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June 18, 2012

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**28** *Asia-Pacific and Middle Eastern airlines will gain representation on the IATA board as their financial importance grows and after that group was accused of being a club of the past, representing the interests of old-style U.S. and European legacy carriers.*

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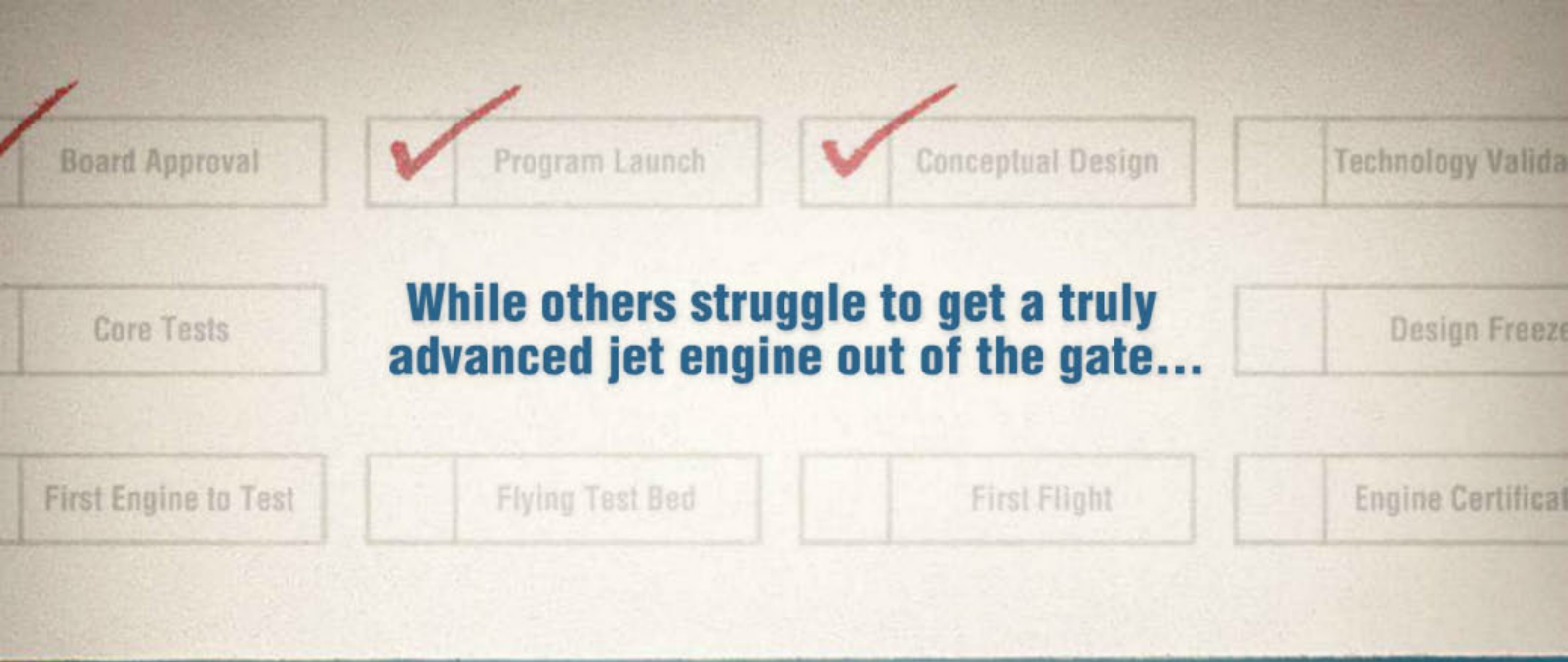


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# AviationWeek.com

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DUTCH MINISTRY OF DEFENSE

## COUNTERING PIRATES

**We report** on our **Ares** blog that on June 12, the Dutch parliament approved reinforcements for NATO's Operation Ocean Shield counterpiracy mission (**tinyurl.com/crlxddo**). This came even as the legislature delayed a decision to expand the EU's parallel Operation Atalanta until after parliamentary elections in September. The reinforcements include a second Cougar helicopter, an unmanned aerial vehicle and a diesel submarine. **AviationWeek.com/ares**

## CHANGE OF MIND

**Germany's** Diehl BGT Defense is throwing itself into a new guided glide-bomb program called Pilum, we report on our **Ares** blog (**tinyurl.com/7nvrgv7**). With Pilum, Diehl is going after customers that need all-weather weapons delivery at a cost that is less than that of a full-up cruise missile. The company sees its customer base mainly as Eurofighter Typhoon operators in Europe. **AviationWeek.com/ares**

ROBERT WALL/AW&ST

## PREMIUM CONTENT

**Use** the World Aerospace Database to find suppliers in thousands of product categories and subcategories. Its powerful advanced search capabilities allow you to find potential suppliers based on location, disadvantaged or minority-owned status, sales volume and more. **AviationWeek.com/awin**

## TIME OUT

**Every Friday**, our **Things With Wings** commercial aviation blog explores the oddities and curious developments in the airline world. To read about bizarre tales from air rage to harmless shenanigans, go to **AviationWeek.com** and check out our blogs and opinion page.

SDB II

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# FEEDBACK

Aviation Week & Space Technology *welcomes the opinions of its readers on issues raised in the magazine. Address letters to the Managing Editor, Aviation Week & Space Technology, 1200 G St., Suite 922, Washington, D.C. 20005. Fax to (202) 383-2346 or send via e-mail to:* **awstletters@aviationweek.com**
*Letters should be shorter than 200 words, and you must give a genuine identification, address and daytime telephone number. We will not print anonymous letters, but names will be withheld. We reserve the right to edit letters.*

## SOME SEEM ABSENT

It was refreshing to read about the Medal of Honor aviators in "Sagas of Valor" (*AW&ST* May 28, p. 54). However, at least one MOH awardee was conspicuous by his absence—U.S. Navy Vice Adm. James Stockdale from the Vietnam War era.

In addition to being awarded the MOH, Stockdale received two Distinguished Flying Crosses. The DFC was established in 1926 to recognize military aviators who distinguished themselves by heroism or extraordinary achievement in flight.

*Chuck Sweeney*
CORONADO, CALIF.

*(Only warfighters who earned medals as a direct result of military combat framed the feature article—Ed.)*

## FEWER MOH AVIATORS AHEAD?

"Sagas of Valor" by Anthony Velocci, Jr., is excellent. The article postulates that due to the changing dynamics of combat flying, it is less likely that an aviator will be in a situation that meets the criteria for MOH consideration.

One might also speculate that changes in rules of engagement (ROE) have unfavorably impacted aviators, although I believe trained and motivated aviators will do whatever is necessary, regardless of the ROE.

The Distinguished Flying Cross is also mentioned. The DFC Society has published "On Heroic Wings, Stories about the Distinguished Flying Cross." It is well worth the read.

*Bill Bradfield*
BLAINE, WASH.

## DEGREES OF CHOICE

Your article on the Medal of Honor awarded to aviators was a wonderful tribute to the heroism of those who have received the U.S.'s highest award for valor. U.S. Air Force Gen. Norton Schwartz talks about the roles that subjectivity and judgment play in making the tough call between an Air Force Cross and an MOH. He notes that does not diminish the heroism that occurred to earn the lesser award, but only draws attention to the conclusions that were reached by the particular review board as they dealt with "shades of gray."

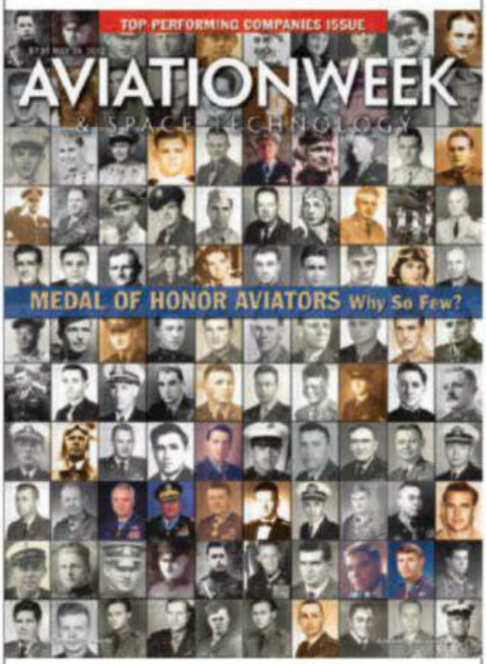
Heroes share the same traits. Dave Grossman in his book "On Killing" points out that studies revealed that only 1% of the pilots in WWII accounted for more than 40% of the combat kills. As one peruses the citations that preserve the historical narratives of those individual acts of valor for the members of the Distinguished Flying Cross Society (DFCS), it is truly amazing how many of those airman have more than one award. One member holds six—two DFCs per war—for heroic service in WWII, Korea and Vietnam.

We should all be very grateful that our nation produces men and women who are willing to do the "heavy lifting" when called upon.

*J. Bruce Hoffman, DFCS Director*
UPPER JAY, N.Y.

## MEMBER OF THE DFC CLUB

I want to express my appreciation for your recognition of those who flew combat missions for the U.S.




As a member of the Distinguished Flying Cross Society and a recipient of that award for service in World War II, I am delighted to see the recognition of others for their meritorious and heroic service to our country.

*Joseph Geary*
DALLAS, TEXAS

## COMMENDATIONS FOR ALL

I am a the president of the one of the Distinguished Flying Cross Society chapters. Our chapter, 128 members strong, encompasses Arkansas and has representatives from WWII to the Korean and Vietnam wars and all branches of the service. Pilots, navigators, flight engineers, load masters and more contributed to the cause of freedom.

One of our members—Lt. Col. Bob Hite—was copilot of the B-25 #16 Doolittle Raider and was a prisoner of war. We all wear our DFCs proudly.

Thank you for the great article.

*Gordon L. Hartley*
IRA C. EAKER CHAPTER, DFCS
SHERWOOD, ARK.

## JACKSON AND CREW

In "Sagas of Valor" the "Miracle at Kham Duc" describes the gallant action of Col. Joe M. Jackson. I am the proud owner of the oil painting by Keith Ferris that illustrates the article. It also is the cover art for my book, "Hit My Smoke—Forward Air Controllers in Southeast Asia."

The call sign for Jackson's C-123 was "Bookie 771." The co-pilot was Maj. Jesse W. Campbell. The combat controllers who were rescued were Sgts. Mort Freedman and Jim Lundie. The third man rescued was Maj. John Gallagher, a C-130 pilot.

*Jan Churchill*
NEW CASTLE, DEL.

## CLAUSEN AND MORE

On your roster of MOH aviator recipients, Pfc. Raymond M. Clausen, Jr., is listed as "Crew Chief and Pilot." He was a crew chief, but not a pilot.

I was a pilot in HMM-263, Clausen's squadron at the time of the incident. Though I did not fly on the mission he was lauded for, I researched and wrote the original citation. The aircraft commander on the mission was Lt. Col. Walter Ledbetter, who received a Navy Cross; the co-pilot was Lt. Paul Parker, who received a Silver Star.

This is meant in no way to denigrate the brave, deserving actions of Clausen, merely to set the record straight.

Thank you for such an extensive overview.

*Darcy Vernier*
MARINA DEL REY, CALIF.

*(The online version of the article and the accompanying video have been amended to reflect the Clausen update)—Ed.)*

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# WHO'S WHERE

J. C. Wolfenbarger

D. H. Pullen, Jr.

Simone Menne

Manin Al-Said

M. K. McLelland

Kelly D. Smith

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*USAF* Gen. **Janet C. Wolfenbarger** (see photo) has become the service's first female four-star general and has assumed the top position at Air Force Materiel Command, Wright-Patterson AFB, Ohio. She succeeds Gen. **Donald Hoffman,** who is retiring after 42 years.

**George Maffeo** has been named president of *Boeing Japan*, succeeding **Mike Denton**, who is expected to retire in October. Maffeo was VP of 787 supplier management.

**Nelson Krahenbuhl Salgado** has been appointed president of Embraer subsidiary *Visiona Tecnologia Espacial*, Sao Jose dos Campos, Brazil. He has been active in the airframer's strategic planning and financial sectors.

**Josh Salzman** has been tapped to become VP-global government affairs at Washington-based *Airlines for America*. He was an aide to Rep. Pete Sessions (R-Texas).

**Christopher Bero** has joined Dallas-based *Flexjet* as director of marketing. He was strategic marketing advertising manager at Samsung.

**David K. Lang** has been appointed VP and CFO of the *United Launch Alliance*, Centennial, Colo., succeeding **Joe Potter**, who has retired. Lang was CFO for Boeing's Integrated Logistics Div.

**DeEtte Gray** has been named president of the Intelligence & Security sector at *BAE Systems*, Arlington, Va. She was VP for Lockheed Martin's Enterprise Information Technology Solutions business.

**Dwight H. Pullen Jr.** (see photo) has been appointed aviation market director at Englewood, Colo.-based *CH2M HILL*. He was principal program manager.

**Bob Freiberg** has become president and CEO of Herndon, Va.-based *Cassidian Communications*. He was VP and general manager for Cassidian's 9-1-1 Call Center Applications and the Notification Solutions & Services units.

**Chris Monroe** has been promoted to treasurer from senior financial analyst at *Southwest Airlines*. He succeeds **Scott Topping**, who left the airline last year.

**Simone Menne** (see photo) has been appointed to the executive board of *Deutsche Lufthansa* as CFO, effective July 1. She succeeds **Stephan Gemkow**, who will become CEO of the Haniel Group.

**Marco Laos** has been named quality assurance manager for *Heads Up Technologies*, Carrollton, Texas. He was director of quality engineering at St. Jude Medical.

**Manin bin Khalifa Al-Said** (see photo) has become general manager for quality and safety of *Oman Air*. He was an IOSA-qualified auditor and consultant with Aviation Services.

**Tom Chambers** has been appointed director of aviation services at *Solomon Cordwell Buenz* of Chicago. His architectural portfolio includes the design of the United Airlines Terminal One at Chicago O'Hare International Airport and work at Suvarnabhumi International Airport in Bangkok.

**Michael K. McLelland** (see photos) has been promoted to executive director of the Space Systems Directorate in *Southwest Research Institute's* Space Science and Engineering Div. in San Antonio. He was director of the Space Systems Department, and has been succeeded by **Kelly D. Smith**, who was manager of the Electromechanical Systems Section.

**Colin McGregor** has been appointed general manager for project operations for *Algae Tec*, Perth, Australia. He was director of a fuel efficiency program for a major international carrier.

*USAF* Maj. Gen. **Kenneth D. Merchant** has been named program executive officer for weapons at the Air Force Life Cycle Management Center of Air Force Materiel Command, Eglin AFB, Fla. He has been commander of the Air Armament Center and Air Force program executive officer for weapons. Maj. Gen. **Craig S. Olson** is the new program executive officer for command, control and communications information and networks at the command's Air Force Life Cycle Management Center at Hanscom AFB, Mass. He was program executive officer for business and enterprise systems and director of the Enterprise Information Systems Directorate of the command's Electronic Systems Center, Maxwell AFB, Ala. Brig. Gen. **Dwyer L. Dennis** has been named program executive officer for fighters and bombers at the command's Air Force Life Cycle Management Center, Wright-Patterson AFB, Ohio. He was director of intelligence, surveillance, reconnaissance and requirements. Brig. Gen. **Mark A. Ediger** has been appointed deputy surgeon general in the Office of the Surgeon General, USAF Headquarters at the Pentagon. He was commander of the Air Force Medical Operations Agency, Office of the Surgeon General in San Antonio.

## HONORS AND ELECTIONS

**Ralph Crosby, Jr.,** chairman/CEO of EADS North America, has been awarded the Tyson's Corner, Va.-based *National Defense Industrial Association's* James Forrestal Industry Leadership Medal in recognition of his corporate leadership and commitment to a robust defense-industrial base, in particular the development of the B-2 bomber.

**Pramod K. Varshney** has been selected to receive the 2012 IEEE Judith A. Resnik Award, sponsored by *IEEE Aerospace and Electronics Systems, Control Systems and Engineering in Medicine and Biology Societies*, Piscataway, N.J. Varshney is being honored for pioneering work on data fusion methods that have driven the proliferation of multisensory networks for the aerospace industry and other applications.

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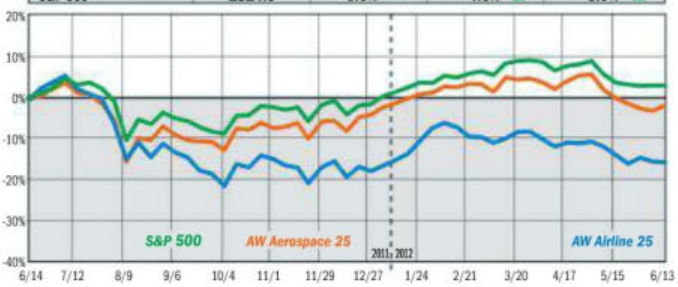
BY ROBERT WALL

*International Editor Robert Wall blogs at:* **AviationWeek.com**

## AW&ST/S&P Market Indices

(as of 6/13/2012) PERCENT CHANGE

| MARKETS | INDEX VALUE | WEEK AGO | YEAR-TO-DATE | YEAR AGO |
|---|---|---|---|---|
| AW Aerospace 25 | 1386.4 | 1.6% ▲ | 1.7% ▲ | -1.6% ▼ |
| AW Airline 25 | 786.8 | -0.3% ▼ | 2.4% ▲ | -17.7% ▼ |
| S&P 500 | 1314.9 | 0.0% — | 4.6% ▲ | 3.9% ▲ |




## Weekly Market Performance

*Closing Prices as of June 13, 2012*

| Company Name | Current Week | Previous Week | Fwd. P/E | Tot. Ret. % 3 Yr. | Tot. Ret. % 1 Yr. | |
|---|---|---|---|---|---|---|
| **AEROSPACE & DEFENSE** | | | | | | |
| AeroVironment Inc. | 23.22 | 23.35 | 15.1 | -14.9 | -20.9 | ▼ |
| Allegheny Technologies Inc. | 28.22 | 31.12 | 9.8 | -29.4 | -53.6 | ▼ |
| Alliant Techsystems Inc. | 46.77 | 48.49 | 7.3 | -47.4 | -29.8 | ▼ |
| BAE Systems plc | 4.30 | 4.27 | 6.9 | 0.5 | -6.4 | ▼ |
| Boeing Co. | 72.06 | 69.02 | 15.2 | 51.6 | -1.0 | ▼ |
| Bombardier Inc. 'B' | 3.78 | 3.68 | 8.1 | 24.5 | -42.2 | ▼ |
| Cobham plc | 3.61 | 3.53 | 10.9 | 49.4 | 12.3 | ▲ |
| Curtiss-Wright Corp. | 30.51 | 30.07 | 11.1 | -3.4 | -3.9 | ▼ |
| DigitalGlobe Inc. | 14.93 | 16.24 | 19.4 | -17.7 | -39.4 | ▼ |
| EADS NV | 33.47 | 33.01 | 13.8 | 140.2 | 26.4 | ▲ |
| Eaton Corp. | 39.28 | 41.34 | 8.4 | 74.7 | -14.6 | ▼ |
| Elbit Systems Ltd. | 34.80 | 33.42 | 8.9 | -38.5 | -14.9 | ▼ |
| Embraer-Empresa Brasil ADR | 26.72 | 27.88 | 9.1 | 63.9 | -14.5 | ▼ |
| Esterline Technologies Corp. | 61.30 | 62.97 | 10.5 | 110.2 | -17.6 | ▼ |
| Exelis, Inc | 10.03 | 9.93 | 5.8 | .... | .... | |
| Finmeccanica SpA. | 3.41 | 3.68 | 6.3 | -68.5 | -66.6 | ▼ |
| FLIR Systems Inc. | 20.15 | 21.61 | 12.0 | -17.0 | -39.6 | ▼ |
| General Dynamics Corp. | 63.49 | 63.62 | 8.7 | 14.9 | -7.2 | ▼ |
| General Electric Co. | 19.37 | 18.88 | 12.2 | 57.1 | 8.0 | ▲ |
| GKN plc | 2.84 | 2.75 | 7.1 | 104.4 | -11.1 | ▼ |
| Harris Corp. | 40.42 | 40.89 | 7.9 | 43.6 | -8.6 | ▼ |
| Hexcel Corp. | 24.60 | 23.96 | 15.7 | 124.9 | 23.1 | ▲ |
| Honeywell International Inc. | 55.12 | 54.66 | 11.8 | 69.1 | -1.0 | ▼ |
| Huntington Ingalls Industries Inc. | 37.08 | 36.80 | 11.1 | .... | 1.4 | ▲ |
| L-3 Communications Hldgs. Inc. | 69.57 | 69.36 | 8.3 | 0.1 | -11.8 | ▼ |
| Lockheed Martin Corp. | 82.67 | 82.38 | 10.6 | 12.3 | 8.7 | ▲ |
| Moog 'A' | 36.94 | 37.64 | 10.6 | 36.5 | -9.7 | ▼ |
| Northrop Grumman Corp. | 59.75 | 58.59 | 9.1 | 49.2 | -3.9 | ▼ |
| Orbital Sciences Corp. | 12.02 | 11.33 | 11.5 | -28.4 | -29.5 | ▼ |
| Parker-Hannifin Corp. | 78.93 | 80.25 | 9.9 | 80.1 | -9.4 | ▼ |
| Precision Castparts Corp. | 165.37 | 161.65 | 16.3 | 95.7 | 8.0 | ▲ |
| QinetiQ Group plc | 2.41 | 2.37 | 10.2 | 8.9 | 31.5 | ▲ |
| Raytheon Co. | 52.27 | 50.68 | 10.0 | 27.0 | 10.6 | ▲ |
| Rockwell Collins Inc. | 49.75 | 50.45 | 10.5 | 15.8 | -14.6 | ▼ |
| Rolls-Royce Group plc | 12.95 | 12.50 | 14.8 | 149.3 | 35.9 | ▲ |
| Safran SA | 33.60 | 34.08 | 13.3 | 199.3 | -5.9 | ▼ |
| SAIC Inc. | 11.62 | 11.47 | 8.8 | -35.4 | -27.8 | ▼ |
| SIFCO Industries Inc. | 20.83 | 18.83 | .... | 88.6 | 30.3 | ▲ |
| Singapore Technologies Eng. | 2.28 | 2.29 | 15.9 | 39.8 | 4.7 | ▲ |
| Spirit Aerosystems Holdings | 23.09 | 22.60 | 10.0 | 47.4 | 6.6 | ▲ |
| Textron Inc. | 23.94 | 24.16 | 11.8 | 111.0 | 11.1 | ▲ |
| Thales | 29.69 | 29.98 | 7.7 | -23.9 | -15.0 | ▼ |
| Triumph Group Inc. | 58.25 | 60.32 | 10.5 | 166.2 | 23.5 | ▲ |
| United Technologies Corp. | 73.54 | 73.64 | 13.1 | 41.5 | -10.3 | ▼ |

**COMMENTARY**

# Embraer's E-Jet Game Plan

With an array of competitors launching new aircraft, it's fair to ask why **Embraer** is waiting until the end of the decade to introduce its next-generation of E-Jets. The answer: Why make the current 70-122-seat family obsolete any earlier than need be?

