763-9147

Fax: +1 (844) 609-4274

Subscription Information for other Aviation Week Products

Aviation Week Intelligence Network,

MRO Prospector and Fleet Data:

(866) 857-0148 or outside the U.S.: +1 (847) 763-9147.

Fax: (844) 609-4274 or outside the U.S. +1 (847) 763-9682

Web: www.aviationweek.com/awin

Email: aw_intelligence@aviationweek.com

Business & Commercial Aviation: (800) 525-5003 or
+1 (847) 763-9147

SPECIAL PRODUCTS & SERVICES

Conferences/Exhibitions

www.aviationweek.com/events:

To Sponsor/Exhibit: Beth Eddy;
(561) 862-0005; betheddy@aviationexhibits.com

To Register: Alexander Zacharias;
(646) 392-7883; alexander.zacharias@aviationweek.com

AW&ST Mailing List Rental and Sales

Zach Sherman;
(212) 204-4347;
zach.sherman@penton.com

Justin Lyman;
(913) 967-1377;
justin.lyman@penton.com

Reprints, Photocopies and Permissions

Custom Reprints: Nick Iademarco;
niademarco@wrightsmedia.com

Wright's Media, 2407 Timberloch Place, Suite B
The Woodlands, Texas 77380

Office: (281) 419-5725
Toll Free: (877) 652-5295
Cell: (281) 853-5434
Fax: (281) 419-5712
www.wrightsmedia.com

Black and White Photocopies: Copyright Clearance Center;
(978) 750-8400; www.copyright.com

Copying without the express permission of the Copyright Clearance Center or Penton Media is prohibited.

Requests for other rights and permissions: Michael Stearns
at Aviation Week Permissions Department,
stearns@aviationweek.com

Social Media

Join the conversation! Follow us at:

Facebook: www.facebook.com/AvWeek

You Tube: www.youtube.com/AviationWeek

Linked In: www.linkedin.com/groups?gid=2104198

Twitter: www.twitter.com/AviationWeek



For more information visit us online at
www.aviationweek.com/awst

Aviation Week & Space Technology
January 15-February 1, 2015 VOL. 177, NO. 1
(ISSN 0005-2175)
1166 Avenue of Americas, New York, N.Y. 10036

Member of Audit Bureau of Circulations and Magazine Publishers of America. Published biweekly by Penton Media Inc., 9800 Metcalf Ave, Overland Park, KS 66212-2216. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canada Post International Publications Mail Product Sales Agreement No. 40026880. Registered for GST as Penton Media, GST # R126431964. Title reg. ® in U.S. Patent Office. Copyright © 2014 by Penton Media. All rights reserved. All rights to these names are reserved by Penton Media. **Postmaster:** Send address changes to Aviation Week & Space Technology, Attention: Subscription Services, P.O. Box 5724, Harlan, IA 51593-1224



AVIATION WEEK EVENTS

FACE-TO-FACE COMMUNICATION
HIGH-LEVEL CONTENT
RELATIONSHIP BUILDING

We deliver the professional development you need.

Learn more! www.aviationweek.com/events



Future Events

Feb. 2-3—MRO Middle East, Dubai.

March 5—Laureate Awards, Washington.

April 14-16—MRO Americas, Miami.

Aerospace Calendar

To submit Aerospace Calendar Listings

Call +1 (703) 997-0227

e-mail: kyla.clark@aviationweek.com

Jan. 27-29—Microelectronics Reliability and Qualification Working Meeting. The Aerospace Corp., El Segundo, California. See www.cvent.com/d/9rqnf1

Feb. 1-3—Routes Americas. Denver. See www.routesonline.com/events/172/Feb.1-3

Feb. 3-6—National Business Aviation Association Schedulers & Dispatchers Conference. San Jose, California. See www.nbaa.org/events/sdc/2015/

Feb. 4-5—18th Annual FAA Commercial Space Transportation Conference. National Housing Center, Washington. See www.faaast2015.com