With only eight years of operational E-Jet service under its belt, the Brazilian aircraft maker is looking for more time to amortize its investment. At the same time, it knows something has to be done to keep the Embraer 170/175 and 190/195 families commercially viable as new competitors hit the market. So Embraer is rolling out a series of enhancements it plans to introduce in the next few years to lower fuel burn, reduce maintenance cost, and add new cabin and avionics features.

A major aerodynamic clean-up program should shave 5% of fuel burn on an E-175 and 3% on the E-190 on long flights, says Paulo Caesar Silva, Embraer's president for commercial aviation. Drag-reduction efforts could include a modified winglet design. Clean-up options on the drawing board are more concentrated in the fuselage, and a new wingtip is being analyzed to improve the overall wing aerodynamic efficiency, says Luiz Sergio Chiessi, the aviation unit's vice president for market intelligence.

Another planned improvement will be longer inspection intervals, with A checks extended to every 750 flight hours from 600, and C checks to 7,500 flight hours. To further reduce maintenance-related costs, Embraer is looking to expand the capabilities of the E-Jets' health-monitoring system, called the "Ahead-Pro Platform." The number of systems being tracked in that tool—which already includes features such as the hydraulic reservoirs and pumps, brake control valves, bleed valves and flow sensors—is set to grow. Current users of the system have seen a 30% drop in technical interruptions.

New avionics and an updated interior are also planned for the upgraded E-Jets. One of the first enhancements to emerge is the Controller Pilot Data Link Communication to improve flight operations. That feature, which will also be available as a retrofit, should be ready in September. Chiessi says studies have indicated that equipping 75% of aircraft with the communication tool could generate 11% more capacity in an air traffic management system.

While much has been made of growth in emerging aviation markets, Embraer sees big opportunities for its E-Jets in the mature U.S. market. A catalyzing event for new deals may be a scope clause change **American Airlines** is expected to negotiate with its pilots in its Chapter 11 bankruptcy protection proceedings, to permit the carrier to fly smaller jets. Embraer is hoping for a big order from American in the coming year, and is also targeting **Delta Air Lines** and **Continental Airlines**.

There is "huge opportunity that we see now in the U.S. market," Silva says. "We estimate that in the next few years, there will be 400-500 aircraft that will have to be acquired by these major airlines in the United States."

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

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## AIR TRANSPORT

### Above 1,400

Within days, Air Lease Corp. and Norwegian Air Shuttle finalized deals for 36 and 100 Airbus A320NEOs, respectively. Norwegian's deal propels the A320NEO orderbook to 1,425 units, around 1,000 more than rival Boeing has secured for its 737-8 MAX. Norwegian in January also ordered 22 737NGs. The airline has purchase rights for 50 additional A320NEOs and for 737 MAXs, too. An engine selection for the A320NEOs has not been announced; the MAX is only offered with the CFM Leap-1B. Norwegian expects to start taking delivery of its NEOs in 2016, with the MAXs to follow in 2017. Airbus's backlog at the end of May was 4,341 aircraft, only two away from the 4,349 at the end of April. With overall production rates increasing, deliveries in the first five months were 228 units, up from 217 for the same period in 2011.

### Cathay Will Take Deliveries

Hong Kong's Cathay Pacific Airways is ruling out deferring aircraft deliveries even as it accelerates retirements of Boeing 747-400s in response to weak demand. Chief Executive John Slosar says that even if business is tough, an airline should always want to replace old aircraft. Cathay expects delivery of 24 Boeing 777-300ERs and 14-15 Airbus A330s during the coming three years. The company said in April that business conditions had continued to worsen. There has been no material change since then except for a decline in fuel prices, Slosar said while attending the International Air Transport Association's World Air Transport Summit in Beijing. Cathay has lost demand for economy travel since late last year. More recently the weakness has spread to business class, leading the management to warn staff in April that Cathay might have to cut its schedule and park aircraft.

### 'Hurry Up And Decide'

Emirates is pushing Boeing to make a quick decision on the next-generation 777. Emirates President Tim Clark says Boeing could "sell immediately 150-200" of them. Emirates alone has 174 777-300ERs in its fleet or on order and plans to retire the first of them in 2017. Clark says Boeing would make a mistake if it waited until the performance of the competing A350-1000 becomes clear. "If you think you don't have to move because the -1000 is in trouble, think again." Instead, he says, "If you believe in your product and your client base is telling you the same, why wouldn't you get on with the job?"

CHAD SLATTERY

### Northrop Grumman Unveils U.S. Navy's MQ-4C Triton

The newly named MQ-4C Triton Broad Area Maritime Surveillance (BAMS) unmanned aircraft system for the U.S. Navy was officially revealed at Northrop Grumman's Palmdale, Calif., facility on June 14.

Meanwhile, The Navy says it has yet to confirm the cause of an accident June 10 that led to the loss of one of five BAMS demonstrator Global Hawk Block 10 aircraft near NAS Patuxent River, Md.

The MQ-4C Global Hawk derivative is the first of two test and development versions and paves the way for a planned fleet of 68 for the Navy. "This capability has never been needed more as we rebalance toward the Pacific," says the vice chief of naval operations, Adm. Mark Ferguson.

Describing the unmanned system as a force-multiplier, Ferguson says, "BAMS will provide an asymmetric advantage to the U.S. Navy. Long-range persistent surveillance transforms the nature of warfare at sea," he adds.

The Triton will be part of a new joint force with 117 Boeing P-8As to replace the aging fleet of 230 Lockheed P-3 patrol and surveillance aircraft. First flight of the UAV is planned by year-end. Following up to nine test flights in the Edwards AFB, Calif., restricted airspace near Palmdale, the aircraft will move to Patuxent River to complete development work. Initial operational capability is planned for December 2015.

### Etihad Adds A320 Winglets

Etihad Airways has decided to take some of its A320s on order with winglets that Airbus is developing for the narrowbody. Deliveries of A320s equipped with "Sharklets" are to start this year, with Etihad due to receive its first in the third quarter of next year. Of the 20 A320s the carrier has ordered, 17 will be using the devices. Airbus has promised around 3.5% fuel burn improvement on long-range flights, although flight testing suggests the benefit may be slightly higher. The winglets will be standard on the A320NEO reengined aircraft due to come into service in 2015. Airbus also will offer a retrofit kit for some existing A320 customers.

## DEFENSE

### LAS Spat Sparks New Suit

Sierra Nevada Corp. (SNC) has filed a lawsuit seeking reinstatement of its $355 million U.S. Air Force contract to supply 20 Embraer A-29 Super Tucano light air support (LAS) aircraft to Afghanistan. The company says the U.S. Court of Federal Claims action is in response to a lawsuit filed by disqualified bidder Hawker Beechcraft Corp. (HBC), which

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led USAF to set aside the December sole-source award and reopen the competition. SNC argues "cancellation of the contract was an extreme response to what appears to be paperwork errors on the part of the USAF," which launched an internal investigation after discovering the reasons for disqualifying HBC's AT-6 were inadequately documented. HBC confirms its own lawsuit against USAF was "dismissed as moot" after the service took corrective actions. SNC, which says it has never previously protested a bid, also claims the amended LAS request for proposals issued in May "is tilted in favor of the competition."

### UAV Defense

The proliferation of low-cost unmanned aircraft has driven Thales back to embracing the concept of gun-based air defenses. "You cannot afford to use very expensive missiles" against such targets, says Laurent Dupont, who is in charge of advanced weapon systems at Thales. Its RapidFire system looks to take advantage of improvements in sensor accuracy and ammunitions to enable the gun air defense concept. The system, unveiled last week during the Eurosatory arms exhibition in Paris, is cued by the Thales Controlmaster 60, and uses a vehicle-mounted 40-mm gun developed by Nexter and BAE Systems, with a cased telescope anti-aerial air burst munition. The vehicle also features an electro-optical tracker. Thales is using the Controlview command and control system to coordinate fires. The key element is the munition, which projects a cloud of tungsten pellets to destroy its target.

### Sky Dragon Sighted

China is starting to globally market a new medium-range surface-to-air missile system called Sky Dragon. China North Industries Corp. claims an engagement range of 3-50 km (2-31 mi.), with a maximum engagement altitude of 20 km. The target set includes fighters, helicopters, unmanned aircraft and cruise missiles. A system comprises 3-6 launchers with four missiles each, an Ibis150 3D radar providing greater than 130-km detection range and a battle command system. The company says 12 missiles can be controlled at the same time.

## SPACE

### ISS To Get EO Platform

NASA plans to launch an exterior Earth-observation platform to the International Space Station under a cooperative agreement with Teledyne Brown Engineering Inc., which builds the flight releasable attachment mechanism manufactured by Huntsville, Ala.-based subsidiary Teledyne Technologies Inc. The Multi-User System for Earth Sensing (Muses) is due for delivery by the end of 2014 and expected to provide precision pointing and other accommodation for high-resolution digital cameras and other Earth sensors. As many as four instruments will be accommodated at once on the Muses platform, which is being designed for instrument change-outs, maintenance and upgrades with the station's robotic arm. Teledyne says the agreement with NASA calls for the company to operate the sensing platform as part of its new commercial space-based digital imaging business.

### Webb Instrument Checkout

Technicians at NASA's Goddard Space Flight Center will soon begin integrating the first instrument received there for the James Webb Space Telescope. The Mid-Infrared Instrument (MIRI), assembled by the Rutherford Appleton Laboratory in the U.K., will cover wavelengths of 5-28 microns from the Webb's planned perch at the Earth-Sun L2 Lagrangian point. "MIRI will enable Webb to distinguish the oldest galaxies from more evolved objects that have undergone several cycles of star birth and death," says Matt Greenhouse, project scientist on the Integrated Science Instrument Module that Goddard is developing for the Webb observatory.

### NuSTAR Achieves Orbit

NASA 's Nuclear Spectroscopic Telescope Array (NuSTAR) is in orbit and sending back signals following its June 13 air-launch over the central Pacific Ocean on an Orbital Sciences Pegasus XL rocket dropped from the belly of an L-1011 Stargazer aircraft that took off from Kwajalein Atoll. NuSTAR separated 13 min. after the winged solid-fuel rocket ignited, and NASA's Tracking and Data Relay Satellite System picked up signals from the spacecraft a minute after that. NuSTAR is expected to observe the highest-energy X-ray emissions, seeing through gas and dust to reveal black holes in the Milky Way galaxy and gas and dust hidden in the centers of other galaxies.

### Engineers Narrow Mars Rover's Target

Spacecraft engineers at NASA's Jet Propulsion Laboratory (JPL) hope to land the Mars Curiosity rover closer to its target than originally planned, moving the "sky crane" touchdown about 4 mi. nearer the base of the mountain where scientists seek to explore layers of sedimentary rock for evidence that a wetter Mars could have supported life.

Pete Theisinger, the Mars Science Laboratory project manager at JPL, says navigation software already uploaded to the spacecraft for the Aug. 6 landing was refined to target a smaller landing zone. This change was based on extensive Monte Carlo probability runs using flight software that indicated the margins originally programmed were overly conservative. Before, the Curiosity landing was aimed at an ellipse 12 mi. wide and 16 mi. long (see larger ellipse). With the changes, the nuclear-powered rover is targeted on an ellipse 4 mi. wide by 12 mi. long (see smaller ellipse), with the center closer to the foot of Mount Sharp on the floor of the equatorial Gale Crater.

Word of a successful landing could come as soon as 14 min. afterward, given the minimum time lag for communications between Mars and Earth. But if terrain shields the rover from satellite relays over Mars, it could take a day or two to find out if Curiosity made it down on cables lowered from a hovering lander platform (*AW&ST* Aug. 1, 2011, p. 38).

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BY MICHAEL MECHAM

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COMMENTARY

# Acquire and Adapt

## Strategies for a small supplier

Consolidation in the aerospace and defense supply chain can be big news when it involves publicly traded companies as prominent as United Technologies and Goodrich.

Merger and acquisition activity of smaller, privately held A&D suppliers largely goes unnoticed, although their business strategies are similar to the big names: acquire what you don't have to expand your product offering, nurture trusted partners and team for specific projects. Expansion is possible through organic growth, but the risks associated with internally funded research and development can be high. Sometimes the best growth comes not from new products but from a service expansion.


TACTAIR FLUID CONTROLS

Tactair Fluid Controls Inc., a 350-employee, privately held manufacturer of hydraulic and pneumatic controls for aircraft and defense applications is a case study in all of the above. Its product line is concentrated in flight control systems and engine, nacelle, brake, landing gear, and nosewheel steering controls. Its product line incorporates valves, actuators and dampers, accumulators and reservoirs and it is increasingly involved in the evolution of fluid and mechanical systems into electric controls. The company operates two plants with a total of 180,000 sq. ft. in Liverpool, N.Y., on the outskirts of Syracuse.

Tactair was started 50 years ago but had its greatest growth after being acquired in 1986 by Young & Franklin, a control maker for industrial gas turbines that wanted an entree into A&D. Young & Franklin does not publish an earnings report, but President Michael Yates says Tactair has annual revenues of $70 million from a 50:50 split of military work for transports, trainers and helicopters with business and regional jets on the civil side. Its customer base is predominantly in the Americas.

For the decade that followed its own acquisition, Tactair expanded by buying others—Phoenix Controls, Teledyne's Hydra-Power Div., Kaiser Fluid Technology and the aerospace product lines of York Industries. Each buy added to what the company could market. York, for instance, brought in hydraulic accumulators, self-displacing accumulators for gas bottles, fire-suppressant valves, auxiliary hydraulic power packs and hydraulic hand pumps.

The company has been affected by shrinkage in the business and regional jet markets that followed the 2009 recession. "Business has been tough," says Yates. But its civil trough has been offset by good military sales from resupply, retrofit and new-build aircraft. Tactair also is taking advantage of favorable exchange rates. "In the past 5-6 years, Europeans are looking to partner with people like us that are dollar-denominated suppliers," he says. So, despite the recession, Tactair is profitable and its revenues are growing.

It sells to Tier 1 suppliers more often than airframe makers, but not always. Niche applications are a strength, such as the brake metering valves and hydraulic accumulators it provided to General Atomics for Scaled Composite's WhiteKnightTwo aircraft. But it also makes leading-edge flap actuators and hydraulic accumulator overhaul kits for the U.S. Air Force's KC-135R Stratotanker fleet. It built the servo actuators for the nose-wheel steering system on the Hawker-Beechcraft T-6 Texan trainer and wheel-brake secondary flight controls and door controls for Embraer's Phenom business jet family.

Acquisitions have been hobbled in the past few years because nearly all of its competitors have been bought by larger Tier 1 and 2 suppliers. So, growth these days is internal. The emphasis is on establishing the Tactair name as a systems integrator that is comfortable working with traditional hydraulics and pneumatics or the newer electrical systems.

"Tactair isn't a name like Parker or Eaton that anyone in the world knows," Yates says. "But [it] has a name that everyone in [our] marketplace knows."

While it manufactures nearly everything in its assemblies, the company does not make controllers, so Yates is searching for a trusted source either through acquisition or partnering. Its competition comes primarily from North America, Europe or Japan, not China, Mexico or India. Yates is skeptical that those three will be competitors. "Lower labor costs can only be taken so far," he says.

The company's integrator message will be carried to Farnborough next month for the air show, with applications like a prototype electromechanical actuator uplock system (see photo). While some unmanned aerial vehicles use all-electric systems, finding enough power to run them becomes an issue as platforms grow larger. The reliability of electric systems may be less than traditional hydraulic systems, he says. "Nobody is at the point where they've got this thing licked," Yates notes. "There's a lot of challenges. That's a big opportunity for us."

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COMMENTARY

# Restricted Entry

## Business jet-making: Not for the timid, nor the many

Concerned about the growing influence of foreign business jet manufacturers, the U.S. Congress charged the U.S. International Trade Commission (ITC) with examining the status of what has been a U.S.-dominated business, albeit one suffering from a severe, years-long economic downturn. When disseminated recently, the resulting report surely brought relief to Embraer—which it detailed as a formidable, but fair, competitor—yet the document might give some would-be participants pause.

EMBRAER

The U.S. pretty much invented the business jet industry in the early 1960s, and has been the predominant producer ever since. U.S. manufacturers accounted for 54% of all deliveries in 2010. However, the report noted that's down from 83% in 2008, and that today three of the industry's six major players—Dassault, Bombardier and Embraer—are based in France, Canada and Brazil, respectively. And thus the congressional fret. Cessna, Gulfstream and Hawker Beechcraft were named as the main American players.

Embraer, the newest member of what the ITC describes as an OEM oligopoly, has steadily grabbed market share since it began building business jets, rising from 3% in 2008 to 19% in 2010, mostly on the success of its Phenom 100 and 300 (above) light jets. Moreover, the manufacturer is developing two medium models, the Legacy 450 and 500, which must elbow into what is already a crowded field.

How crowded? Citing testimony from one expert, the report noted, "Roughly 206 models of business jets" are in production today, a number that actually reflects all models ever built. By comparison, *Business & Commercial Aviation*'s 2012 Purchase Planning Handbook lists 45 business jet models in current production, and while that is far fewer than ITC's count, it still seems like quite a variety of choices for such a limited market. And those listings don't include models now under development by the oligopolists, such as the Lear 85 and Citation Latitude.

And yet, others want access to the club and to add to the count. The ITC report noted that five companies—Cirrus, Diamond, Eclipse, Honda and SyberJet—plan to go into business jet production and U.S. firms Spectrum and Stratos are considering doing so. Beyond that it notes China "has embarked on a multiyear strategy to develop a business jet industry" and has teamed with Cessna to build jets there.

Were newcomers to read ITC's description of the demands confronting those venturing into jet-making, they might want to reconsider. To wit: ". . . it typically costs between $500 million and $1 billion to develop a new business jet program. Moreover, much of this investment involves upfront costs, which tend to be highly risky due to the uncertainty of aircraft certification and the years required to recoup the investment. Government certification . . . can be a significant barrier to entry in the global business jet industry due to the time and cost involved. Barriers to entry provide advantages to established firms. . . ."

Still, for those with the stomach, bankroll and ambition, welcome. If the world economy ever recovers, who knows, maybe there will be room for 206 models after all.

### REASON TO CELEBRATE

May 10, 2012, was a big night for Boeing, whose 787 Dreamliner was awarded the Collier trophy during a black-tie dinner at Reagan Washington National Airport where Signature Flight Support's hangar was transformed into a glittering, grand hall. The star of the evening was the 787 itself, which dominated the ramp in floodlit glory just beyond the open hangar doors.

NATIONAL AERONAUTIC ASSOCIATION

While the Dreamliner drew the attention of the celebrants, their Signature hosts eyed with pleasure the gaggle of flying machines parked in the big Boeing's shadow. Some 19 business jets rolled onto the fixed base operator's (FBO) ramp that day, among the highest number since security concerns after the 9/11 terrorist attacks virtually banned general aviation operations at DCA. For years following, the once super-busy FBO had no visiting aircraft at all.

Now after a series of meetings and negotiations between general aviation interests and federal security officials, those restrictions have eased a bit. The shadowed turnout is seen as a positive, hopeful result.

So, what was an award day for Boeing was a workday for Signature, and both were well satisfied with the way it turned out.

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COMMENTARY

# Charter Models

## Enter Air strives to streamline maintenance costs and Air Urga seeks help with fleet modernization

Low-cost carriers and charter operators in Central Europe face stiff competition, among themselves and from state carriers that "run on an emotional basis and are treated like they will go on forever," says Sandor Szomora, deputy chief executive of Lufthansa Technik Budapest. Szomora, who worked for a Malev Hungarian Airlines joint venture before joining LHT, says these state carriers often are "not nimble or adaptive."

Neither Enter Air, which formed in 2009, nor 18-year-old Air Urga have this problem and both operators are trying hard to adapt to grow their businesses and contain costs.


INTERNATIONAL JOINT-STOCK AVIATION CO.

Enter Air, which proclaims itself as the largest charter airline in Poland, operates 11 Boeing 737s and established its business based on best practices from leading low-cost carriers (LCC) in Europe. It faces many of the same costs—such as overflight and landing fees—that large LCC and legacy carrier competitors do, which puts more pressure on variable costs.

Sixty percent of its costs are for fuel, which concerns Mariusz Olechno, vice president-technical for the airline, which has grown in capacity year over year since its launch. At about $5,000 per flight hour, ferrying costs for maintenance are high. For this reason, Olechno says his priorities when selecting maintenance vendors are capabilities, availability and "staying as close to home as possible." Quality is a given.

Why isn't cost in that mix? Olechno says: "There is no low cost in maintenance because of regulations, type certificates, etc., so we must optimize maintenance plans to the needs of our network and be proactive and reactive at the same time." In other words, try to be nimble.

Like Enter Air, fuel costs are a big concern for Ukrainian carrier Air Urga, which operates a fleet of nine Antonov An-24s (above), 10 An-26s and one leased Saab 340 on passenger and cargo charter flights.

Oleksandr Halinskyi, director general of International Joint-Stock Aviation Co., Urga's parent company, says: "We are looking for more modern and fuel-efficient aircraft" and "support to help transition to Western aircraft." He says the United Nations, for which the company flies under contract and performs line maintenance for peacekeeping missions, wants to see more Western aircraft in Urga's fleet. Changing its fleet would obviously change the company's approach to line and base maintenance, spare parts, cabin crew and maintenance training.

"We are looking for answers," Halinskyi says.

Ideally, International Joint-Stock Aviation Co. would like to find "one good partner," but Halinskyi says he would be open to multiple partners if he felt the quality control and oversight functions would be manageable.

International Joint-Stock Aviation Co. has been working on its infrastructure to support future changes and efficiencies. In late 2010, it opened a new passenger terminal to improve comfort and security standards for travelers. Halinskyi says this is one of the first private passenger terminals in the Ukraine. Last year, it opened a new maintenance facility in Kirovograd, Ukraine, that complies with European Aviation Safety Agency Part 145 maintenance standards and could service Urga's aircraft types along with an ATR 72 and Boeing 737-500, he says. Halinskyi, an An-26 navigator who was Urga's flight-training center director before assuming his current position last year, says the company also plans to enlarge the flight-training center and purchase a multi-engine aircraft for commercial pilot training.

With the infrastructure in place, Urga seems serious about seeking a partner or two and upgrading its fleet. The company also has ambitions to launch a catering service and branch out into business aviation.

Like other operators and maintenance companies in this region, Urga has a technically qualified and young staff. The average age of employees at Urga is 36 years and 98% of them have advanced degrees. With 19% of the personnel 20-28-years old and 49% of them 29-40 years, only 32% are 41 years or older

"The company has a very high level of intellectual and technical potential, along with the well-developed aviation infrastructure," says Halinskyi.

It should be interesting to see how Urga and Enter Air further adapt.

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MAKINO

BY FRANK MORRING, JR.

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COMMENTARY

# Bandwagon

## "Success has a thousand fathers . . . "

Rep. Steven Palazzo wants to set the record straight, after Presidential Science Adviser John Holdren declared that the Obama administration made possible the successful flight of the SpaceX Dragon cargo capsule to the International Space Station and back. "The Commercial Orbital Transportation Services program was proposed by the Bush administration in 2005 and authorized by Congress," says Palazzo, the Mississippi Republican freshman who chairs the House Science space and aeronautics subcommittee. "The COTS contract that funded the SpaceX mission was awarded in 2006. The Commercial Resupply Services contract won by SpaceX and Orbital was announced at the end of 2008. Let the record be clear."

SPACEX

Palazzo is right, of course. But now that SpaceX has demonstrated it can fly to the space station with pressurized and unpressurized cargo, and bring pressurized cargo back to Earth, there is plenty of credit to go around. Even Michael Griffin, who headed NASA during the Bush administration and conceived and funded the COTS federal seed money program that got Dragon off the ground, acknowledges that President Barack Obama upped the ante to $500 million a year from $500 million total funding (*AW&ST* May 38, p. 27).

More important is what the SpaceX flight means for commercial spaceflight in the future, both the cargo missions COTS funded for SpaceX and Orbital Sciences Corp. (which plans to fly its first Antares/Cygnus stack this year), and possible human missions under NASA's commercial crew development (CCDev) effort. There was an immediate, practical impact on Capitol Hill, where the Republican-led House has adopted language "directing" NASA to pick a single CCDev vehicle to save development money. The same day that the Dragon splashed down in the Pacific, Rep. Frank Wolf (R-Va.), who chairs the House Appropriations subcommittee that handles NASA funding, agreed to soften the House position in conference committee negotiations with the Senate. In a deal negotiated with Administrator Charles Bolden, Wolf agreed to let the U.S. space agency pick "2.5 program partners"—two proposals for a full share of federal seed money to develop commercial crew vehicles, plus another company that will receive a "partial award." Wolf also accepted the Senate funding level for commercial spaceflight in fiscal 2013—$525 million—but not the $836 million NASA requested. The agreement also formalized NASA's plans to use a Federal Acquisition Regulation procurement for the integrated commercial crew systems the agency picks, instead of the less restrictive Space Act Agreements now in force.

For SpaceX itself, the successful flight meant some new business right off the bat. At one end of the spectrum, Intelsat contracted to be the first customer for the Falcon Heavy follow-on to the Falcon 9. And Spaceflight Inc., a Seattle-based startup founded by Andrews Space CEO Jason Andrews, signed up to use the Falcon for its planned secondary-payload business on missions with excess lift capacity.

"SpaceX is very proud to have the confidence of Intelsat, a leader in the satellite communication services industry," says SpaceX founder Elon Musk, who has said he plans to take his company public this year. "The Falcon Heavy has more than twice the power of the next largest rocket in the world. With this new vehicle, SpaceX launch systems now cover the entire spectrum of the launch needs for commercial, civil and national security customers."

Musk makes no secret of his desire to take over the market for launching cargo and crews to Earth orbit. The Dragon had been scarred from the beginning for commercial crew operations, and the successful rendezvous and grappling with the ISS probably gives it a leg up in the coming NASA downselect for the next round of commercial crew development support. One flight isn't going to win this space race, and Musk must be hearing the footsteps behind him as he circles the track.

Sierra Nevada Corp., which has received $100 million in CCDev funding to convert NASA's HL-20 lifting body into a hybrid-propellant commercial crew vehicle called Dream Chaser, has completed preliminary design review on the vertical-takeoff, horizontal-landing spaceplane. The review set the basic parameters of the design, architecture and performance of the integrated system, which includes its compatibility with the United Launch Alliance Atlas V that would take it to orbit. Sierra Nevada plans helicopter drop tests of the Dream Chaser, with autonomous approach and landing at Edwards AFB, this summer (*AW&ST* June 4/11, p. 14).

BY JEN DIMASCIO

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**COMMENTARY**

# What is War?

## Debate over Cyber shifts to rules of engagement

The recent revelation that the U.S. may have used cyber-worms to infiltrate Iranian centrifuges has Washington abuzz with leak rumors. But as politicians argue about whose lips should be zipped, the incident may bring out a more public discussion of cyberwarfare.

Defense Secretary Leon Panetta described last week how the nation is constantly fending off attacks and needs to move quickly to protect its financial systems and power grids from cyberattacks. "Technologically, the capability to paralyze this country is there now," Panetta told senators, responding to a question about the likelihood of a cyber "Pearl Harbor." Asked about the probability of such an attack, he said, "I think there's a high risk."

U.S. DEFENSE DEPARTMENT

**'Technologically the capability to paralyze this country is there now.'**

DEFENSE SECRETARY LEON PANETTA

The U.S., other governments and cybercriminals continue to mine computer systems seeking an advantage. Lawmakers are in the process of approving new mandates to draw up offensive cyberstrategies. But what is lacking in the public discussion, according to Senate Armed Services Committee Chairman Sen. Carl Levin (D-Mich.), is a sense of the rules of engagement governing cyberwar. "We need an understanding of what the ground rules are, because [the U.S. does] a heck of a lot of probing ourselves."

### WORLD RECORD

With the 2012 Summer Olympics just a month away, the U.S. government is poised to set a world record of its own—pulling in more than $50 billion in foreign weapons sales for the fiscal year that is not over yet. The previous record was set just last year—a tad more than $30 billion—says Andrew Shapiro, the assistant secretary of state for political military affairs. Two key sales are driving the U.S. to new levels of success in weapons brokering: The $29.4 billion sale to Saudi Arabia of 84 Boeing F-15 aircraft and upgrades, and the sale to Japan of four Lockheed Martin F-35 Joint Strike Fighter aircraft with options to buy 38 more for $10 billion. For the Obama administration, that means an economic boost in an election year. Shapiro says the Saudi deal alone will support 50,000 jobs and $3.5 billion in annual economic impact to the U.S.

At the same time, the State Department continues its effort to rewrite the U.S. Munitions List to protect only the "most sensitive" items. The administration intends "to have robust consultations with Congress" before it notifies members of the final lists and anticipates being close to overhauling the system of export controls by the end of the year. "By January of next year, we'll either be done or so close that this will be up to the next administration to push the ball over the goal line," Shapiro says.

### ON DECK

The nomination of Michael Huerta, the acting director of the FAA since last December, may finally advance. The Senate Commerce, Science and Transportation Committee has scheduled a hearing for June 21. Huerta was the agency's deputy under administrator Randy Babbitt, who resigned after being charged with driving while intoxicated. Those charges were later dismissed.

Huerta rose through the ranks of the Clinton administration's Transportation Department, before moving on to jobs with the ports of San Francisco and New York. He helped to manage the 2002 Winter Olympics in Salt Lake City. The hearing is the first step in the approval process. If the committee and the Senate OK the nomination, Huerta will be in charge of implementing the NextGen air traffic modernization during a period of declining federal spending.

### CRUSHED GEMS

Despite an appeal to protect the Gravity and Extreme Magnetism Small Explorer (GEMS), the mission is a casualty of NASA's efforts to squeeze its astrophysics budget. The explorer, slated for a November 2014 launch, was intended to study the origin of polarized X-ray emissions in the strong magnetic fields around black holes, neutron stars and supernova remnants. But GEMS's $119 million cost was projected to grow by up to 30%, and NASA opted to kill it this month. "One of the major contributors was the technology development in maturing the instrument technology so it would be ready for spaceflight," said Paul Hertz, NASA's astrophysics division director. "It has been more difficult and taken longer than originally estimated."

But the project's death won't mean a total loss to the scientific community. NASA's Nuclear Spectroscopic Telescope Array, or NuSTAR, air-launched on a Pegasus on June 13, will pick up some of the same objectives. And others may piggyback onto Japan's Astro-H mission scheduled for a 2014 launch. In addition, the agency's astrophysics division intends to select new Small Explorer missions next spring.

# Shift of Power

## As Persian Gulf carriers continue to grow rapidly, so does their influence

Qatar Airways CEO Akbar Al Baker will represent the Middle East and Africa on IATA's board of governors.

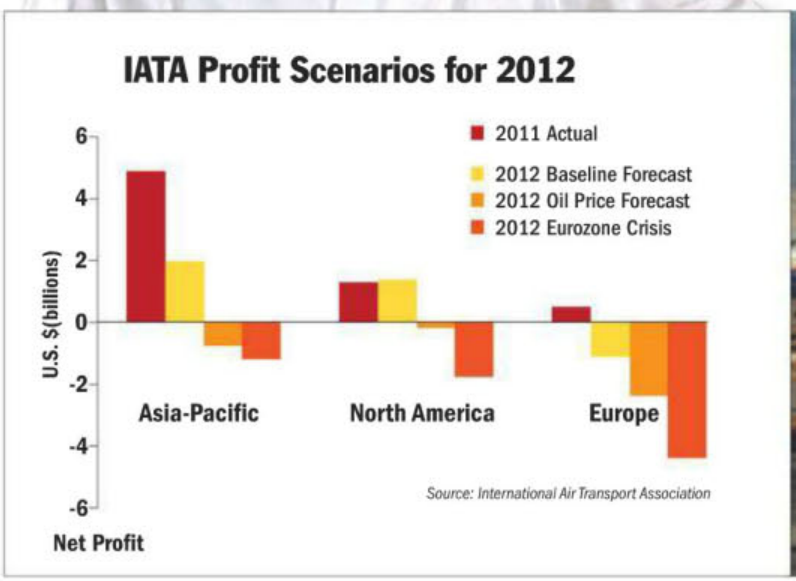
**JENS FLOTTAU, ADRIAN SCHOFIELD and BRADLEY PERRETT/BEIJING**

With huge losses for European airlines and growth in the Asia-Pacific region, the pattern of the power shift in the air transport industry is firmly set. But Middle Eastern airlines are also driving consolidation and securing key positions that give them a tight grip on the industry's general agenda.

The new balance of power comes in several shapes and sometimes is apparent in tiny instances, such as occurred on the sidelines of last week's International Air Transport Association (IATA) annual general meeting in Beijing. But all of them send a strong message. Lufthansa CEO Christoph Franz has been the most vocal opponent of the three big Persian Gulf carriers— Emirates, Etihad Airways and Qatar Airways—criticizing them for being state-owned and subsidized. He believes that the Persian Gulf carriers enjoy other unfair advantages such as access to export financing, low or no taxes and cheap labor. Franz's rage culminated in the statement that the Persian Gulf countries are a "sandpit with money."

But several high-level diplomatic interventions and a lunch date with Emirates President Tim Clark later, Franz now says he has "high respect for the entrepreneurial achievements" of his new competitors.

Their influence is stronger because Emirates, Etihad and Qatar continue to grow relentlessly, while other regions, and Europe in particular, are suffering. The shift may even lead to new partnerships in some cases. For example, Qantas has fought against the three exhaustively to protect its "Kangaroo route" between Australia and Europe, once a lucrative business. But this month, the Australian carrier said it will take a full-year net loss. Investor shock drove Qantas stock down 32%, shaving $1 billion from the company's market capitalization.




In addition to its baseline forecast, IATA issued financial predictions based on higher oil prices and a worsening Eurozone crisis. It sees a probability of only 50% for its baseline scenario.

Qantas CEO Alan Joyce, who was still elected as IATA's new chairman of the board of governors, is under immense pressure to deliver improved results. But Emirates was quick to say it is interested in a "commercial arrangement" with Qantas, as Clark said here, noting that Emirates does not want to buy a stake in the largest Australian airline. As the three Persian Gulf carriers are offering attractive connecting services through their Middle East hubs, a deal with Emirates would be similar to admitting defeat for Qantas.

Emirates does, however, want access to local feed in Australia, particularly now that its rival Etihad is picking up a 4.99% stake in Virgin Australia. Etihad CEO James Hogan would like to increase the shareholding significantly, with the deep commercial alliance between the two that includes Etihad's wet-lease of a Virgin Australia Boeing 777-300ER.

Etihad is in negotiations with Air France over a possible code-sharing agreement, and it also has stakes in Air Seychelles, Air Berlin and Aer Lingus, and its Middle Eastern competitors are considering buying into other carriers, too. Qatar Airways has invested in Cargolux and was close to purchasing Spanair before pulling out of talks early this year. Turkish Airlines, fast-growing and

ideally situated between Europe, Asia and Africa, is on the verge of taking a minority stake in LOT Polish Airlines. It is also imaginable that a Persian Gulf carrier could buy the International Airlines Group (IAG) stake that Spain's troubled financial institution Bankia might be forced to sell, a purchase no one would have foreseen a few years ago.

Qatar Airways and Etihad are also playing with the idea of joining one of the global alliances, as well. The sidelines of the IATA meeting were rife with rumors that Qatar Airways will announce it is joining Oneworld. But no announcement came, and CEO Akbar Al Baker refused to say anything on the matter. Industry executives indicate the process is not far enough along for anything more concrete at this stage.

But a potential Oneworld membership was about the only thing on which Al Baker did not have a comment, and the resonance of his opinions has grown, too. Previously, Al Baker wielded influence by writing multibillion-dollar checks for new Airbus and Boeing aircraft and scaring competitors with record rounds of passenger growth. Last year, he criticized IATA for being a club of the past, a nontransparent lobby representing the interests of old-style legacy carriers in the U.S. and Europe.

IATA's chairman for the past year, KLM CEO Peter Hartman, was forced to launch a review of the association's corporate governance and distribution of power, resulting in remarkable changes that were adopted by the general assembly. North America is losing a board seat and the Middle East and Africa are gaining one—to be filled by Al Baker. The Asia-Pacific region will also get more representation. Other governance changes include limiting board members to three three-year terms.

Hartman points out that the measures are "by no means" the end of the reforms and states that more changes can be made if members are in favor of them.

The shift in power is taking place against the backdrop of an industry on the edge, particularly in one of its former strongholds, Europe. IATA Director General and CEO Tony Tyler sees "serious downside risks" for the projected $3 billion profit of its members in 2012. "The biggest and most immediate risk is the crisis in the Eurozone," he says. "If it evolves into a banking crisis, we could face a continent-wide recession—dragging the rest of the world and our profits down." IATA's baseline forecast is for $631 billion in revenues and a $3 billion profit, a margin of 0.5%. But a 1% shift in revenues could turn the profit into a $3 billion loss.

That IATA was not forced to revise its forecast downward has to do with the fact that oil has become somewhat cheaper, relieving some pressure on operating costs. The cargo market appears to have put the worst behind it after sharply declining in the last 1-2 years, and passenger demand is still strong in several key markets, including Europe, whose airlines have nonetheless been unable to turn that demand into profitability. In fact, IATA's stable guidance masks significant deterioration in Europe, where the association now expects a combined loss of $1.1 billion, almost twice as much as it predicted only three months ago. North American airlines, by contrast, are now projected to reach a $1.4 billion profit, $500 million more than foreseen in March and a little better than in 2011.

Carriers in the Asia-Pacific region are struggling with continuing weakness in cargo traffic—despite some improvement in the first half of the year—as well as the economic slowdown in China and India, which still contribute two-thirds of the overall industry profit. The deteriorated European markets will lower Middle Eastern airline profits to $400 million from $500 million, although they are the fastest-growing carriers and have received 80% of the benefits of the slow rebound in cargo markets.

In the current cycle, global air transport profits peaked in 2010 at $15.8 billion, a margin of 2.9%. A year later, they fell to $7.9 billion, a 1.3% margin. Where they will go next depends largely on which risks will become realities and when.

IATA Chief Economist Brian Pearce says, "overall performance is still pretty good, except in Europe." Cash flows are close to mid-cycle levels and airlines have managed to keep load factors up. Pearce notes that carriers have also added capacity at a slower pace. But he is worried this might change soon with an expected up-tick in aircraft deliveries from Airbus and Boeing this year.

"The problem is that the rest of this year looks very uncertain," Pearce says. "We expect further deterioration in Europe; the second half will be worse." The IATA guidance assumes anything up to and including a Greek exit from the Eurozone, but nothing more dramatic. The guidance also assumes a weak U.S. economic recovery, no hard landing of the Chinese economy, no Iran conflict and an average oil price of $110 per barrel.

To bolster airlines' ability to capitalize on demand, meanwhile, IATA is proceeding with its initiative for airline distribution. Tyler says the global distribution systems "have not been able to facilitate innovation like we have seen in other industries." Therefore product innovations "cannot break free of product descriptions limited to booking classes such as F, C or Y and their derivatives," he says.

IATA is working on new distribution standards that better enable airline differentiation; the foundation standard, to

REUTERS/LANDOV FILE PHOTO

**IATA's general meeting in Beijing underscored how rising demand in the Asia-Pacific region and economic turmoil in Europe are creating opportunities for carriers in the Middle East.**

be defined this year, will be the basis for a common interface between airlines, consumer applications, distributors, travel agents or even other airlines. The common interface is also intended to allow airlines to make offers tailored to individual consumers. The business case for the new system and a road map for its implementation are to be presented at the World Passenger Symposium 2012 in Abu Dhabi in October.

Separately, to save costs, IATA is consolidating its global operations, reducing the number of local offices to 45 from 59. The remaining offices will in turn take on a broader role and drive global campaigns on a local level. The IATA financial settlement system will be consolidated into five hubs: Miami, Amman, Beijing, Madrid and Singapore.

# Trading Shots

## While EU emissions rhetoric grows louder, ICAO works on global emissions solution

**ADRIAN SCHOFIELD, BRADLEY PERRETT and JENS FLOTTAU/BEIJING**

As international pressure mounts against Europe's attempt to make airlines pay for emissions, progress is being made on a global plan that offers the best hope of preventing a political standoff from turning into a full-blown trade war.

The inclusion in the European Union's emissions trading system (ETS) of non-European carriers that operate in the region has raised the ire of governments around the world. And as the first deadline to buy emissions credits draws closer, Europe's refusal to back down is giving all parties less room to maneuver.

About the only thing the opposing sides agree on is that a broader international approach developed under the auspices of the International Civil Aviation Organization could supersede the EU ETS. The intention is to use market-based measures to encourage emission reductions.

While the process of developing such a plan still has a long way to go, it is moving in the right direction. An ad hoc group of ICAO member states—and the EU—are examining which measures would work best and how they could be implemented.

The group comprises representatives of 11 ICAO members and a few stakeholders such as the International Air Transport Association (IATA). It is expected to report on its efforts at an ICAO council session this month, issue a further progress report in November and present proposals by year-end in preparation for a decision at the 38th ICAO Assembly in October 2013.

IATA Director General Tony Tyler says he is "very encouraged by the recent progress at ICAO." The group's work means that "for the first time there will be concrete [global] proposals on the table for states to consider," he says.

Four options are being considered: a global offset program, an offset program that would generate additional revenue to be channeled to emissions-reductions efforts, a global emissions-trading system, and a similar credit-trading system based on airline efficiency gains rather than emission volumes. This list is likely to be whittled by the time the ad hoc group reports again in November, says Paul Steele, IATA's director for aviation environment.

It is still too early to pick which is the most likely framework to emerge from the ICAO process, Steele says. The ad hoc group is so far only examining the technical aspects of the various options, but there will be cost and political feasibility considerations, too.

While it is encouraging that the EU is engaged in the ad hoc group, its refusal to back away from the ETS timetable is threatening the entire process, says Steele. In April 2013, the EU will require airlines to submit credits they have bought for emissions that exceed allowance levels. The response of non-European airlines to this deadline will determine whether governments on both sides of the issue will engage in retaliatory actions.

Tyler notes that the deadline means Europe is effectively negotiating with "a gun to the head" of the states opposed to the EU ETS. While all parties, including Europe, agree that a global solution is needed, achieving it will be "impossible under current conditions," says Tyler.

Steele says it is important for the EU to make a "tangible step away" from the April deadline, which would encourage governments to "negotiate in good faith."

Under the EU ETS, aircraft emissions will be calculated for a whole flight, not just the segment in European airspace. Airlines argue that this disadvantages some carriers unfairly, since their connecting hubs are further away. Carriers are also concerned that an emerging global patchwork of emissions measures will be burdensome for the industry.

But Steele notes that the issue has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**China has forbidden its airlines from participating in the European emissions trading system.**


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moved far beyond the cost to industry. Non-European governments are concerned about sovereignty issues, since the EU unilaterally imposed its measures on foreign airlines. Some countries have gone so far as to ban their carriers from participating in the EU ETS.

A group of 29 governments has also outlined a set of retaliatory measures it may take if the EU ETS proceeds. These include reconsidering air service agreements and open-skies deals with European nations and the EU. Levies may also be imposed on European airlines.

Steele says the situation is "extremely charged" at the moment. It is not yet at the level of a trade war, but "we are on the brink of something like that happening."

China has gone a step further than other countries, not only prohibiting its carriers from participating in the EU ETS but also using its Airbus order backlog as leverage.

Airbus needs sign-off from the Chinese government to finalize 35 orders for A330s that are due to be delivered to Chinese carriers from next year. The approval is being withheld due to the ETS dispute. Airbus officials say 10 A380 orders are also affected.

# Oneworld Widens

## Consolidation and regional growth lead to changes in airline alliance membership

**JENS FLOTTAU, ADRIAN SCHOFIELD and BRADLEY PERRETT/BEIJING**

India and Latin America, among the fastest-growing air transport markets, are catching the attention of the global airline alliances, and Oneworld is the one gaining in both of them.

The alliance announced that it will take on SriLankan Airlines as its next membership candidate. While the process is on hold for Kingfisher Airlines because of its financial troubles, the group will have much better access to India through SriLankan's large network in the subcontinent. In Latin America, Oneworld will be able to keep LAN, while TAM Brazil will likely be forced to leave Star to comply with antitrust conditions for its merger with LAN.

Oneworld announced last week that SriLankan will be joining the alliance, although the full membership process will likely take until late 2013. Using its fleet of 21 aircraft and Colombo hub, the carrier operates a sizable network in Southern India. It also dominates international traffic to the Maldives, a popular tourist destination. The carrier "serves a very important part of the world where we haven't had a lot of physical presence," Oneworld Chief Executive Bruce Ashby tells Aviation Week.

SriLankan already code-shares with Malaysia Airlines, which is also in the process of joining Oneworld. SriLankan has agreements in principle to code-share with Oneworld carriers Royal Jordanian and S7 Airlines as well, and deals with other alliance members are likely to occur during the membership process, Ashby says. SriLankan intersects with the Oneworld network at major hubs in Europe and Asia.