Feb. 11-14—Lawyer Pilots Bar Association Winter Convention. Sunscape Sabor Resort, Cozumel, Mexico. See www.LPBA.org

Feb. 12-13—Air Force Association Air Warfare Symposium and Technology Exposition. Rosen Shingle Creek, Orlando, Florida. See www.afa.org/AirWarfare/airwarfaresymposium/airwarfaresymposium

Feb. 16-20—Bangalore Airshow. Begumpet Airport, Hyderabad, India. See www.india-aviation.in/

Feb. 20—Society of Experimental Test Pilots' Eighth Annual Southeast Section Symposium. Eglin AFB, Florida. See www.setp.org/symposium/meetings/southeast

Feb. 22-26—IDEX. Abu Dhabi National Exhibition Center. See www.idexuae.ae/

Feb. 24-March 1—Australian International Airshow and Aerospace & Defense Exposition Avalon 2015. See www.airshow.com.au/airshow2015/index.asp

Feb. 26—Australian Helicopter Industry Association Technical Conference. Avalon Airport. See secretary@austhia.com

Feb. 25—ATW Airline Industry Achievement Awards. Omni Shoreham Hotel, Washington. See atwonline.com/atw-airline-industry-achievement-awards

March 2—SpeedNews Fifth Annual Aerospace Raw Material & Manufacturers Supply Chain Conference. Beverly Wilshire Hotel, Beverly Hills, California. See speednews.com/aerospace-raw-materials-and-manufacturers-supply-chain-conference

ADVERTISERS IN THIS ISSUE

ATW's 41st Annual Airline

Industry Awards 65

Aviation Week Events

Aviation Week MRO Americas 23

Aviation Week MRO Middle East 19

Aviation Week Laureate Awards 35

Aviation Week & Space Technology

Step Inside 3rd Cover

Boeing 2nd Cover

AviationWeek.com/awst

Breitling 4th Cover

CFM 17

Komy Co., Ltd. 49

MTU Aero Engines. 13

Ontic 3

Rolls-Royce. 8-9

SpeedNews Aerospace Additive

Manufacturing Briefings. 3

CLASSIFIED ADVERTISING. 71

A.S. Wadhwa/Air India.

Abaris 71

DAR Corporation 71

Matec 71

AVIATION WEEK & SPACE TECHNOLOGY

MORE
Interactive and
Expanded Content
You Don't Want
To Miss!



To Subscribe:

1-800-525-5003 (in the U.S.)

+1-847-763-9147 (outside the U.S.)

aviationweek.com/awstdigital

All paid subscribers will receive expanded content sections in digital format. Selected subscribers will also receive either the MRO or Defense Technology section insert in their printed copy of AW&ST.



Go to Mars Nonstop

BY MARCIA SMITH



Thirty years ago, the White House was in the midst of choosing members of a National Commission on Space to satisfy a requirement of the fiscal 1985 NASA authorization act. A year earlier, President Ronald Reagan had said in his State of the Union address that NASA should build a space station and invite other countries to join. Congress agreed but it wanted to know where the space shuttle and this new space station were taking the U.S. NASA sold the space station as “the next logical step” in human spaceflight. Congress wanted to know “the next logical step to where?”

“Landing people on Mars is a goal on which there is widespread consensus. The problem is agreeing on the steps in between.”

I was privileged to be executive director of the commission and confess to being astonished that 30 years later we are still debating that question. Congress asked for a report that looked out at the next 20 years, but also said the panel could not make any recommendations about the space shuttle or space station. They were “givens” and since they would consume many of those 20 years, we received permission to extend our time frame to 50 years—to the year 2035.

Former NASA Administrator Tom Paine was our chairman. Paine was a true visionary whose zeal for human exploration of Mars was well known. Thus it was no surprise that landing humans on Mars was the long-term goal expounded in the commission’s report. But it was much more than that. Our 15-member panel included astronauts Neil Armstrong and Kathy Sullivan (now head of the National Oceanic and Atmospheric Administration), scientists Laurel Wilkening (our vice chair) and George Field, commercialization guru Gerry O’Neill and other exceptional individuals with broad expertise including Luis Alvarez, Chuck Yeager, Jeane Kirkpatrick and Gen. Bernard Schriever. Paine met with key members of Congress who agreed we should make bold recommendations, and bold they were.