Kapila Chandrasena, SriLankan's CEO, says code-sharing will be sought with Cathay Pacific Airways, too. He notes that Cathay already serves Colombo and SriLankan serves Hong Kong, and he says the benefit to SriLankan would be leveraging Cathay's network to North America and China.

SriLankan has been growing rapidly, doubling its fleet over the past two years, to 21 aircraft: eight Airbus A320s, seven A330-200s and six A340-300s. All are on operating leases. The carrier's current five-year plan is to grow to 26 aircraft by 2016.


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With AviancaTaca and Copa scheduled to join the Star Alliance this week at official events in Bogota and Panama City, even the group itself expects its current Brazilian member TAM to leave at least in the medium term. Oneworld will benefit the most.

"There have been clear signals that TAM will get out," Lufthansa CEO Christoph Franz tells Aviation Week. He points out, however, that TAM has so far not formally declared it will exit.

LAN and TAM were to finalize their merger formally June 12 with the end of the takeover offer to TAM's current shareholders, although that period has been extended by 10 days to reach a 95% mark needed for a mandatory sell-off of the remaining minority shares. The Chilean antitrust regulator has approved the transaction only under the condition that the emerging Latam will not be part of the same alliance as its main Latin American rival, AviancaTaca. It has allowed a transition period giving TAM a year before it must make a formal move.

**SriLankan's extensive network to India will make it an important Oneworld member, providing connections in a part of the world where the alliance has little representation.**

AviancaTaca and Copa are strong players in the northern part of Latin America and have good connections to North America, but once TAM leaves, Star will lack a partner in the region's biggest economy, Brazil.

LAN is expected to remain a member of Oneworld, but TAM's future is unclear. Industry officials say one option would be for the Brazilian carrier to leave Star and become an independent airline with bilateral relationships in different camps. Not joining Oneworld would allow TAM to keep its existing ties with Star carriers such as United Airlines or Lufthansa while adding more in other camps.


The first P-8A Poseidon, the world's most advanced maritime patrol aircraft, was recently delivered to the U.S. Navy. On time and on-budget, the P-8A will soon provide critical capabilities the U.S. Navy and allies need to keep sea lanes open and combat the increasing threat of hostile submarines. Poseidon is on its way, with all due speed.

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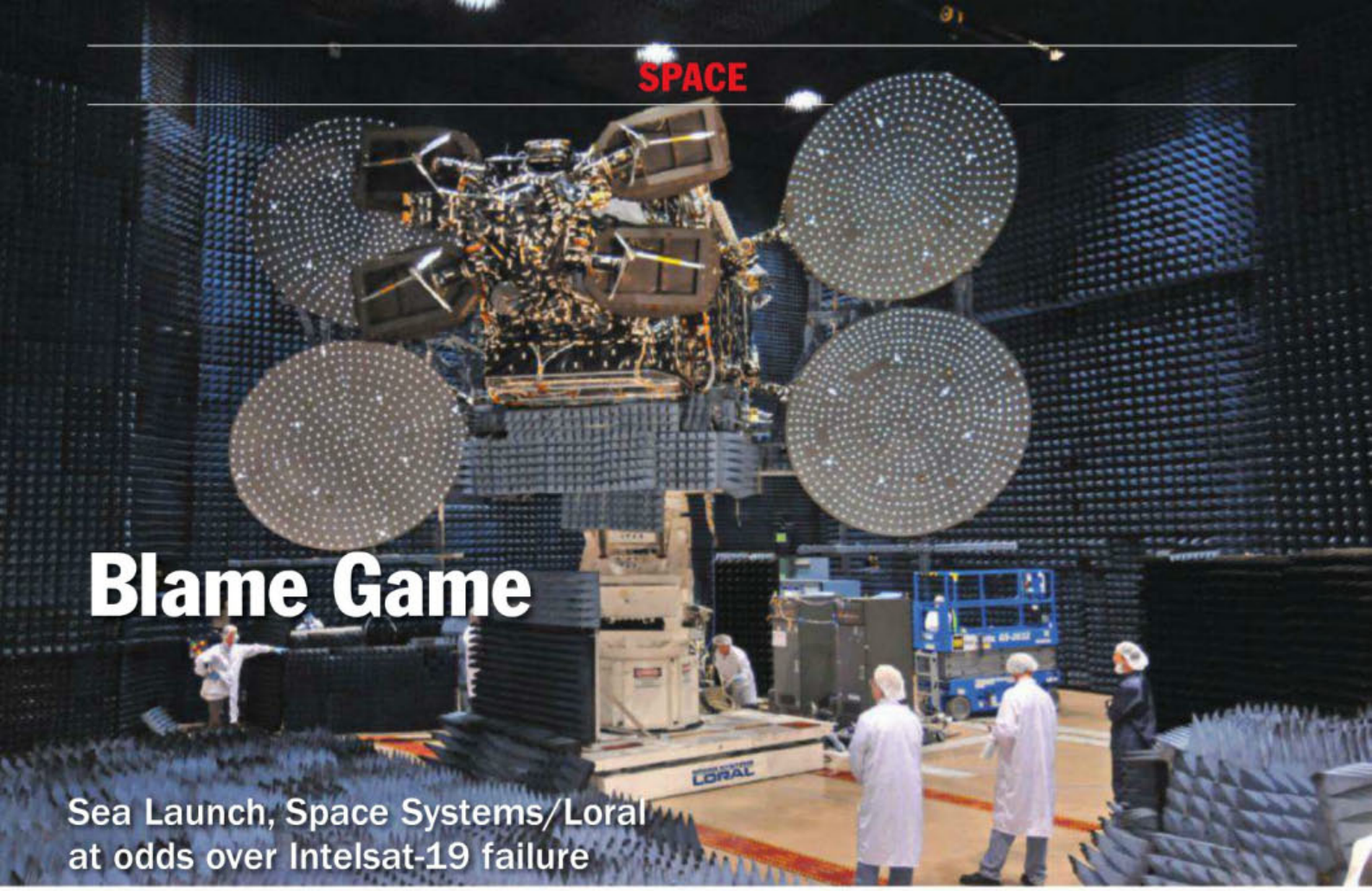
# Blame Game

## Sea Launch, Space Systems/Loral at odds over Intelsat-19 failure



HUGHES NETWORK SYSTEMS

**The $K_a$-band EchoStar 17 satellite is based on the same Loral-built LS-1300 spacecraft bus that failed to deploy one of two solar array panels on the Intelsat-19 spacecraft launched May 31 atop a Sea Launch rocket.**

**AMY SVITAK/PARIS**

Rarely has the delicate balance between risk and reward been so clearly on display as it has been since the unexplained May 31 failure of a large commercial telecom satellite to deploy one of its two solar arrays.

While the owner of the Intelsat-19 satellite, Luxembourg- and Washington-based Intelsat, is able to analyze what went wrong at its leisure, such is not the case for two fleet operators preparing to loft similarly built satellites from two separate launch sites in the coming days.

Both the SES-5 satellite, owned by SES of Luxembourg, and the EchoStar 17 spacecraft owned by U.S.-based Hughes Network Systems/EchoStar, feature solar array panel-deployment mechanisms built by Space Systems/Loral that are nearly identical to those on Intelsat-19.

As a result, plans to launch both satellites ground to a halt following the May 31 Intelsat-19 failure, which happened shortly after liftoff atop a Sea Launch rocket from an ocean-based platform on the equator.

For SES and EchoStar, every day that passes without their satellites in orbit means mounting revenue losses, leaving both companies anxious to see their spacecraft lofted to orbit. For the respective launch-service providers—Reston, Va.-based International Launch Services (ILS), which markets Russia's Proton vehicle, and Europe's Arianespace consortium—maintaining the current schedule despite any uncertainties means sticking to their 2012 business plans.

The situation is more complicated for Arianespace, which has the added pressure of launching a second spacecraft, Europe's MSG-3 meteorological satellite, aboard the EchoStar 17 mission.

Since the Intelsat-19 failure, Sea Launch and satellite builder Space Systems/Loral have issued statements using the same argument to point the finger of blame at one another. The only other time a similar failure occurred was in 2004, when Sea Launch delivered the Loral-built Telstar 14/Estrela do Sul-1 satellite to geostationary transfer orbit.

In both cases, Sea Launch and Space Systems/Loral detected an out-of-boundary pressure event some 72 sec. after liftoff. And, in both cases, the satellite was released with a solar array panel that refused to deploy.

Last week Bern, Switzerland-based Sea Launch released preliminary "quick look" telemetry data, saying its rocket performed nominally during launch all the way through separation of the payload fairing and satellite release. But it will take at least several days, if not more, to fully analyze all the telemetry available to Sea Launch.

In the meantime, the clock is ticking for EchoStar, SES, ILS, Arianespace and Space Systems/Loral, not to mention the satellite operators' insurers, who have hundreds of millions of dollars riding on the SES-5 and EchoStar 17 satellites.

On June 11, Arianespace said it had rescheduled liftoff of MSG-3 and EchoStar 17 to July 5 from June 19 to give Hughes/EchoStar time to conduct additional checks of the $K_a$-band satellite. The following day, ILS said it would go ahead with a June 20 launch of SES-5 by a Proton-M/Breeze-M rocket from the Baikonur Cosmodrome in Kazakhstan. But it is entirely possible that no definitive answers about what happened to Intelsat-19 will be available before these launch dates.

U.S. ARMY

# Fly to Buy

## U.S. Army wants to test what industry can offer before another armed scout contest

**GRAHAM WARWICK/WASHINGTON**

Having canceled the replacement for its hard-flown Bell OH-58D Kiowa Warrior armed scout helicopter not once, but twice, the U.S. Army is anxious to avoid any mistakes this time around.

Industry is telling the Army it can build helicopters for the Armed Aerial Scout (AAS) mission, and has built demonstrators to prove it. But having failed first with the Boeing Sikorsky RAH-66 Comanche in 2004 and then with the Bell ARH-70 Arapaho in 2008, the service is being cautious.

The Army is not abandoning the Kiowa Warrior. Cockpit and sensor obsolescence is being tackled with the OH-58F upgrade, and the Army is keeping open its option to extend the service life of the F-model. But the service also is asking industry for information on designs that could replace the armed scout and to volunteer its helicopters for a flight demonstration.

This is not a flyoff competition, the service stresses, but an evaluation intended to inform a decision by year-end on whether the AAS requirement is to be fulfilled by a Kiowa Warrior service life extension program (SLEP) or by launching a "full and open competition" for a new armed scout helicopter.

It is a strategy not without risk. The Army already has a funding wedge in the budget plan for the SLEP, but this option requires the service to live with the OH-58D's performance and survivability limitations. The alternative requires the Army to divert SLEP funds to pay for development of a new helicopter, and accept the risk in keeping an aging Kiowa Warrior fleet flying until the replacement AAS is fielded.

The strategy was approved by the Pentagon in May, and the Army met with industry late last month to discuss its plans for the AAS request for information (RFI) and voluntary flight demonstration (VFD). "We had a good response from industry and expect that four or five [companies] will demonstrate technology and capability with a flyable aircraft," says an Army spokeswoman.

"The flight demos may begin as early as the end of June and are projected to be complete in October/November," she says. "We have planned approximately two weeks with each vendor for the flight demos, which could vary depending on the individual scope."

Bell Helicopter is planning to participate in the VFD with the OH-58D Block 2, Boeing with the AH-6i, EADS North America with the AAS-72X and MD Helicopters with the MD 540. AgustaWestland has not confirmed whether it intends to participate. These and other interested companies have until July 2 to respond to the Army's RFI, which seeks information on "commercial, commercial-modified, military [and] conceptual" contenders for AAS. The RFI projects an average procurement unit cost for the AAS of $13-15 million, based on a requirement for 428 aircraft. At its cancellation, the ARH-70's projected cost had increased more than 70% to $14.5 million.

This has been a long process. Companies responded to the first RFI in March 2010, and have continued to invest in-

**Funding to extend the service life of the Kiowa Warrior has been reserved in case the Army decides a replacement is too risky.**

ternal R&D in improving and demonstrating their helicopters' capabilities. Recognizing this, the Army has updated the RFI, increasing the weight of avionics, mission equipment and armor to be carried by 50 lb. to 770 lb., based on the current OH-58D and upgraded OH-58F to be fielded in 2017.

The Army completed a lengthy AAS analysis of alternatives in May 2011, identifying significant performance, lethality, survivability and interoperability gaps not met by the OH-58D/F. But the service determined it could not afford to develop a clean-sheet aircraft, so instead it will assess data from the RFI and VFD to "determine if an achievable, affordable capability exists [to mitigate the gaps] with moderate risk."

While the RFI is open to any existing or conceptual aircraft, attention is focused on those helicopters that are available to be evaluated by the Army in the VFD. The service stresses that aircraft participating in the demonstration will be evaluated not against each other, or the AAS requirement, but against the RFI responses to help understand the technology, cost and schedule risks in each bidder's proposed AAS solution.

Detailed cost and risk assessments by industry and the Army are a key part of the process. None of the off-the-shelf helicopters are expected to meet the AAS requirement, so the Army must decide if the capability beyond the OH-58F SLEP that is offered is worth the risk of not modernizing the Kiowa Warrior and instead procuring a new aircraft. Experience with the RAH-66 and ARH-70 ensures industry has a high hurdle to cross in convincing the Army it will deliver on AAS.

The Army has scheduled up to five demonstrations, each involving about 10 hr. of flying to assess performance, handling qualities and human factors. Flights will include a complete mission profile to measure fuel burn and assess cockpit systems.

# Resurrecting Seasprite

## New Zealand sees value in ex-Australian Navy helicopters

**LEITHEN FRANCIS/SINGAPORE**

New Zealand's government will face an uphill political battle convincing the public that buying 11 ex-Australian navy Kaman SH-2G Super Seasprite helicopters makes sense. Nonetheless, officials seem convinced the purchase is worth the money.

Defense Minister Jonathan Coleman says New Zealand received an unsolicited offer from Kaman Corp. and that the ministry has already done some due diligence and received authorization from the cabinet to negotiate with the manufacturer. "We're not considering any other types of helicopters at this stage," says Coleman. "We are very familiar with the Seasprites and we are facing a tight budget fiscal situation." If New Zealand were to switch to another type, it would have to retrain its pilots and invest in new training equipment.

"Some in New Zealand's mainstream news media have [asked] 'why are we considering buying Aussie castoffs?'," says Coleman, who spoke to Aviation Week on the sidelines of the IISS Shangri-La Dialogue in Singapore in early June. "We've been assured [by Kaman] the issues relating to the Seasprites have been corrected. We're investigating further to see if the helicopters will meet our needs and ... would achieve airworthiness certificates in New Zealand," he says.

With 11 Seasprites, the country could get needed capability at a good price, Coleman says. "It would be foolish for us not to consider it." He adds that Australia spent an enormous amount to upgrade the helicopters with state-of-the-art technology, to the extent that these "are effectively brand-new helicopters."

New Zealand needs more naval helicopters, he says, because without them it "can't optimize its maritime assets." The country would like to have naval helicopters stationed on many of its offshore patrol vessels.

Australia's Labor government decided in early 2008 to offload the Seasprites, arguing they were unsafe. The Australian defense minister at the time, Joel Fitzgibbon, said in a March 2008 press conference: "The Seasprite project had to be canceled on safety grounds alone." He added: "The airworthiness and crashworthiness of the aircraft was not up to 21st-century standards and it was pretty clear the capability was not likely to be delivered in full." Whether the Seasprites are unsafe is a matter of conjecture. It could be argued that Fitzgibbon made those claims to tarnish the Liberal and National parties. The earlier Liberal-National coalition government signed the contract with Kaman.

Coleman says if the deal with Kaman goes ahead, New Zealand will sell its existing five SH-2G Super Seasprites to the manufacturer. This route is appealing, because New Zealand has had difficulty finding buyers for its old equipment, he says.

For example, the air force's eight Douglas A/TA-4K Skyhawk ground-attack aircraft have been in storage awaiting buyers for about 10 years. Coleman, however, says the country has recently secured a non-military buyer for the Skyhawks and that the details will be released soon. An earlier impediment to any sale involved obtaining U.S. State Department approval, he says. New Zealand's Skyhawks are fitted with a Westinghouse (now Northrop Grumman) APG-66, the same type of radar as on Lockheed Martin F-16A/B Block 15 fighters.

The air force, meanwhile, has a requirement for trainer aircraft. Currently the service uses 12 Pacific Aerospace CT-4 single-engine trainers and five Beechcraft KingAir 200 multiengine trainers. The Air force chief, Air Vice Marshal Peter Stockwell, says the leases on the KingAir 200s and CT4s expire at the end of June. He says the lease on the CT4s will be renewed, but the air force plans to replace its five KingAir 200s. "We are currently in negotiations with Hawker Pacific to conclude a contract to lease five second-hand KingAir 200s to replace the fleet currently leased from Aeromotive," he says. "This follows a competitive tender process," says Stockwell, adding that the replacement aircraft "will have Proline 21 glass cockpits to provide a standard fit across the fleet and give better lead-in training for the operational fleets that we are currently introducing, which all have glass cockpits." Stockwell told Aviation Week in February the issue they had with Aeromotive's KingAirs was a lack of cockpit commonality; there are four different cockpits among the five aircraft.

The air force also seeks a more advanced single-engine trainer to supplement CT4s. Contenders are the Beechcraft T-6 Texan II, Pilatus PC-7MKII and Korean Aerospace Industries KT-1.

Coleman says: "We will need new training aircraft and I'd be expecting to receive some initial advice over the next six months." When asked when New Zealand will be in a position to order the trainers, he replies: "Over the next couple of years. I can't give a more specific timeframe. But we know we've got to do something."

**In 2008, an Australian navy Seasprite was wrapped and ready to be shipped back to Kaman in the U.S.**

AUSTRALIAN DEFENSE DEPARTMENT

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# Economy Class

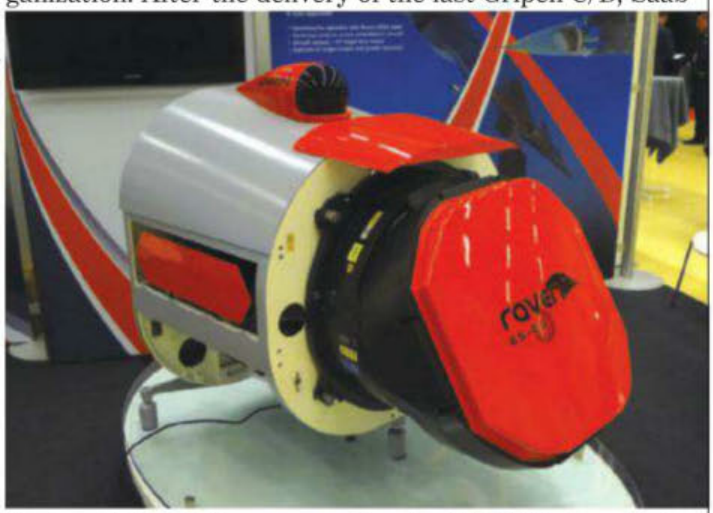
## Low operating costs should secure Gripen's future

**BILL SWEETMAN/MALMEN AB, SWEDEN**

Provided nationally endorsed plans in Sweden and Switzerland survive political or economic upsets, the JAS 39E/F, the product of the Gripen Demo and Next Generation programs, will be delivered to customers in 2018. This will mean that Saab and its supplier team will have created what is in most respects an entirely new aircraft, compared to the original JAS 39A/B, since development of the in-service C/D started in June 1997.

This has been done so far under fixed-price contracts for development, new production and retrofits, according to a presentation by FMV, the Swedish defense procurement organization. After the delivery of the last Gripen C/D, Saab returned an unspecified sum of money to the Swedish government because costs were lower than predicted.

BILL SWEETMAN/AW&ST




**Mockup of Selex Galileo sensor package for JAS 39E/F shows single-rotation repositioner and side-looking phased-array IFF antennas.**

More details of the JAS 39E/F emerged at an aerospace conference hosted by the Swedish air force and Saab earlier this month at Malmen air base, and attended by current and prospective Gripen operators.

The schedule is set by two interlocking commitments. The Swedish government has decided to replace the C/D with the E/F and has committed to developing the aircraft in time to support Switzerland's requirements. The Swiss government has selected the E/F as the sole affordable replacement for the F-5E/F, and subject to a referendum and negotiations will sign a contract in 2014, triggering a full-scale go-ahead by Sweden.

Some development work will continue to lay the foundation for the four-year program. As long as the political process stays on track, the first of two built-from-the-ground-up E/F development aircraft, identified as 39-8, will fly in late 2013. The Gripen Demo has been equipped with a prototype of the Selex Raven ES-05 active, electronically scanned array radar and will be used to test the E/F's revised avionics system and weapons.

The E/F airframe will be largely new, although it should be possible to use some major components from existing C/D airframes, including the wings. Mid and aft fuselage sections will be new, to accommodate the General Electric F414 engine (and its larger airflow) and the new landing gear. The blended wing-body sections will be larger, placing the wing attachment points an estimated 30 in. farther apart. The goal is to maintain the same wing loading for the E/F's 2.5-ton increase in gross weight. The body will be slightly longer, maintaining or improving fineness ratio. Sources suggest the design will incorporate F-35-style diverterless supersonic inlets.

The E/F is expected to supercruise with weapons carried. Still under discussion is whether to use the Enhanced Performance Engine (EPE) version of the F414, which could be configured to deliver more thrust, better fuel efficiency or a combination of the two.

A mock-up of the Selex Galileo sensor suite for the E/F was on display at Malmen, confirming important features of the design. The Raven ES-05 features a "repositioner": the AESA is sharply canted and mounted on a rotating bearing, giving it a +-100-deg. field of regard, almost twice that of a fixed AESA. It has a single bearing, unlike the more complex two-bearing design planned for the Eurofighter Typhoon, reducing weight and cost.

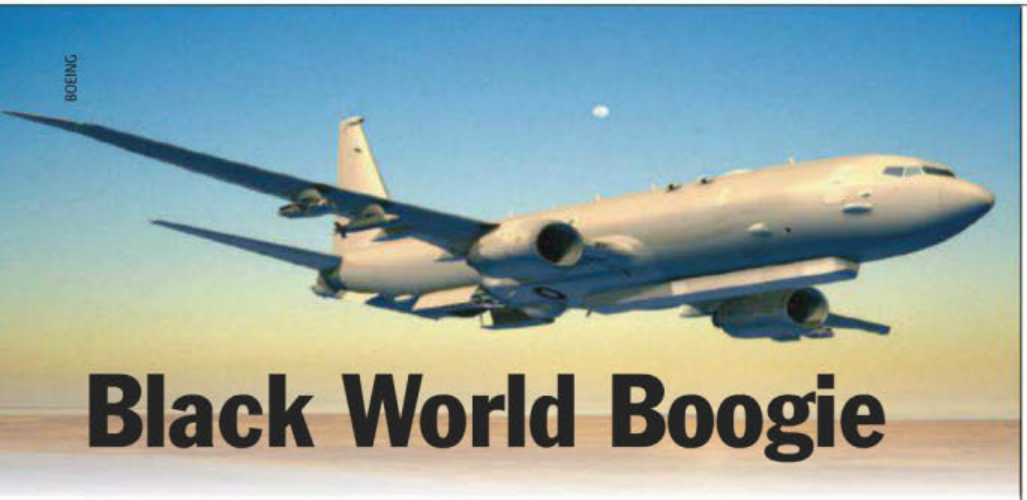
The AESA incorporates an identification friend-or-foe (IFF) function that works in conjunction with the SIT 426 IFF. The latter features large active-array antennas on the fuselage sides, behind the radome, providing unprecedented IFF coverage in azimuth and range. Finally, the Skyward-G infrared search-and-track system is air-cooled—reducing weight.

The sensor suite design, focused on low weight, supports part of the E/F strategy, which is to provide a common upgrade path for new E/F customers and current C/D operators by making the new sensors, and the revised avionics system, retrofittable to the C/D.

This in turn supports the economic strategy behind Gripen. While the fighter's flyaway costs are not quoted, a senior Swedish officer notes that "it is not a cheap aircraft" to acquire. On the other hand, new Swedish Defense Minister Karin Enstrom said in an interview at Malmen that "the alternatives are not viable, either." This reflects the fact that the operating costs of the Gripen are claimed to be far lower than those of any competitor.

According to Swiss air force Chief of Staff Lt. Gen. Marcus Gygax, the national evaluation showed that the Dassault Rafale and Typhoon would have costs per flight-hour within a few per cent of one another—but roughly twice that of the JAS 39E/F. (Gygax also confirms that leaked reports out of Swiss weapons acquisition agency Armasuisse are based on old data and do not reflect the Gripen configuration chosen by Switzerland.)

Norway, in its 2008 evaluation of Gripen against the F-35, penalized the Swedish fighter with life-cycle cost estimates based on high upgrade development costs, spread over a small number of aircraft. However, Swedish leaders point to the C/D—which includes a new cockpit, data link and electronic warfare system, developed at far lower cost than most comparable upgrades. The E/F's new central avionics system is intended to feature an unprecedented degree of partitioning between mission systems and flight-critical functions, reducing development and upgrade times and costs. According to Saab, flight-critical systems take as much time and money in verification and testing as they do in initial design, but the E/F mission systems should be verified in 10-15% of that time. Gygax points out that with a common C/D upgrade path, the E/F operators will be part of the same community as current operators of the type.


BOEING

# Black World Boogie

## Closely held Navy/Raytheon program evades competition

**BILL SWEETMAN/WASHINGTON**

A full-scale development program is underway to develop a version of the U. S. Navy's Boeing P-8A Poseidon maritime patrol aircraft (MPA), fitted with a long-range, high-resolution surveillance radar. It could provide a ready-made, Navy-funded replacement for the aging Joint Stars while potentially performing maritime targeting missions.

The Raytheon Advanced Airborne Sensor (AAS) project, which has been under contract since July 2009, has received Milestone B approval for development and production planning and is proceeding toward critical design review.

Boeing received a $277 million contract in February to modify the first P-8A, aircraft T-1, for aerodynamic and structural tests of the AAS radar pod, which is carried under the fuselage. Those tests are to be completed by August 2016. The radar itself, a much-modernized evolutionary development of the Raytheon APS-149 Littoral Surveillance Radar System (LSRS) is to be tested on a P-3C Orion, the current carrier for the APS-149. The value of the radar development contract has not been disclosed.

The Navy's goal is to acquire an undisclosed number of AAS systems and A-kits (parts that are attached to the aircraft to support the radar) and to configure some P-8As to carry the radar. Initial operational capability dates are also secret, but Boeing/Navy P-8A briefings suggest it is likely to follow the 2016 fielding of the P-8A's Increment 2 upgrade.

The P-8A radar plan has been in the works for almost a decade, but has been shrouded in secrecy because its predecessor, LSRS, was a black program—a classified and unacknowledged effort. To this day, although some AAS-related contracts have been announced, the program has no publicly visible budget. None of its elements has been competed or subjected to a formal analysis of alternatives process. AAS is managed by a one-program office, Advanced Sensor Technology, under the direction of Rear Adm. Don Gaddis, program executive officer for tactical aviation at Naval Air Systems Command.

LSRS itself was developed by the former Texas Instruments unit of Raytheon, which has historically provided Navy patrol aircraft with their search radars. The program started in the late 1990s or early 2000s and attained early operational capability in 2005, carried on P-3Cs flown by patrol squadron VP-46 out of NAS Whidbey Island, Wash. After the program was mentioned (apparently accidentally) in an unclassified document, and the modified aircraft had been photographed in transit to and from the Middle East, a small amount of information was released.

It is known that the LSRS P-3s have been extensively used both to support combat operations—not only for the Navy—and for tests and demonstrations, including tracking both land and maritime moving targets for engagements by stand-off missiles.

Based on active, electronically scanned array technology, LSRS has been assessed as far superior to the older APY-7 carried by Joint Stars. The antenna is double-sided, so the aircraft can scan simultaneously to left or right, and the radar can interleave ground moving target indication (GMTI) and synthetic aperture radar (SAR) modes rather than being restricted to one mode at a time.

**Artist's concept of P-8A variant with the Advanced Airborne Sensor and AGM-154 Joint Standoff Weapon, a version of which is in the running to replace the Harpoon anti-ship missile.**

AAS is expected to be more capable than LSRS, and will include new features such as NetTrack, developed by the Defense Advanced Research Projects Agency, to track high-value targets—for example, key insurgent personnel and their vehicles—in high-clutter environments, by using high-range resolution radar measurements. AAS has what Boeing describes as "weapon-capability" accuracy, and Boeing illustrations and videos show aircraft directly striking ground targets with Small Diameter Bombs.

However, the system could also have potential for maritime operations. In 2004, the USAF used Joint Stars to guide datalinked weapons onto ship targets in the Resultant Fury exercise, using technology from the Affordable Moving Surface Target Engagement project. The latest Naval Aviation Vision report, published in March, discussed development of a follow-on strike weapon to replace Harpoon and SLAM-ER, which will be "net-enabled" and a maritime interdiction version of Tomahawk—both of which would be designed to exploit long-range, high-resolution targeting from other platforms.

Plans to develop this version of the P-8A started in 2003, before Boeing was selected as the winner of the Navy's Multi-mission Maritime Aircraft (MMA) program. At that time, Boeing changed the basis of its MMA design from the 737-700 to the longer-bodied 737-800 and introduced an aft weapon bay and two forward-fuselage centerline hardpoints. At the time, Boeing would only say the design was to accommodate a classified Navy capability, but in fact, it was to accommodate the antenna of the LSRS.

The inter-service politics of the program are intricate. The Navy is apparently willing to dedicate some of its P-8s to a largely overland, joint-service mission, possibly to maintain support for its large MPA force, while Boeing sees potential for selling up to 15 air-ground surveillance versions of the P-8A to the Air Force to replace Joint Stars. The USAF "is really fighting to not put any more money into large-platform GMTI," says one observer. "I can't honestly see how they win that fight in the long run. It's too easy for the Army to claim they absolutely need GMTI and the Air force must provide it."

# Last Stand

## Military, airlines team up to save biofuels initiative

**JEN DIMASCIO/WASHINGTON**

U.S. NAVY

**In 2010, the U.S. Navy demonstrated a blend of camelina-based biofuel and conventional jet fuel on an AV-8B Harrier.**

Whether the U.S. Navy's first demonstration of a biofuel-powered fleet represents a one-off effort or the potential start of a new industry may now rest in the hands of the U.S. Senate.

The Navy bought 450,000 gal. of fuel—made from algae or other crops—for about $27 per gallon to power its "Great Green Fleet" in the Rim of the Pacific exercises scheduled to start later this month. But if the defense authorization bill passed by the Senate Armed Services Committee stands, the biofuel-powered fleet will run aground next year.

Citing the need to cut spending during a time of ballooning deficits, both the Senate Armed Services Committee and the House voted to block the military's development of advanced biofuels that cost more than regular diesel.

For those trying to launch the biofuel industry, the Pentagon is ideal. The military is the largest consumer of fuel in the U.S., and can support purchases large enough to help seed commercialization. But the military also has a keen interest in the program, since for every dollar increase in the price of a barrel of oil, the Pentagon must pay another $130 million per year. Already, the military is trying to offset spending by another $3 billion because of fuel price increases in fiscal 2012.

These congressional actions represent a blow not only to the Pentagon's plans for reducing U.S. dependence on foreign oil, but also the airline industry's hopes for reducing carbon emissions.

# Tactical Moves

## UAV plans take shape in France and German

**ROBERT WALL and AMY SVITAK/PARIS**

European unmanned aircraft programs advance in stops and starts, but given current budget limitations any movement is welcome.

In Germany and France, there are now signs that long-expected unmanned aircraft modernization programs may be gaining traction, if only at an early stage. Both countries are mulling whether fixed-wing or helicopter-based systems are the way forward, or whether they should buy a mix of systems. Despite much discussion in Europe about cooperation on new procurements, at this point there is no indication that Berlin and Paris plan to work hand-in-hand.

Germany is starting to think about how to replace its KZO and Luna tactical UAVs now used in Afghanistan. The timeline is not set, but it has industry looking at options. German unmanned aircraft maker EMT is working on the Luna NG (next-generation) which is still in the development and concept phase. The exact configuration is still evolving and will largely depend on where the German military's requirement ends up.

The NG will feature greater payload capacity and endurance than the existing version. The payload is expected to be variable, between 15 kg (33 lb.) and 30 kg, depending on how users want to trade payload for endurance (the current Luna has a payload of around 5 kg). At 15 kg, EMT targets 14-hr. endurance. A demonstration flight of the Luna NG is likely before year-end, a company official says.

The Luna NG would be able to carry multiple payloads. Like Luna, it could act as a beyond line-of-sight relay for other Luna NGs, but do so even while carrying a surveillance sensor.

With uncertainty over whether Germany will also opt for a vertical-takeoff-and-landing system, EMT is keeping a foot in both camps and is finishing assembly of the 130-kg-class Museco helicopter unmanned aircraft. It is to be delivered soon to the German defense ministry's armaments agency, the BWB.

EADS also has its eye on the market and is about to take control of a UAV joint venture in Germany that combines Rheinmetall's programs, such as KZO, with its own, says Nicolas Chamussy, head of unmanned systems at Cassidian. The company is looking at a tactical system that could operate in more austere conditions than larger tactical unmanned aircraft, such as the Thales Watchkeeeper the U.K. is buying.

In France, the military has recently issued a request for information for its tactical unmanned aircraft. The goal is to define what a future requirement should look like, industry officials say. The army undertook a similar exercise several years ago, but never moved to procurement.

Sagem, a previous provider of that capability to the French army, is looking at the Patroller-S UAV as a candidate. The modular UAV can be fitted with pod-mounted payloads for flights lasting 20-30 hr. at a maximum altitude of 25,000 ft.

Sagem recently completed a series of 18 test flights of the system during flight trials conducted in March. The UAV carried a new version of the Sagem Euroflir 350 gyrostabilized

If advocates for the nascent industry want to keep the Pentagon's program alive, they will first face a heated Senate floor debate and then a contentious and divided conference process to resolve the difference between the two bills. The Senate is likely to consider the defense authorization bill in mid- to late July.

Passage of the biofuel provision was a bit of a surprise, since biofuels are supported by many Democrats, who hold a majority in the Senate. But Democrats Jim Webb of Virginia and Joe Manchin of coal-rich West Virginia sided with Republicans on the amendment sponsored by Sen. John McCain (R-Ariz.). Sen. Susan Collins (R-Maine), who likely would have cast a nullifying tie vote, was out of the room and did not vote, and the amendment passed 13 to 12. She has pledged to back biofuels on the Senate floor.

Sen. Mark Udall (D-Colo.), one of the committee Democrats opposing the amendment, is part of a coalition working to strip it from the bill. "Be assured when the bill comes to the floor, this is one of the big fights we'll have," he says. "I'm optimistic that we'll prevail. When the full Senate considers the importance of biofuels, the progress that's been made, the energy independence that it would allow us, I think we have a fighting chance to strip out those provisions which I think, with all due respect to my colleagues, were misdirected and ill-founded."

Udall is working with the support of Senate Majority Leader Harry Reid (D-Nev.), the blessing of Sen. Carl Levin (D-Mich.), who leads the defense policy panel and Sen. Jeff Bingaman (D-N.M), who leads the Senate Committee on Energy and Natural Resources.

Outside groups are also involved. The Advanced Biofuels Association (ABA) is working with a coalition of biofuel, agricultural, environmental and airline groups. "It's at the top of our agenda to do between now and the August recess," says Michael McAdams, ABA's president.

The coalition will need 60 votes to amend the bill. They are considering at least three different options, including a straight repeal of McCain's amendment.

Airlines For America (A4A), the top airline trade association, vowed its support for stripping McCain's amendment in a joint statement with ABA and other groups including the Pew Charitable Trusts. The airlines, and aerospace companies like Boeing support development of biofuels to offset oil price volatility while reducing greenhouse emissions.

A4A and national security groups including the American Security Project are trying to sell that message to Congress by highlighting the national security implications of continuing to rely on foreign sources of energy.

The administration has weighed in as well after the House passed its version of the bill blocking the Pentagon from pursuing biofuels. The Office of Management and Budget objected to the new provision, saying it would "further increase American reliance on fossil fuels, thereby contributing to geopolitical instability and endangering our interests abroad."

But Republicans in the Senate argue that when the nation is trying to trim a crippling federal deficit, the military should be spending its dollars on weapons, not on spinning oilseeds into kerosene. "That should be done at the Department of Energy or someplace else," says Sen. Jim Inhofe (R-Okla.). "Using our defense funds for experimentation is not what they should be used for."


AMY SVITAK/AWST

**EMT of Germany is developing a next-gen Luna UAV concept to replace Germany's current KZO drone.**

imaging pod, including a high-definition television channel, third-generation high-definition infrared channel and a laser rangefinder. Patroller also flew a ship automatic identification system receiver used for real-time monitoring of cooperative maritime traffic as well as a distress-beacon detector.

Patrick Durieux, vice president of sales for Sagem UAVs and aerosurveillance, said the tests proved Patroller's ability to fuse data from different sensors and transmit it to a command and control center for coastal surveillance. These tests also showed the ease with which new payloads can be integrated into the 1-ton-class drone's mission system, and the complementary capabilities of the optronic and electronic sensors in tactical situations. Durieux estimates Sagem can deliver Patroller S for €25-30 million ($32-$40 million) per three-aircraft system.

EADS has focused more on the potential interest of the French army in a helicopter UAV. There is also interest in such a system from the French navy, with political pressure, at times, for a combined purchase. Flight trials have confirmed the Tanan system should meet an 8-10-hr. endurance target set for the 300-kg vehicle, Chamussy says. Specific fuel consumption of the diesel engine is surpassing expectations, he notes. EADS is now ensuring that production can also be industrialized.

Larger questions in France hang over the way forward in the medium-altitude, long-endurance UAV sector.

During a Franco-British summit held in February, U.K. Prime Minister David Cameron and then-French President Nicolas Sarkozy agreed to forge ahead with joint development of a medium-altitude, long-endurance (MALE) drone by 2020.

While the accord singled out Paris-based Dassault Aviation and Britain's BAE Systems to study design concepts, the new government of President Francois Hollande is reviewing France's broader UAV strategy. By July 14 French Defense Minister Jean-Yves Le Drian has vowed to provide more clarity, including whether France will proceed with an interim purchase of a MALE system planned by the previous administration. The French air force would like to field a system with weapons-delivery capability.

Dassault has been promoting the purchase of Israel Aerospace Industries' Heron-TP, while EADS is pushing continuation of the current Harphang—a version of the basic Heron—rather than making an interim purchase, noting that the government could decide whether it would be largely an off-the-shelf system or a system more tailored to French needs.

At this point any decision would be helpful, notes Eric Trappier, executive vice president-international at Dassault. "At least it would give us some clarity," he says.

# Back in Business?

## NetJets places record order, but economic headwinds could crimp bizjet recovery

**JOSEPH C. ANSELMO and KERRY LYNCH/WASHINGTON**

BOMBARDIER

**The NetJets order more than doubles Bombardier's backlog of Challenger 300s (like this one) and 605s.**

It is, without a doubt, a big win for an industry that has been waiting a long time for good news. In the largest business-jet order ever tendered, NetJets agreed to buy up to 425 new business jets from Bombardier and Cessna as part of a 10-year plan to overhaul its fleet. The value of the deals would reach $9.6 billion, if the world's largest fractional ownership operator exercises all of its options for Bombardier Challenger 300 series and 605s and Cessna Citation Latitudes.

Cameron Doerksen, an aerospace analyst at National Bank Financial in Montreal, notes that the magnitude of the order was "much larger than market expectations." Indeed, all three companies bought full-page advertisements in the June 13 *Wall Street Journal* to trumpet "the world's largest aircraft investment."

But business-jet manufacturers should not pop champagne corks just yet. Encouraging as it is, the NetJets news comes as the beleaguered industry is facing new headwinds that could further postpone the end of a slump now in its 45th month. The financial crisis in Europe, slow economic growth in the U.S. and decelerating growth in China and Brazil could strike another blow to an industry that delivered 40% fewer aircraft last year than in 2008. This month, JPMorgan lowered its forecast of global economic growth in 2012 to 2.1% from 2.6%. It notes that business-jet flight activity in the U.S.—which remains the dominant market—stalled in the second half of 2011 and has yet to recover. Small- and medium-sized jets continue to bear the brunt of the downturn, and prices for used aircraft remain depressed.

It is little wonder that analysts are being measured in their enthusiasm about the NetJets orders. "Whether this marks a real turnaround in the bizjet market remains to be seen," says Robert Stallard, the London-based aerospace analyst at RBC Capital Markets.

NetJets has a history of ordering or taking options on a lot of aircraft and then pulling out when hard times hit. After the current downturn took hold in late 2008, the Columbus, Ohio-based fractional operator canceled orders for hundreds of aircraft from Cessna, Hawker Beechcraft and Gulfstream. The latest NetJets orders are "speculative, conditional and optimistic," says Teal Group analyst Richard Aboulafia. "We've seen this movie before. NetJets orders at the bottom of the trough and they get good prices. But it doesn't necessarily mean anything if demand doesn't return for them."

Owned by billionaire investor Warren Buffett's holding company, Berkshire Hathaway, NetJets pioneered the concept of selling fractional shares to wealthy individuals and businesses. The shares give those customers access to a fleet of professionally owned and maintained business jets for a fixed number of hours per year. Launching the fractional program 26 years ago in the face of naysayers, NetJets grew to be the single-biggest buyer of business jets. But an abrupt slump in demand almost killed the company in 2009, when it posted a pre-tax loss of $711 million. Its fleet has shrunk by 20% since the end of 2008.

"A few years ago, NetJets was my number one worry," Buffett wrote in a note to Berkshire Hathaway shareholders in February. "Its costs were far out of line with revenues, and cash was hemorrhaging. Without Berkshire's support, NetJets would have gone broke. These problems are behind us, and [NetJets] is now delivering steady profits from a well-controlled and smoothly running operation."

NetJets Chairman and CEO Jordan

CESSNA CONCEPT

**NetJets will become the launch customer for Cessna's new eight-passenger Citation Latitude jet.**

Hansell says sales of shares are creeping up, but slowly and from a very low base. He predicts that the market will return in the U.S. and grow internationally. But only 125 of NetJets' 275 orders with Bombardier and Cessna are firm, giving the company leeway to use the new jets as fleet replacements or, if demand takes off again, exercise the options to expand its network. Deliveries will stretch out over a decade, starting with the Challengers in 2014 and the Citation Latitudes in 2016.

Hansell declines to reveal whether the orders require the aircraft builders to accept trade-ins of older jets, a provision the company has demanded in previous deals. Bombardier "could have agreed to take older/pre-owned aircraft onto their balance sheet . . . [which] could be a drag on inventory," notes Bank of America Merrill Lynch analyst Ronald J. Epstein.

That said, the order for up to 200 Challenger 300 series jets and 75 Challenger 605s positions Bombardier—which operates its own fractional ownership subsidiary, FlexJet—to become a cornerstone of NetJets' future. It adds to a $2.8 billion order in 2011 for a mix of Bombardier Globals and in one stroke more than doubles the backlog of Challenger 300s and 605s.

Doerksen predicts the order will support higher business-jet production rates at the Montreal-based company in 2014 and beyond. The only negative he sees is that Bombardier's future business aircraft backlog is now "overweighted to one single customer, NetJets, which does have a history of canceling orders when the market hits a downturn."

While the deal with Cessna is much smaller—just 25 firm orders and 125 options, with a potential value of $2.3 billion—it provides a big-ticket launch customer for the Citation Latitude, an eight-passenger jet that entered development last November. It also replaces some of the many Cessna orders NetJets had canceled and renews a relationship that had frayed over NetJets' belief that Cessna was not investing enough in new products. "This order from NetJets shows confidence in the growing strength and long-term outlook of the global economy and the aviation industry," says Cessna President and CEO Scott Ernest.

A milestone, perhaps. But only time will tell whether NetJets' move is truly a turning point—or another dead end on the industry's long road to a recovery.

*—With Graham Warwick in Washington.*

# Eclipse Redux

## Modest plans, realistic schedules and a higher price set VLJ reincarnation apart

**GRAHAM WARWICK/WASHINGTON**

**The new-build Eclipse 550 will have better cockpit displays and processors, synthetic and enhanced vision and autothrottle.**

As Eclipse Aerospace loads the jig for its first new-production very-light jet, the company's ambitions are not those of its predecessor, which failed spectacularly in its bid to blacken the sky with low-cost air taxis. The new company instead aims to make a solid profit on modest production.

The original Eclipse Aviation was formed in 1998 with the vision of selling thousands of million-dollar jets into a booming air-taxi market. But its biggest customer, unable to raise financing in an economic downturn, closed its doors in 2008, taking with it 1,400 of the 2,600 orders on the books.

Eclipse's business model was based on high volume, and the failure of air-taxi operator DayJet helped push the company into bankruptcy and eventually liquidation. Its successor has a more moderate approach, with a slow production ramp targeting a recovery in the global business-jet market by around 2014-15.

"We are not in the same position as other manufacturers," says Chairman and CEO Mason Holland. "We are growing the business at a measured pace behind the speed at which the market is moving, where others have had to consolidate and cut back to get down to the pace of the market."