Our overarching recommendation was to open the inner solar system for science, exploration and development. Human spaceflight was a big part of it, with a return to the Moon by 2005, landing on Mars by 2015 and establishing a base there by 2035. The key was establishing a permanent inner-solar-system transportation system: a “Highway to Space” and a “Bridge Between Worlds.” We wanted to es-

tablish infrastructure, as boring as that sounds, to avoid another dead-end effort like Apollo. Involving international and commercial partners was essential.

So what happened? The Challenger tragedy occurred midway through our deliberations and that certainly had an effect. Our report was formally released in July 1986, six months after Challenger, when the appetite for bold recommendations about the future of the space program was at a low point. Commercial space ventures that planned to use the space shuttle fell by the wayside (although the accident opened the door to commercial space launch services).

More important than Challenger, however, is that it took 25 years to build the International Space Station instead of 10 and it cost between \$60-100 billion (depending on how one does the math), instead of \$8 billion. Whatever the merits of the program now, it was an impediment to moving beyond.

Many “future-of-space” reports have been written since ours, including the excellent National Research Council’s “Pathways report” just last year. But they are just reports. It is time to take action. NASA is developing interesting ideas in its “Evolvable Mars Campaign.” It is heartwarming, in fact, to see so many similarities between what is described there and what we recommended—good ideas may languish for decades, but sooner or later they resurface.

Will NASA’s newest plans languish as well, or are we finally ready to move out on the next phase of human exploration? Can we avoid diversions like the Asteroid Redirect Mission? Will Congress sustain the level of funding it provided for NASA in fiscal 2015—\$549 million more than what President Barack Obama requested? Is that enough to make real progress? The “Journey to Mars” hype associated with the Orion test flight last month seems to have made clear to the public that NASA has not, in fact, gone out of business. Yet won’t many people wonder what happened when several years pass with no more Orion flights?

Landing people on Mars is a goal on which there is widespread consensus. The problem is agreeing on the steps in between. Perhaps this will be the year that debate ends. If Congress can continue to find the funds, and if Congress and the White House can agree on the steps, perhaps the first humans will land on Mars by the end of the Paine Commission’s time frame: 2035.

Some may think my views are too government-centric. I wholeheartedly support the private sector charting its own path to the stars, but rash efforts—by anyone—that unnecessarily risk lives would prove a setback to effective human exploration of Mars. It would be extremely unfortunate if the first human trip to Mars was the last because of public backlash. ☹

A veteran space policy analyst, Smith is the president of the Space and Technology Policy Group and the founder and editor of the website SpacePolicyOnline.com.

AVIATIONWEEK & SPACE TECHNOLOGY

step inside

DAILY COVERAGE/
instant delivery



ACCESS/
anywhere



ENHANCED/
in-depth read



Welcome to Your New Subscription!

Step inside a whole new way to experience the most trusted source for in-depth insights within the aviation, aerospace and defense industry.

For more details, visit:
stepinside.aviationweek.com

Need assistance?
aviationweek.com/awst-faq

Get Started Today:

Unlock your access in two simple steps.

1: Log In Online

Access articles online at aviationweek.com. Click "LOG IN" in the upper right of the page and enter the email address associated with your subscription and your password.

2: Download The App

DOWNLOAD. Download the *Aviation Week & Space Technology* app to your iPad or iPhone device* from the App Store at bit.ly/AWSTiOs.

OPEN. Once downloaded, open the app and tap  on the intro ad to access the homepage.

LOG IN. Tap any locked article  to access the log in screen. OR tap the menu icon  in the upper right corner of the app screen and log in using the same email and password as above.

*Not an iPad or iPhone user? The app will be soon be available in Google Play for Android devices, please stay tuned...

AN ICON JUST GOT LARGER



THE NEW NAVITIMER 46 mm

WorldMags.net