The first new-production Eclipse 550, an improved version of the original Eclipse 500, is slated for delivery in July-August 2013 and, where the original company built more than 100 aircraft in its first full production year, Eclipse Aerospace is targeting 45-50 deliveries in 2014.

"We could build up to 100," he says. "But we're moving into production at a limited, measured pace. We have the orders for deliveries through 2013 under contract and 60% of the orders identified for 2014." The Eclipse 550 is priced at just under $2.97 million, up from $2.15 million for the last 500s sold in 2008, but less than the competing Cessna Citation Mustang at $3.2 million and Embraer Phenom 100 at $4.1 million.

The unscheduled, on-demand air taxi market pioneered by DayJet is no longer the driver. Instead, the Eclipse 550 is being aimed at the owner-flown sector "that was not focused on by the prior company," says Holland, as well as the "air limousine" charter market and traditional corporate flight departments. Medical supply, overnight freight and military special missions and training are other potential uses, he says.

Low cost and high volume may no longer be the business drivers, but "to move the market, we need to be competitively priced, with industry-standard or better margins for the company so we can guarantee long-term support," he says. "We will be the last twin-engine jet to be priced below $3 million because we don't have to retire a huge R&D cost. We inherited that for pennies on the dollar."

Eclipse Aviation halted production in October 2008 after building, and losing money on, 267 aircraft, and it was pur-

chased out of liquidation by privately held Eclipse Aerospace. The new company's first goal was to rebuild customer support then bring in-service Eclipses up to the capability that had been promised but never delivered. It always had an eye to restarting production.

Sikorsky, which agreed in 2010 to invest in Eclipse and use its aftermarket capabilities to help rebuild product support, has played a key role. Sikorsky's parent, United Technologies Corp. (UTC), says the company invested "less than $25 million" in Eclipse, giving it a 42% stake. But the May announcement that Sikorsky's Polish subsidiary PZL Mielec will produce the Eclipse 550 airframe makes UTC its single-biggest supplier.

Between PZL and engine-maker Pratt & Whitney Canada, UTC companies will provide "over 75% of the aircraft as Tier 1 suppliers," says Holland. Airframe fabrication and primary assembly will migrate from the Eclipse factory in Albuquerque, N.M., to Poland over 18 months, he says. Final assembly, completion and customer delivery will remain in Albuquerque.

The first Eclipse 550 will take 55-56 weeks to complete because "we are validating the line and focusing on the quality of the aircraft build. We are implementing process improvements the prior company needed to do, as well as new ones suggested by Sikorsky," Holland says. Funding to restart production is coming from existing shareholders, he says.

In May, UTC CFO Greg Hayes told analysts, "we are not investing any more money in Eclipse .... We're in the aftermarket business supporting the planes that are out there. But we're not in the manufacturing business for light jets." While Holland believes that could change once UTC completes its acquisition of Goodrich, he says, "we have not asked them for any more money. Our future is totally independent of what they do."

Business aviation's doldrums could yet impact the pace of Eclipse's plans. "The timing to relaunch production is based on a recovery in 2014-15. We had to start now to be ready," says Holland. "We'll continue to adjust our plans as the market ebbs and flows."

The aftereffects of the original Eclipse's high-profile failure appear to be fading. "All the suppliers are re-engaged. They believe the business plan is more solid and realistic," he says. "Restarting an aviation business is tough, but we have good support. People see the value in the product, built at a measured pace for the right market segment."

**1998** Eclipse Aviation founded by Vern Raburn

**Nov. 2002** Eclipse 500 prototype flies with Williams EJ22 engines

**Dec. 2004** Eclipse 500 flies with P&W Canada PW610F turbofans

**Feb. 2006** Eclipse wins Collier Trophy

**Sept. 2006** FAA certifies Eclipse 500

**Jan. 2007** First delivery

**July 2008** Raburn resigns

**Sept. 2008** Largest customer DayJet ceases flying

**Oct. 2008** Eclipse 500 production halted

**Nov. 2008** Eclipse files for Chapter 11 bankruptcy protection

**July 2009** Assets sold to new company, Eclipse Aerospace

**Sept. 2009** Eclipse Aerospace opens for business

**March 2010** Eclipse Aerospace offers refurbished EA500 "Total Eclipse"

**Jan. 2011** Sikorsky invests $25 million for 42% stake in Eclipse Aerospace

**May 2012** Sikorsky subsidiary PZL Mielec to supply airframe

**June 2012** Eclipse Aerospace begins production of first Eclipse 550

# Wing Worries

## Airlines face massive operational disruptions to repair A380 wings

**JENS FLOTTAU/BEIJING and FRANKFURT**

Airbus is already facing a huge bill to restore the A380 fleet to full life-cycle capabilities. But the cracks in wing rib feet are causing such huge operational disruptions that airlines want more than just repaired aircraft—compensation for lost revenues and profits is also sought.

Airbus has assured its customers that the A380 wing repairs are a "warranty issue" and that all work related to it will be paid for by the manufacturer. But Emirates Airline President Tim Clark said last week on the sidelines of the International Air Transport Association (IATA) annual general meeting that he is not prepared to accept the huge impact to his airline's bottom line lying down. "[Airbus Chief Operating Officer for Customers] John Leahy has said there is no compensation, but we take a different view," Clark insists. Lufthansa shares that view and notes that negotiations with Airbus regarding compensation for lost revenues and profits are ongoing. A representative from Qantas Airways states the airline is "discussing the cost implications of the inspection and repair process with Airbus," but does not comment on compensation claims.

However, one potential problem for the airlines is that the purchase contracts with Airbus have no clause covering the situation they now face, at least not those signed by Emirates and Lufthansa. Contractually, Airbus appears to be on the safe side. But Clark points out that "nobody would have ever contemplated anything like this." And Airbus personnel have implied on some occasions that at least some recompense is forthcoming. An Airbus official says talks beyond repair expenses are "confidential."

Following the discovery of Type 1 and the more serious Type 2 cracks during routine maintenance, Airbus developed a short-term repair program for the in-service fleet. In addition, a final fix has been designed for the first 120 aircraft—due to be available from early 2013—that will include modified wing rib feet, among other amendments to the original wing design.

In the fix, the Al7449 rib feet booms are being replaced with pieces constructed of 7010 alloy. The rib feet will also be strengthened.

Clark says Emirates discovered 700 Type 1 cracks in the two wings of one particular aircraft. There were far fewer Type 2 cracks. Airbus says approximately 20 out of 4,000 wing rib feet are typically affected per aircraft.

The financial impact on airlines is already huge and significant operational disruptions are likely to continue for several years. Clark estimates the A380 wing problems are having a monthly impact of $30 million on the carrier's bottom line. Emirates' external auditors claim the actual figure is closer to $50 million. Emirates is the largest A380 operator with 21 aircraft in service and another 60 on firm order. Of the 23 units due to be delivered through early 2014, all have the old wing design.

Emirates has had up to six A380s—almost one-third of the fleet—grounded at a time for maintenance checks and preliminary repairs since the problems emerged. The last two aircraft are undergoing repairs this week and are not due to return to revenue service until the end of July. Clark says that though Airbus claims Type 1 repairs can be done within 10 days, Emirates disagrees. Its aircraft have been grounded for an average of 35 days and some were in the shop for 42 days.

What is more, aircraft that have already been repaired will likely undergo the same process again after flying 500 additional cycles. "We know there will be new [Type 1] cracks after 500 cycles, because we have seen them well before 500 on our aircraft," Clark says. That means the airline will have to take aircraft out of service again after only a few months.

Emirates has redeployed Boeing 777-300ERs on some A380 routes and removed the compromised aircraft from its Seoul service. The airline has lost some lawsuits filed by irate customers in Malaysia who expected to fly on the A380s.

Airbus and Emirates have meanwhile mapped out a plan for the permanent retrofit that will put its A380s back onto the original life-cycle expectation. The program is due to start in the third week of January 2013 and run until November


**Emirates, with a fleet of 21 Airbus A380s, is the carrier most affected by repairs needed to the aircraft's wings.**

2014; it involves taking four A380s out of service at any given time. Another 1-2 units will be out for the interim fix work, which could take more than one month. Clark says regular C checks are also taking much longer than expected because of multiple smaller issues, and they are lasting up to 42 days, compared to the original plan of about 20 days.

The Emirates A380 work will be undertaken at four MRO bases, including Gamco in Abu Dhabi, United Arab Emirates, and Lufthansa Technik Philippines in Manila. Clark believes Airbus will need a total of eight stations to handle the work for all operators. "They [Airbus] realized too late how [complex] the problem will be," he criticizes. On the other hand, he acknowledges that former Airbus CEO "Tom Enders has stepped up, admitted mistakes and was absolutely determined to get the job done. I have been impressed with that."

Airbus has proposed that airlines split the work so it can be performed during regular C checks, but Emirates has opted to address the retrofit separately. Lufthansa says it will link the job to some C checks that are coming up, but will also take part of its fleet out of service for some retrofit-specific work. For the German carrier, which currently has nine A380s in its fleet and is expecting two more soon, the repairs on subsequent aircraft are equivalent to taking one unit out of the fleet for one year.

Air France says its first A380 (F-HPJA) was checked on March 22, repaired and returned to revenue service. The airline, Airbus and the European Aviation Safety Agency agreed to conduct a further inspection after 500 cycles. The second aircraft (F-HPJB), was temporarily grounded on May 2 and returned to scheduled flying on May 14. F-HPJC, the third A380 delivered to Air France, is slated to be checked and repaired in weeks 35 and 36. Subsequent ground times are being planned. Air France has eight A380s and four more on order.

Airbus has already earmarked €260 million ($327 million) in additional costs for this year to accommodate the A380 work. This is on top of another €100 million that was booked in 2011. But there will be more massive costs in 2013 and 2014. According to Clark, about 30,000 man hours per aircraft are needed to install the retrofit on the first 120 aircraft alone—that does not take into account short-term repairs and redesign work for the new wings that will be fitted to later aircraft.

# Big Promises

## Early focus on fuel burn and reliability underscores 747-8 debut with Lufthansa

**GUY NORRIS and JENS FLOTTAU/FRANKFURT and WASHINGTON**

Airframe makers know a smooth entry-into-service is just as vital to encouraging new sales as a botched one is to putting them off. All the more reason for Boeing to be watching the debut of its 747-8 with Lufthansa with hawk-like attention as it pursues much-needed new orders for the stretched passenger model.

However with the 747-8, there is even more attention to this early phase than would normally be expected for a derivative. The aircraft is both later and heavier than planned, and the all-important fuel-burn performance that operators want for long-range missions is below original targets. Yet, as Lufthansa introduced the first 747-8 on services between Frankfurt and Washington on June 1, there is encouraging news for Boeing and Lufthansa. Early indications are that, relative to the early disappointment of missing initial fuel-burn goals by as much as 3%, the aircraft's first-time performance appears to be marginally better than advertised.

Although more significant engine and airframe improvements are in the pipeline for 2013 onward, early evidence gives Boeing and General Electric—maker of the 747-8's GEnx-2B engines—cautious optimism that they may recover more lost ground than they are publicly willing to admit.

Anecdotal signs of improved performance emerged on the May 1 delivery flight from Seattle to Frankfurt, when Lufthansa's informal fuel-burn analysis indicated performance was 99.7% of the baseline prediction says Elmar Boje, the carrier's 747-8 chief pilot. This indicates that actual fuel burn was 0.3% better than expected, he adds. Boje cautions, however, that the numbers are not official as fuel-burn data were not collected under the stricter conditions observed during formal nautical air mile testing.

For the first revenue flight a month later, trip fuel consumption on the first westbound transatlantic flight to Washington Dulles International Airport was around 176,200 lb. This was slightly below the preflight estimate of 178,850 lb., which itself was almost 5,000 lb. (or around 3%) less fuel consumed than if the same mission had been flown by one of the airline's 747-400s.

In Lufthansa's configuration, the 747-8 is fitted with seating for 358, of which 100 are higher-revenue first- and business-class versus 322 for the -400 with 88 premium seats. For the 747-8, Lufthansa is moving the first-class cabin downstairs and is taking part of business class into the upper deck.

The carrier is one of only two airlines that has so far opted to order the 747-8 as well as the Airbus A380. The idea is to have capacity steps of roughly 100 seats between the different long-haul models. Lufthansa's A380s have up to 526 seats, the A340-600s seat 306.

In Lufthansa's layout, the operating empty weight of the 747-8 with everything but galleys is around 490,530 lb.,

**Distinguished by new engines, wings and longer fuselage, Lufthansa's first Boeing 747-8 arrived at Washington Dulles International Airport on June 1.**

adds Boje. The first revenue flight was made with a takeoff weight of 831,720 lb., well below the aircraft's maximum takeoff weight of 987,000 lb.

Lufthansa expects to see further improvement with the handover of the 11th aircraft in 2014.

The airline, which was the launch customer for the model in 2006, expects to officially receive its second 747-8 by early July, followed by three more at monthly intervals through September. The latest 747 versions are mainly replacing the 747-400. Depending on market conditions, Lufthansa plans to operate the two types for several more years. The -400s are mostly written off and can therefore be more easily used to adapt capacity. The current difficult market conditions have led Lufthansa to sell several of its -400s this year.

The 747-8 fleet will continue to expand in 2013 with the sixth aircraft being the first to incorporate a $K_u$-band broadband satellite antenna for inflight Internet connectivity. Lufthansa ordered 20 747-8s and the second batch of 10 will include a range of enhancements. From the 11th airframe, which is due for delivery in 2014, these will include several block changes including a lighter structure, upgraded "performance improvement package" PIP GEnx-2B engines and full-flight management computer functionality.

GUY NORRIS/AW&ST

All the improvements, including the reactivation of the tail fuel tank, which is closed out on the initial aircraft, will be cleared in an extensive flight-test program set for 2013, says Elizabeth Lund, Boeing's 747 vice president and general manager. The combined benefits will bring performance "very, very close to the [2006] brochure, and better than guarantees by 2014," says Lund.

Buoyed by the start of deliveries, progress with upgrade plans and nascent signs of market activity, Lund says Boeing is optimistic about adding to its orderbook in the coming months. It also has high hopes about converting the first of the 30 747-8 passenger model commitments it has on hand into firm orders. "I think we'll see more sales in 2012. It will come in two versions: we hope to get confirmation of some of the MoUs [memorandums of understanding] that are not in our firm backlog, and I believe we will see additional 747-8 sales as well," she says.

"We're in active sales campaigns for the passenger variant," says Lund. "I would like to announce some orders this summer, but I don't know if it will be before or after Farnborough," she adds, referring to the U.K. airshow in July. The current orderbook stands at 106 aircraft, of which 70 are for the 747-8F freighter variant. In contrast to the relatively solid sales of the freighter, and the resilience of that orderbook in the face of a soft cargo market, sales of the passenger model have remained sluggish. Excluding Lufthansa, only Korean Air and Nigeria's Arik Air are now on the books with orders for five and two, respectively.

The key to turning this around could be converting a series of MoUs for approximately 30 747-8s from a range of customers. These include announced would-be operators such as Air China, which awaits government permission before converting its order for five, and Russia-based Transaero Airlines for a batch of four. "The Air China deliveries will probably be in 2014," says Lund.

However the largest yet-to-be-confirmed order—15 aircraft—remains with an undisclosed buyer. The deal, announced at the 2011 Paris air show, involved an MoU thought to have been placed by Hainan Airlines and Hong Kong Airlines parent group HNA of China. The agreement is still in place, and conversion to a firm order is "still going through the formalization and approval process," Lund adds.

# Nigerian Nightmare

## African country experiences serious aviation safety setback

**JENS FLOTTAU/FRANKFURT**

Nigeria's air transport industry appeared to have transformed itself into a small aviation safety success story. But that image is crumbling following two fatal crashes within two days and the grounding of two carriers over safety concerns. Now the search for the root causes begins.

On June 3 a Dana Air MD-83 crashed on final approach to Lagos International Airport following what likely was a dual engine failure. All 153 on board and 10 people on the ground died when the aircraft hit industrial and residential buildings 4-5 nm from the threshold of Runway 18. A day earlier another Nigerian airline, Allied Cargo, lost a Boeing 727-200 on approach to Kotoka International Airport in Accra, Ghana. The aircraft overran Runway 21 after landing in what has been described as a severe thunderstorm. The 727 breached the airport's perimeter fence, crossed a road and hit two cars and a bicyclist. Twelve people on the ground were killed; the crew of five survived with injuries.

And on June 12, the Nigerian Civil Aviation Administration (NCAA) temporarily halted Air Nigeria's domestic operations. This measure was taken to perform a safety audit following a one-week strike by pilots and engineers that had grounded the aircraft. Dana Air has also been grounded since June 4.

NCAA stated the audit was a "routine procedure." But Air Nigeria, formerly Virgin Nigeria Airways, has been facing allegations about unsafe operations for some time. John Nnorom, the airline's former finance director, claimed in a highly charged public announcement last April that engineers were forced to sign off on aircraft that were unfit to fly. Only one of the company's 11 aircraft was airworthy, he said, but all the rest need-

ed "deep and heavy maintenance." Nnorom also claimed that the airline could not afford to perform mandatory checks. Air Nigeria denied the allegations.

The latest developments have been a fundamental setback for aviation in one of Africa's largest countries and healthiest economies. The country began to tackle aviation safety in a serious manner in 2005 when Harold Demuren, an internationally respected air transport expert and former head of the International Civil Aviation Organization (ICAO) Council, was appointed to head the NCAA with a mandate to improve safety.

And he did so, believes Gunther Matschnigg, senior vice president-safety, operations and infrastructure at the International Air Transport Association (IATA). "There has been a clear improvement in oversight," Matschnigg points out. And Demuren also pushed through steps against non-compliant carriers. "A dozen airlines were shut down," Matschnigg says. Demuren's fight to improve standards was opposed by the affected airlines and by local politicians. Nevertheless, Demuren prevailed. The country had not experienced a fatal accident for the last six years.

Ironically, following the two latest accidents, NCAA and its leader are being accused of not having done enough to improve aviation safety. Stella Oduah, Nigeria's aviation minister, appointed a panel to review "technical and administrative practices." Demuren is facing calls for his resignation. The country's senate recommends his suspension. But IATA and the Flight Safety Foundation have urged authorities to not let politics interfere with accident investigations and flight safety oversight.

The situation in Nigeria has put African aviation safety back into the spotlight. According to IATA, the rate of hull losses per million sectors flown improved to 6.17 in 2011 from 15.68 in 2010. The figures include Western- and Eastern-built jets as well as turboprops. Matschnigg says the performance this year so far has not changed much. But at a recent IATA regional summit on airline safety, a five-point action plan for Africa was drawn up calling for:

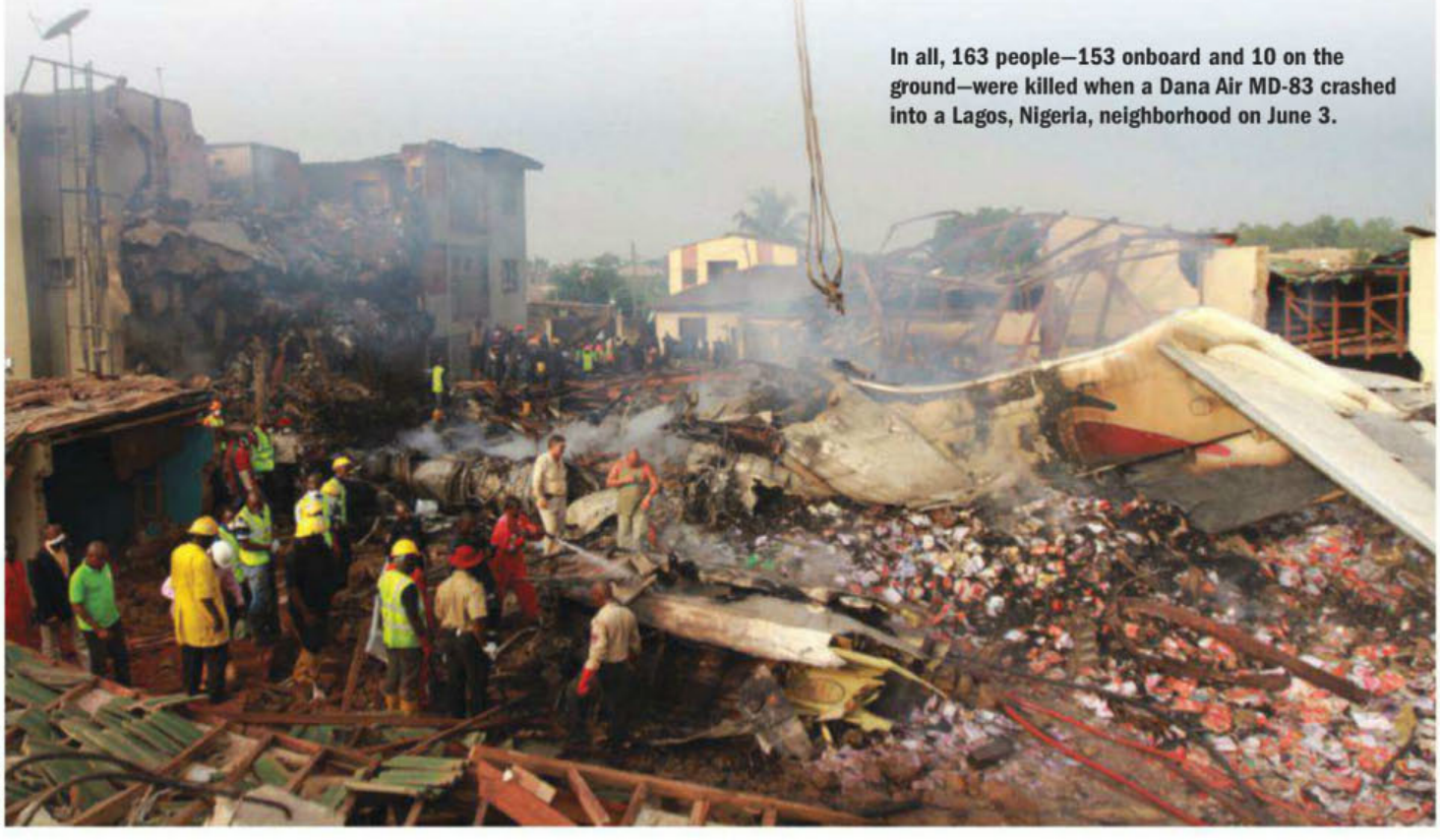
- Government-initiated development of robust safety oversight.
- Focus on runway excursions—the most common accident category in the region.
- Loss-of-control prevention training.
- Improved data sharing.
- More widespread use of IATA's Operational Safety Audit (IOSA).

In Nigeria, only two carriers have undergone IOSA—Arik Air and Air Nigeria, the airline that was temporarily grounded last week.

The cause of the Dana Air crash, the worst aviation accident anywhere this year, is still unknown. The crew, comprising a U.S. captain and an Indian first officer, is reported to have declared an emergency around 11 nm out, at an altitude of 5,000 ft. According to NCAA, the crew, along with listing the dual engine failure, also reported that the throttle was not responding. The aircraft touched down at a very nose-high altitude, according to eyewitnesses, which indicates slow airspeed. There have been reports about a possible birdstrike as a causal factor. The flight data and cockpit voice recorders were recovered on June 4.

On that same day, NCAA revoked Dana Air's air operator's certificate for an indefinite period "for safety and precautionary reasons." The airline had already suspended all operations.

According to Dana Air, the captain had accumulated 18,500 flight hours, 7,100 on MD-83s. The first officer had flown 1,100 hours, 800 of them on MD-83s. The aircraft had logged 60,846 hr. and 35,219 cycles. Its last A check was performed on May 30 and the next C check was set for September. Some staff members have reported that the aircraft had to undergo frequent repairs in the past, but that could not be independently confirmed, and previous flaws might not be linked to the cause of the accident. The aircraft, registered 5N-RAM, was originally delivered to Alaska Airlines in 1990 and sold to Dana Air in 2009.



**In all, 163 people—153 onboard and 10 on the ground—were killed when a Dana Air MD-83 crashed into a Lagos, Nigeria, neighborhood on June 3.**

REUTERS/LANDOV

RUSSIAN HELICOPTER

**The Mil Mi-8 family still comprises the core of the Russian commercial helicopter fleet.**

# Russian Renewal

## The Russian commercial helicopter fleet adds lighter models as it modernizes

**MAXIM PYADUSHKIN/MOSCOW**

The Russian fleet of commercial helicopters is still a Soviet legacy, consisting mostly of outdated and aging models. Russian models will most likely continue to dominate the heavy-class category, but foreign rotorcraft manufacturers will gain market share with lighter models.

A new report by the country's GosNII GA State Research Institute of Civil Aviation reports the Russian fleet included 2,266 rotorcraft, but fewer than half of them—1,063 helicopters—were in commercial operations, while another 251 were listed in the general aviation register, as of the first quarter.

The commercial fleet was mostly formed during the Soviet era, so its average age is 23 years. Half of the helicopter fleet is more than 25 years old and only 11% is younger than five years old. GosNII GA experts note that 77% of the fleet is dominated by models with a payload of 3-6 tons (or 20-40 seats). This class includes two families of Russian bestsellers—the Mil Mi-8 and the Kamov Ka-32 coaxial rotor helicopters. Russian companies now operate 788 Mi-8s with various modifications and 27 Ka-32s.

The second-largest share encompasses 7-9-passenger rotorcraft, which make up 12% of the fleet. Helicopters with up to four seats comprise 6% of the fleet, while 5-6-seat capacity types represent 2%, and super-heavy types, 3%. Helicopters with 10-19 seats account for only single numbers per type.

Russian manufacturers traditionally have a strong showing in the domestic commercial fleet market, as evidenced by their 91% share. Along with Mi-8s and Ka-32s, other Russian types in operation include the 3.5-ton Mi-2 (98 helicopters still in service), giant Mi-26T (36 in service), 3.2-ton Ka-26 (15 in service) and Ka-226 (4 in service).

The share of foreign types is growing, but mainly in the light-model category. The fleet included 45 foreign-made aircraft in 2006 and 95 in the commercial fleet. The most popular type here is the Robinson R44 piston-engine helicopter with 54 in commercial operation and 105 more on the general aviation register. Eurocopter takes the lead among foreign manufacturers in the turboshaft segment with 23 rotorcraft in service. Its most popular model with Russian commercial operators is the EC135 with 10 in service. Other models here include AS350s (nine in service), AS355s (three in service) and one EC120. Different foreign manufacturers have an even smaller presence.

But foreign manufacturers hold a fairly high stake in the general aviation (GA) segment. The Russian GA helicopter fleet now includes 251 rotorcraft, of which 187 (about 75%) are non-Russian types, according to the GosNII GA report. Compared with the commercial helicopters, the general aviation fleet is much younger, with an average age of just 12 years. The new helicopters (younger than five years) comprise a significant portion of the fleet, 30%, and the share grows to 45% if the rotorcraft range expands to 5-15-years old.

The GosNII GA analysts point out that the general aviation Russian rotorcraft class corresponds with the global trend of light models dominating the market. In the local fleet, light models, up to four seats, comprise 56% of the fleet; 5-6-seat helicopters account for 12% of the fleet; 7-9-seat models represent 22%; and the 20-40-seat types claim 9%. As with the commercial rotorcraft sector, the 10-19-seat segment is also almost empty in Russia's general aviation market.

As the aging fleet requires renewal, foreign helicopter manufacturers are likely to increase their share of the market here. In the 2008, deliveries reached their peak of 135 civil helicopters, but later decreased due to the global economic crisis. However, in 2011, Russian operators received more than 100 rotorcraft, both domestically produced and imported. The report stresses that up to 80% of new deliveries will come from the light segment, where the Russian producers have no supply.

About 70% of sales of Russian Helicopter— a merger that united the country's disparate rotorcraft builders—are for the Mi-8 family. By 2014 the manufacturer plans to certify the new upgraded version—the Mi-171A2.

The situation in the light-rotorcraft segment is more complex. Russian Helicopters plans to extend the service life of the existing Mi-2 fleet and to start delivering the reengined Ka-226T and Ansat with hydromechanical flight controls, but it has no orders for the latter two types so far. The other light models, such as the Ka-62 and Mi-34S, are still in the development stage.


BOEING

Boeing's 787 returns to Farnborough, where it debuted two years ago, although this time under heavy pressure to show the aircraft in Qatar Airways livery.

# Question Marks

**ROBERT WALL/LONDON**

There is little doubt last year's Paris air show was a love-fest for Airbus and its A320NEO. Now Boeing has launched the rival 737 MAX, but can the U.S. aircraft maker dominate this year's Farnborough International Airshow to the same extent?

Any attempt to boil down the biennial event—held July 9-15 southwest of London—into a horse race between the Airbus and Boeing single-aisle offering would be to grossly understate the challenges global aerospace and defense representatives will have to address as they gather at the largest industrial meeting of the year. Farnborough 2012 may not mark the first big European air show since Western defense budgets have been in remission, but the uncertainties about lean times that had cast long shadows at earlier shows have become a reality.

Supply chain concerns also will remain paramount. Airbus has already decided to forgo, for now, a ramp-up of output to 44 single-aisle aircraft per month. There are shared concerns across original equipment makers that some suppliers are overstretched in trying to satisfy the increasing demand from Airbus, Boeing and others, including the gradual ramp-up expected to unfold with the Lockheed Martin F-35 Joint Strike Fighter program. What is more, retrenching financial institutions, particularly in Europe, have left some small suppliers underfinanced. For the big aircraft makers, Farnborough will provide an opportunity to look some of their smaller suppliers in the eye and gauge their ability to keep pace.

But many observers believe that the commercial airliner business, which has been on the upswing, will be the focal point of the show. Boeing, for instance, has several big product decisions in the pipeline and the gathering could provide some clarity as to the direction Seattle plans to take. First up is the fate of the next member of the 787 family, the -10X, and what other upgrades will be made to the 777X toward the end of the decade to keep the product competitive in the face of emerging competition from the Airbus A350-1000, which is due to be fielded in 2017.

For now, though, Boeing will primarily be focused on getting the 787 into customers' hands. This year, few of those deliveries will be as important as the one to Qatar Airways. The airline's outspoken CEO, Akbar Al-Baker, wants his first 787 to be flying at Farnborough ahead of its service entry on the Doha-London route in August. The CEO has roundly criticized Boeing for being run by lawyers (when the 787 was delayed), so the U.S. aircraft maker will be striving to ensure that the twin-widebody is delivered in time to participate.

Nor is Airbus expected to be idle. Having launched its A330 passenger-to-freighter conversion program at the Singapore air show in February, the European aircraft maker is considering using Farnborough to launch another A330 initiative, a 240-ton maximum-takeoff-weight option. It would be the


Airbus's latest A380 operator, Malaysia Airlines, plans to display its new aircraft during the July 9-15 gathering at Farnborough.

AIRBUS

# Farnborough Airshow's Hot Topics: NEO vs. MAX, A350 vs. 777

second such upgrade for the twin-widebody, which has been enjoying a large market share in recent years. The first 235-metric-ton version should enter service this year.

Other enhancements being considered by the European manufacturer include more-capable winglets modeled on the so-called Sharklets now flying on A320s. But there is still uncertainty about whether the fuel burn gains are worth the structural changes that would be needed. Instead, Airbus may improve load alleviation through its fly-by-wire flight controls to gain small fuel burn improvements. Also, it is working with engine suppliers Rolls-Royce, General Electric and Pratt & Whitney to eke out slight specific fuel consumption gains.

In addition, Airbus will have some other challenges on its hands. Last year's announcement at the Paris air show about revising specifications for the A350-1000 was not well received by airlines. Since then, the aircraft maker has seen the backlog for the largest member of the A350 family shrink. Airbus has argued that the airlines are getting a better product, even if at the cost of a two-year delay, but so far, customers are reticent. John Leahy, chief operating officer for customers, insists that will change. At Farnborough, he will have a chance to see whether his efforts at convincing airlines are gaining traction.

Booking further orders for the A380 also will be on the agenda. Airbus has seen only slow progress in building up its orderbook for its flagship product of late, and with plans to deliver at least 30 aircraft this year it is trying to secure at least that many orders to avoid its backlog shrinking. Eight airlines now operate the A380; Malaysia Airlines, the latest airline to receive its first A380, is due to showcase the aircraft at Farnborough.

Few doubt that the most intense battle will be the A320NEO versus the 737 MAX. Airbus enjoys a huge market share lead over Boeing, which even the European aircraft maker itself does not expect to last at current levels. But Leahy has thrown down a challenge to Boeing, saying the NEO will have a long-term market dominance of 60% in the sector. This year, though, he expects the MAX to garner more deals than the NEO. To some extent, the more important near-term challenge for Leahy is to sell the vacant delivery slots for A320 classics to ensure a smooth product transition to the NEO.

There are still more details to come for the MAX. Boeing's design has evolved in recent months, with the revealing of a new winglet and the gradual increases in fan size. Airbus is touting NEO's much larger fan, but MAX's backers note that the Leap-1—the only engine offered on MAX 737—may have a smaller but lighter fan to make up for the smaller bypass ratio. The war of words over which aircraft is the more fuel-efficient is already underway. It is possible Boeing will book its 10,000th 737 order at the air show.

In the defense realm, there will be far fewer signs of optimism. The degree of austerity that companies are grappling with is perhaps best illustrated by Northrop Grumman's decision to forgo Farnborough entirely. In an era of shrinking defense budgets in the U.S. and Europe, attending an expensive event in an increasingly narrow market had to be weighed against focusing on growth areas such as the Middle East and Asia.

As domestic markets diminish for much of the industry in the West and the focus shifts to exports, the battle for foreign deals is becoming more intense.

Indirectly, that sentiment too will be

reflected at Farnborough. Even though the U.K. is due take delivery of its first F-35B short-takeoff-and-vertical-landing aircraft next month, do not expect the Joint Strike Fighter to be in the forefront. Interestingly, this is not because of the government's high-profile flip-flop—from the F-35B to the F-35C then back to the F-35B. Instead, U.S. officials indicate that London wants the focus to be on the Eurofighter Typhoon, even though BAE Systems is a major JSF program partner. Pressure is mounting to secure more foreign sales for Typhoon in light of recent contract award defeats in Switzerland, India and Japan. There seems to be a sense that the Farnborough stage is not big enough for both fighters.

But the Typhoon program recently received some good news. The U.K.'s latest spending plan includes funding upgrades, not yet spelled out, for the multi-role combat aircraft.

Even if the JSF is downplayed, Typhoon will still have to share the fighter limelight at Farnborough. Saab is bringing its Gripen demonstrator and, in a game of one-upmanship, the Gripen will be equipped with the Selex Galileo Raven ES05 active, electronically scanned array radar (AESA). Typhoon will not fly with its AESA until next year, nor is government funding expected to underpin the development until that time.

The air show could also provide the stage for the newly elected French government to signal whether it will continue with the Anglo-French defense security cooperation effort. As part of that pact—agreed upon by then-French President Nicolas Sarkozy before he lost the election to Francois Hollande last month—France and the U.K. had begun working cooperatively on a medium-altitude long-endurance unmanned aircraft program, and have paved the way to potentially doing the same for unmanned combat air vehicles. Whether Hollande will follow that path is still uncertain.

The unrelenting focus of European and U.S. companies on exports will underpin the majority of the discussions at Farnborough. With the first customer delivery of the A400M European military transport aircraft in sight around year-end, Airbus Military is ramping up efforts to secure export orders. Boeing, too, is eager for more C-17 deals as it labors to keep the strategic airlifter production line open. The appearance of the V-22 at the air show also comes as Bell Helicopter and Boeing look to finalize the first export order for the tiltrotor.

CROWN COPYRIGHT

The Eurofighter Typhoon will follow its Farnborough show duty with a mission to protect the Olympic Games in London next month.


AIRBUS MILITARY

Airbus Military is eager for the A400M to fly at Farnborough next month. The aircraft was grounded by engine woes at last year's Paris air show.

ROBERT WALL/AW&ST

Saab plans to show off its Gripen NG demonstrator outfitted with its new Selex Galileo active, electronically scanned array radar.

# New Players, Same Old Road

BY DOUGLAS BARRIE

*Douglas Barrie is a senior fellow for military aerospace at the International Institute for Strategic Studies in London and a former bureau chief for Aviation Week.*

"Balancing the books has not been easy but our work has produced impressive results. In the new strategic environment we will be able to provide the modern and militarily effective Armed Forces that Britain needs more cost-effectively."

Just the kind of statement you would have expected to hear from British Secretary of State for Defense Philip Hammond last month when he claimed he had closed the gaping maw of defense finances. Except that the assertion was made in 1998 and belongs to a supporting essay in the then-Labour government's Strategic Defense Review (SDR).

Such were the "impressive results" that by 2009 there was a £38 billion ($60.5 billion) chasm between ambition and available cash in the Defense Ministry's 10-year equipment and support program. By some calculations, this figure was £63 billion by 2012.

> "Defense procurement machinations have a habit of crushing the most capable and best-intentioned plans."

There has been the usual Punch and Judy-show politicking. The Conservative-led coalition government repeatedly reminded anyone within earshot of the defense-budgetary "chaos we inherited" from Labour. They are correct, up to a point. But there should be a salutary lesson in Labour's brave prognostications of the 1998 SDR having ended up a decade later as little more than a promissory note and an admission there was no more money. Defense procurement machinations have a habit of crushing the most capable and best-intentioned plans.

The effort by Hammond, and his predecessor Liam Fox, may have resulted in defense expenditure being corralled but it has now to be kept there.

"Reaching a balanced budget for the MOD's [Ministry of Defense] 'Planning Round 12' . . . represents a hugely important milestone in the transformation of defense. It is a symbolic break with the failed practices of the past and a solid foundation on which to build," Hammond told Parliament May 14. Around £160 billion is now allocated for the 10-year equipment and support program, a plan "endorsed" by the finance department. This is of course a significant cut from the £198 billion or £223 billion (depending on the figure used) that would have been required to meet the previous aspiration for the 10-year period.

Not all of the savings are driven by cuts to the equipment program. Two years of frozen pay, followed by two years of a 1% increase cap, and reductions in cost overheads and non-front line expenditure also contribute. Some of the equipment cuts were spelled out in the 2010 SDR. These included canceling the Nimrod MRA4 anti-submarine warfare (ASW) and maritime patrol aircraft, early withdrawal from service of the Harrier GR9, cuts in the number of Tornado GR4s, withdrawal of the Sentinel R1 intelligence, surveillance and reconnaissance aircraft when no longer required for Afghanistan, and pulling the C-130J from service by 2022, nearly a decade earlier than originally slated.

Some of these actions resulted in capability gaps—most notably for carrier strike and maritime patrol efforts. The present planning date to reconstitute carrier strike capability is 2020, assuming no more vacillation on the variant of F-35 being bought, while ASW/maritime patrol is likely a candidate for the ministry's priority list. This is a kind of equipment program reserve bench whereby if enough financial headroom is found then unfunded aspirational projects can be brought into play. The Sentinel R1, for instance, could be granted a reprieve.

The extent and implications of the cuts has not gone unnoticed. The Atlantic Council, a U.S. think tank with many U.S. political and military luminaries in its ranks, cautioned in May in a report into the future of the Alliance that "deep defense reductions risk undermining [the U.K.'s] special status as one of NATO's most capable members."

The British Defense Secretary does recognize that balancing is a continuous act. Planning Round 12 "starts to put the destabilizing uncertainty behind us as we move forward with defense transformation."

Key to keeping the Defense Ministry's books in order will be Bernard Gray, the person in charge of reforming defense equipment acquisition management in the ministry. He is trying to craft a stable defense procurement model after issuing a stinging rebuke of current practices in 2009. The government has already instituted some of Gray's new recommendations, but still has to decide on further structural changes at the Defense Equipment & Support management agency.

It will be the extent to which these are embraced, enacted and embedded that determines whether Hammond's balancing act can be sustained.

# Avoiding Tem

## Boeing adheres to its 'keep it simple' rule in developing the 737 MAX

GUY NORRIS/LOS ANGELES and MICHAEL MECHAM/SAN FRANCISCO

When Boeing executives talk about sticking to the basics in their 737 MAX reengining program, they are not kidding.

Besides the improvements they expect from the new aircraft's CFM Leap-1B engines, Boeing is keeping a tight rein on the technology risks of the biggest upgrade to the 737 since the Next Generation series was launched nearly 20 years ago. To make the MAX work, Boeing needs to distinguish it from rival Airbus's A320NEO while raising the benchmark of what its customers can expect in performance and reliability.

The MAX must be sufficiently advanced to achieve double-digit percentage point improvements in fuel burn and operating efficiency over the NG. Engines and aerodynamic improvement carry most of that burden, but there are numerous technology swap-outs that the company might include in MAX to make the airplane more attractive. However, all of them come at a price, not the least of which is their potential disruption of a finely honed manufacturing process at Boeing's Renton single-aisle jet factory south of Seattle, which is midway through the biggest increase in 737 production rates in history.

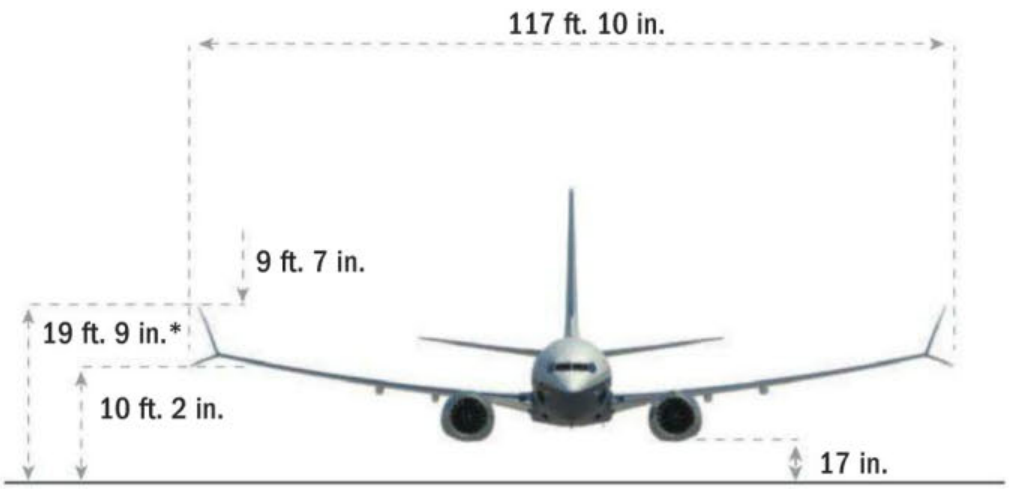
It is essential that Boeing get right this next phase in the four-decade 737 story. The family is a priceless asset and must remain so. Boeing expects 70% of all aircraft sales in the next two decades to be single-aisle transports.

Since deciding last August against its New Small Airplane (NSA) project in favor of the MAX, Boeing has been cautiously working out just how far it needs to go with technology advances in order to compete with the NEO. The company's designers felt they had a game-changing prospect in the NSA that would trump a basic engine upgrade to the A320. At first, so did Boeing's customers. But as fuel costs rose, they began asking for relief sooner than the NSA would be available. The overwhelmingly positive response Airbus gained from the NEO—it quickly shot past the 1,000-order mark—pushed Boeing to shelve the NSA.

**MAX 8 is Flagship for New 737 Family**

| | |
|---|---|
| **Wingspan:** | 117 ft. 10 in. |
| **Length overall:** | |
| **MAX 7** | 110 ft. 4 in. |
| **MAX 8** | 129 ft. 6 in. |
| **MAX 9** | 138 ft. 2 in. |
| **Height:** | 41 ft. 2 in. |
| **Winglet height:** | |
| Ground to top: | 19 ft. 9 in.* |
| Ground to bottom: | 10 ft. 2 in. |
| Winglet spread: | 9 ft. 7 in. |
| **Nacelle ground clearance:** | 17 in. |

**Measurements are for a fueled aircraft.*

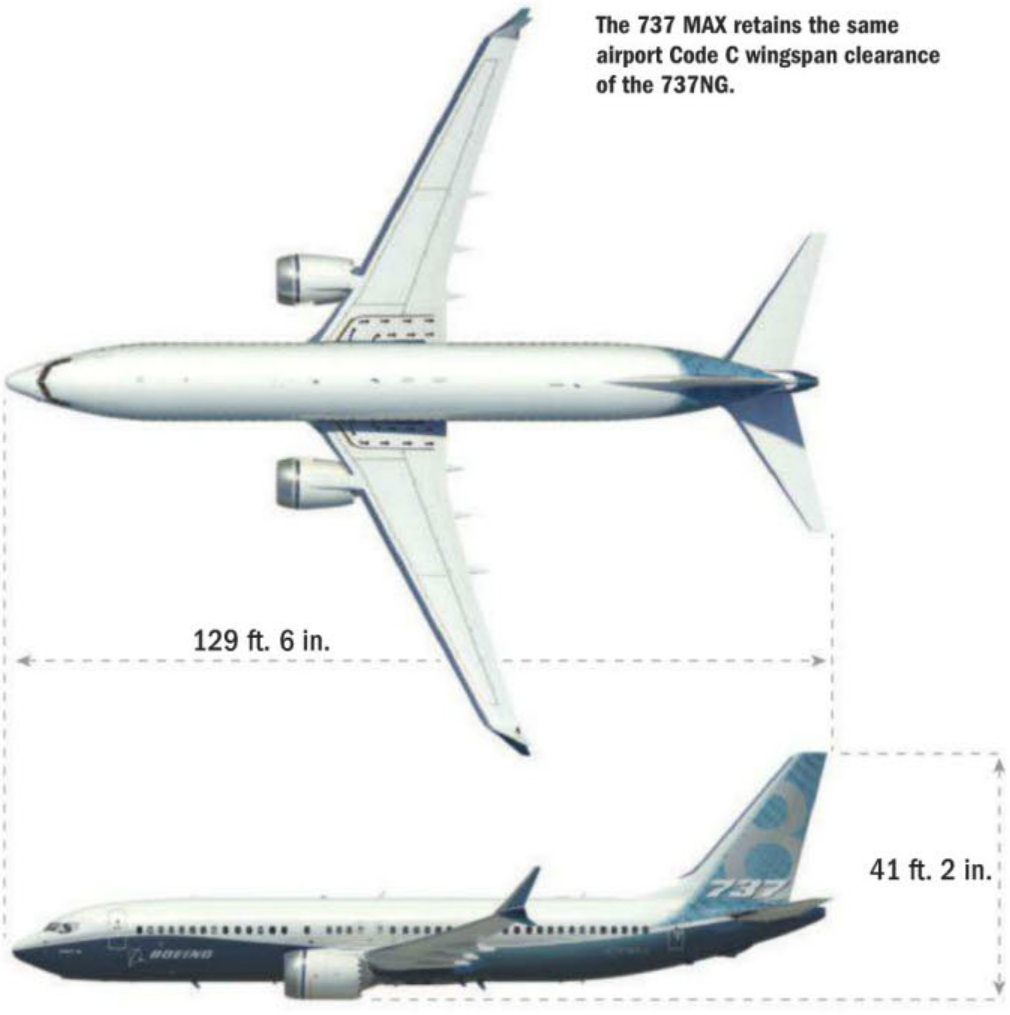


# ptation

With the MAX, Boeing wants to avoid the temptation of adding cost and complexity to the 737 program; it needs to stay focused on what airlines value most, says the MAX's chief project engineer, Michael Teal. "Customers are looking for improved economics," he says.

Teal comes to the MAX from the Boeing 747-8 where, as chief engineer, he witnessed firsthand what can happen when unexpected issues turn a fast-tracked derivative into an over-budget development marathon. Those harsh lessons are keeping the MAX team focused on its development schedule.

Boeing Commercial Airplanes President and CEO Jim Albaugh has hinted that a service entry for the first MAX might be brought forward from the official goal of the fourth quarter of 2017. But Teal says that is only "if we can." There will be no overconfident promises like those made early in the 787 and 747-8 programs that erupted into embarrassing schedule lapses. "I was on those phone calls in 2008, and I didn't like" them, he says.




**The 737 MAX retains the same airport Code C wingspan clearance of the 737NG.**

Boeing will spend the rest of this year "getting the final concept done" before marching on to a firm configuration in mid-2013, Teal says. Design will take place in 2014, assembly in 2015 and first flight in 2016. The 737-800-sized MAX 8 is to be produced first.

This plan reflects the evolution of airline orders for single-aisle jets. In the early days of the 737NG program, the 126-149-seat 737-700 was easily the best-seller, in no small part because of its popularity with launch customer Southwest Airlines. Like many others, Southwest—also the MAX launch customer—is now ordering bigger single aisles, having moved up to the 162-189-seat 737-800. This up-gauging trend is widespread. As of May, there were 1,415 orders for the 737-700, which entered service in December 1997; for the -800, which came on the scene in April 1998, there were 4,053—more than all 737-100s, -200s, -300s, -400s, -500s and 600s combined.

There is a bigger backlog for the 737-900ER, the closest thing Boeing has to a 757 replacement, than for the -700, even though it entered service a half-decade

## By the Numbers

| | | 737NG | 737 MAX |
|---|---|---|---|
| **Maximum range:** | | | |
| 737-700/MAX 7 | | 3,440 nm | ~3,500 nm* |
| 737-800/MAX 8 | | 3,115 nm | ~3,177 nm* |
| 737-900ER/MAX 9 | | 3,235 nm | ~3,300 nm* |
| **Fuel capacity:** | | | |
| 737-700/MAX 7 | | 6,875 gal. | same |
| 737-800/MAX 8 | | 6,875 gal. | same |
| 737-900ER/MAX 9 | | 7,837 gal. | same** |
| **Maximum takeoff weight:** | | | |
| 737-700/MAX 7 | | 154,500 lb. | ~157,590 lb.* |
| 737-800/MAX 8 | | 174,200 lb. | ~177,685 lb.* |
| 737-900ER/MAX 9 | | 187,700 lb. | ~191,454 lb.* |
| **Seating:** | | | |
| 737-700/MAX 7 | 1-class | 149 | 149 |
| | 2-class | 126 | 126 |
| 737-800/Max 8 | 1-class | 189 | 189 |
| | 2-class | 162 | 162 |
| 737-900ER/MAX 9 | 1-class | 220 | 215 |
| | 2-class | 180 | 180 |
| **Cargo:** | | | |
| 737-700/MAX 7 | | 966 cu. ft. | same |
| 737-800/MAX 8 | | 1,555 cu ft. | same |
| 737-900ER/MAX 9 | | 1,585-1,824 cu. ft. | same*** |
| **Cruise speed:** | | | |
| 737-700/MAX 7 | | Mach 0.785 | Mach 0.79 |
| 737-800/MAX 8 | | Mach 0.785 | Mach 0.79 |
| 737-900ER/MAX | | Mach 0.791 | Mach 0.79 |

*Source: Boeing*

*Footnotes:*

**All 737 Next Generation model data are with winglets. 737-900ER range is with two auxiliary belly fuel tanks. MAX estimates are based on a nominal 2% gain from aerodynamic and engine improvements.*

***With two auxiliary tanks.*

****737-900ER's capacity decreases as auxiliary tanks are added to gain range. With no tanks, 1,824 cu. ft.; with 1 tank, 1,674 cu. ft.; with 2 tanks, 1,585 cu. ft. MAX 9 is expected to be the same.*

later. Consequently, the MAX 9 will be the next to enter service, in 2018, and the MAX 7 will follow in 2019.

After considering a huge range of design options—including split trailing edges and hybrid laminar flow—Boeing's choices for the MAX underscore how it is restricting itself to a strict diet to assure as smooth a production transition as possible to the MAX from the NG.

The CFM Leap-1B engine is the principal reason Boeing anticipates a 13% reduction in fuel burn compared to the 2012-standard Next Generation 737. The engine's fan is expected to slightly exceed 69 in. in diameter, so the Leap is larger and heavier than the CFM56-7B. But that weight is more than offset by the Leap's larger 8.5:1 bypass ratio, which will contribute an anticipated 11% fuel burn benefit (see p. 61). Lower drag in the aft fuselage and introduction of novel "dual-feather" winglets account for the rest.

The all-important engine installation is an evolution for the 737 and builds on the mounting design used for the 787. The installation moves the engine "a little forward and up," says Teal. By cantilevering the engine out ahead of the wing, Boeing is avoiding the need for a dry bay above the engine, thereby preserving fuel volume. "It's not new technology, but we wanted a little more room under the nacelle," says Teal. The bottom of the MAX nacelle will be 17 in. off the tarmac, 1 in. less than an NG's.

The nose-wheel landing gear is 8 in. longer than the 737's and prompted Boeing to move the front bulkhead of the nose undercarriage bay—the "doghouse"—and an associated inspection hatch forward about 8 in. The leg extension also means that an aerodynamic fairing is required to accommodate the bulge of the nose wheel. "We're trying to minimize this, and we're still trying to make it smaller," says Teal. Nonetheless, he says the aerodynamic impact is negligible.

Building on the 787 program's application of a natural laminar flow (NLF) nacelle, Boeing is "looking at opportunities as to how we can keep the NLF attached" in the MAX, Teal says. But the option of a hybrid laminar flow control system (HLFC) for the vertical fin will not be undertaken. It was originally studied as part of the interim "737NG Plus" upgrade that was to be a gap-filler

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between the 737NG and NSA. "There is the complexity [in the design] and the build of it, as well as [its] questionable value on short flights," Teal explains. The HLFC system has been developed as a drag-saving device for the stretched 787-9 and, pending full development, is expected to be offered as a 787-8 performance upgrade.

The recently announced dual-feather winglet is the most distinguished external feature of the MAX. The baseline blended winglet is credited with providing a 3-4% fuel-burn improvement over a 737 without winglets. Boeing expects the MAX's feathered design to save up to 5.5% in fuel burn, or the equivalent of an additional 1-1.5% above the 737NG standard, says Teal.

The feathered winglet integrates a downward-tilted version of Boeing's raked-tip configuration with a more conventional winglet. Its ground clearance of 10 ft. 2 in. will be 2 in. greater than the NG's winglet.

The new design has undergone low-speed wind tunnel tests at Qinetiq's U.K. facility and Boeing's transonic tunnel. "The data showed it performed as expected," says Teal. The winglet design team will perform further work on the concept as the fuselage's design details and build plans firm up in 2013. The dihedral of the winglet, combined with anhedral of the modified raked tip, assures that the MAX's wing span is within the "Code C" gate size of the 737NG family.

The fuselage's aerodynamic cleanup is focused on the very aft section just behind the auxiliary power unit (APU). This marks the first tail cone taper revision since the 737's original short, stubby fuselage design emerged in the 1960s. The redesign eliminates the need for the vortex generators that current models use to "help calm down the airflow," says Teal.


**The MAX's design reflects changes from the 737-800 with winglets and 2011 performance improvement package.**

Extending the cone in a 787-style allows the flow to "clean up nicely," according to computational fluid dynamics analysis. A new low-drag APU inlet also will be integrated into the tail, while a horizontal root fillet fairing, or "strakelet," will be added to reduce drag around the empennage.

Although APU upgrades were considered as part of the original 737NG Plus package, Teal says none are planned for the MAX. Instead, system changes will focus on the adoption of fly-by-wire actuated wing spoilers and a digitally controlled engine bleed system for the environmental control system. "The air conditioning packs are not changing, but the control for getting bleed air is going digital," he says. The new spoiler system will save weight and installation costs.

Since the spoilers also will be connected directly to the flight control system, they can be used for maneuver load alleviation (MLA). By symmetrically deflecting the spoilers under certain conditions, wing-bending loads are reduced. This allows use of a slightly lighter wingbox. Other wing changes were considered, including an improved trailing edge for better low-speed handling. While aspects of these studies, such as a mini-split flap, are expected to be tested as part of an upcoming EcoDemonstrator program, Teal says the MAX will not use them. "I don't think we need them," he says.

To handle higher loads associated with the MAX's heavier operating weight, the airframe will be locally strengthened with regauging of skins, spars and structures in the fuselage, empennage, wing and landing gear. "If you have heavier engines, this increases the torsion loads into the body and these are reacted through pickle forks," Teal says, referring to structures in the wing-fuselage join area. The existing design will be retained but

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"just gauged up" for the MAX, he adds.

Also under consideration is the replacement of the longitudinal beam—called a crease beam—which, in the dual-lobe configuration of the 737 fuselage, works with the floor beams to smooth out-of-plane loads at the intersection of the two lobes. "As we work through the certification basis, if the decompression analysis works out, there might be an opportunity to go to a one-piece truss," Teal says.

By the time the MAX enters production in Renton, Boeing expects the factory to be producing 42 airplanes per month from the plant's two final assembly lines. Changes needed to accommodate the new airplane are still being considered, but the general goal is for MAX fuselages to flow seamlessly down the line with the NG's. Early planning includes the possibility of shifting an engine buildup area off Line 1 in Renton's Building 4-82 elsewhere to make room for a proving line for early MAX production.

Spirit AeroSystems provides the 737's fuselages from Wichita and is still in the early planning stages for what accommodations will be necessary for the MAX. But Vice President Forrest Urban, who leads MAX integration as head of advanced projects, says only minor tooling changes are anticipated. The company wants to avoid significant changes to the assembly process in its big Plant 2.

> **"We think the [737] NG is the most efficient, highest-quality production process anywhere"**

Fuselage alterations, such as in Section 48 or at the doghouse, will be accommodated offline and brought to the plant's final assembly, Urban says. This same approach is used for Boeing's P-8 Poseidon maritime patrol aircraft, which is based on the 737NG fuselage. Urban expects changes for the MAX to be less extensive than those for the P-8.

"We think the NG is the most efficient, highest-quality production process anywhere," he says. To keep it that way, the company will turn to its Spirit Exact design-build software process to smooth the MAX's transition into the 737 line.

As of May, Boeing had recorded 451 MAX orders. The new program is leading the 737's charge past the 10,000-total-order mark. As of last week, Boeing was within 221 orders of that milestone, which no other commercial jet has reached. The company does not expect the head start Airbus achieved with the NEO to affect the sales balance between the A320 and 737 over the long run. To European reporters, Vice President Randy Tinseth, Boeing's head of marketing, said the MAX will build on the 737's "higher lease rates, higher 'fair market' values and higher residual values" to attract orders.

With the MAX order count growing, the marketing heat is on for both manufacturers as they head toward next month's Farnborough air show.

## MAX Joins 737 at Historic Renton Factory


The 278-acre Renton factory south of Seattle was opened in 1941 for U.S. Navy flying-boat production. Now it is to accommodate the MAX, the fourth-generation 737.

# MAX Leap

## CFM homes in on final 737 MAX engine configuration as core tests continue

**GUY NORRIS/LOS ANGELES**

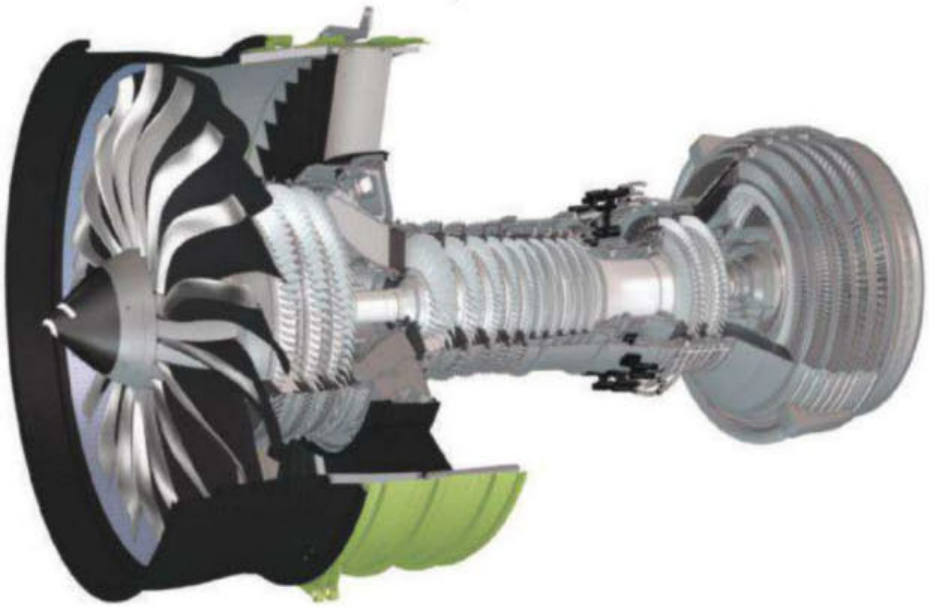
Three decades after CFM International and Boeing revolutionized the single-aisle market by putting a high-bypass turbofan under the low-slung wing of the 737, the two partners are on track to evolve the combination to a whole new level.

The symbiotic relationship between Boeing and the General Electric-Snecma joint venture over the CFM56-powered 737 put it in good stead when Boeing opted last year to develop a reengined 737 rather than an all-new small airplane. Yet CFM says the official selection of the Leap, its successor to the CFM56, as the sole engine for the new 737 MAX project in November 2011, was no slam dunk.

Pratt & Whitney's aggressive posturing over the newly launched PW1000G geared turbofan family, and its early success on the competing Airbus A320NEO, led to serious considerations of a contest for a place on the updated 737. Although no direct competition took place, CFM knew that to compete with the geared turbofan—and meet the ambitious performance targets of the new-generation single-aisles—it had to take bold steps. Ultimately, CFM made the radical decision to move beyond the CFM56 with a fundamentally new architecture.

The move away from the GE F101-based core, which has served CFM so well since the 1970s, is therefore under close scrutiny by the market. This is hardly a surprise, since the engine easily represents the single-biggest contributor to achieving the lower fuel-burn targets of the MAX. But CFM believes the lineage on which the Leap's new formula is based gives it just as much potential as the CFM56. The engine combines GE's GE90 and GEnx large-engine-inspired design with Snecma's low-pressure and advanced composite materials know-how.

"We think we've got the right architecture and, the more we go into it and the closer to defining the design, we feel more comfortable with what we've chosen," says CFM Executive Vice President Chaker Chahrour. Compared to the latest-standard CFM56-7BE, which provided up to a 10% fuel-burn improvement relative to a 1985-standard CFM56-3, the Leap-1B will provide a 15% specific-fuel-consumption improvement at engine level. By the time other factors weigh in, Boeing expects the Leap to contribute around 11% of the MAX's overall 13% fuel-burn advantage over the current 737.



CFM

**The composite fan, fan case and two-stage high-pressure turbine easily distinguish the Leap-1B from a CFM56-7B.**

Providing new detail about the design of the two-shaft turbofan, the Leap program manager for product development, Gareth Richards, says, "we are in the final steps of refining the cycle with Boeing. We've been optimizing very closely with Boeing back and forth." CFM is on track for engine design freeze, or the Toll Gate 3 milestone, in September and is set to begin the detailed design phase in the second quarter of 2013.

The first full Leap-1B will start tests in the second quarter of 2014 with the aim of achieving Part 33 engine certification in the first quarter of 2016. This is designed to provide ample margin for flight tests of the 737 MAX and its planned entry-into-service in the second half of 2017. Boeing has indicated, however, that it may try to accelerate the debut of MAX by several months and Richards says, "we're studying that, and if they ask for a faster schedule path we will support it." The existing development plan, though, has "some margin" should Boeing "pull in" service entry, adds Chahrour.

After some deliberation earlier this year, Boeing and CFM opted to increase the Leap-1B fan diameter to 69.4 from 68 in.—a move made possible by the decision to increase the length of the nose gear leg by 8 in. Combined with the smaller core, the move raises the Leap-1B's bypass ratio to 8.5:1 from around 5:1 on the 61-in.-dia. CFM56-7 versions and further reduces specific fuel consumption.

The fan, like the surrounding fan case and containment system, will be made of lightweight composites built up using the resin transfer molding (RTM) processes pioneered by Snecma. "It's a Snecma-owned module," says Richards. The process involves weaving the composite on a loom and injecting it with resin in a dye rather than laying down fibers and baking it with resin under pressure to form a laminate, he notes, as in the process used by GE for the larger GE90 and GEnx composite blades.

Perfecting RTM provided the critical materials technology breakthrough that enabled smaller-diameter composite fan blades to meet the same bird-strike requirements as larger engines. The 18 composite blades form a 50% lighter blade set than the 24 titanium wide-chord blades used in the -7B or 36-blade -5B. "A lighter fan means a lighter shaft and lower dynamic loads. There's a big

ripple benefit in the system from RTM," says Richards.

As with the ingenious repackaging of the side-mounted gearbox and accessories that gave rise to the first egg-shaped nacelle of the 737-300 in the 1980s, the 21st century variant will be "three-dimensional to provide adequate ground clearance and optimize the fan diameter," says Richards. However, the flattening effect will not be as noticeable with the Leap-1B because of its larger diameter, he says.

Aft of the fan is a debris rejection system built into the "swan-neck" of the flowpath as it curves downward into the compressor inlet. Designed to operate at lower thrust settings for fan modularity, the system consists of automatic variable-bypass vane doors that open to eject particles in the fan flow into the bypass duct. Based on a design successfully incorporated into the GE90, the doors open on the ground during taxi and in the initial takeoff run, as well as during low-thrust flight regimes. "It's a huge benefit, because we don't get erosion or mechanical wearing away of the compressor airfoils," says Richards. The system is also "very effective in dealing with icing and water," adds GE's strategy manager for commercial engines, Ron Klapproth.

The high-pressure heart of the engine is almost entirely derived from GE90 and GEnx technology. The 10-stage high-pressure compressor, for example, is comprised of both bladed stages and blisks (integrally bladed disks), just as in the Leap's larger new-technology semi-siblings. The first five stages are made up of titanium blisks that give way to higher-temperature-resistant nickel-alloys further aft. Pressure ratio is equivalent to the GE90's 22:1, and slightly below that of the GEnx.

The operation of the compressor is being evaluated, along with other elements of the high-pressure spool, by ongoing tests of the eCore. "This is to make sure the compressor, combustor and turbine are matched correctly," says Klapproth. Although each part has been through module and component testing, the ultimate efficiency and performance of the new CFM engine can only be verified by following GE's long-time policy of running baseline cores before full-scale engines. The second eCore completed tests in 2011 while a third eCore will run in the first quarter of 2013. "We're building that right now," he adds.

The combustor is made up of a second-generation version of the twin-annular pre-swirl (TAPS) low-emission design used in the GEnx. Aside from reducing nitrous oxide (NOx) production to levels 50% below CAEP/6 limits, the thorough fuel-air mixing and broader combustion front of the TAPS generate a consistent flame front and even temperature going into the high-pressure (HP) turbine.

"Temperature profile is the bane of the life of an HP turbine designer because the peak distribution is what they have to live with," says Klapproth. "Having a flat profile is a big benefit to durability and time on wing and, indirectly, to efficiency because it means the turbine blade design doesn't have to put so much cooling air into the blade."

CFM

**Integrally bladed disks, or blisks, are expexted to improve the efficiency of the Leap's high-pressure compressor.**

The two-stage HP turbine is the single most important fundamental change in architecture from the CFM56 to the Leap. The decision to break with a design feature that has helped propel CFM into the No. 1 engine maker slot was not taken lightly.

"There was a debate over one or two [HP turbine stages], but the outcome was clear eventually that fuel burn in combination with maintenance costs was the right course," says Richards. Based on a direct scale of the GE90 and GEnx, the turbine incorporates a new generation of cooling design. Although not willing to disclose more detail, Richards says the configuration "allows us to have a more flexible design with a more even and uniform cooling flow within the blade structure."

The HP turbine first-stage shroud is also, for the first time on any CFM engine, made from a ceramic matrix composite (CMC). "It's a relatively simple application, but there is a tremendous payoff in terms of the architecture it enables," Richards says. "First the high-temperature capability of the material means a significant reduction in cooling air. The classic material shroud is a lattice of cooling holes, so a lot of cooling air for that is a burden on the cycle. With CMC, that cooling air is not required and that air can be working."

Secondly, CMCs are lower density, approximately one-third the weight and require less supporting structure. "They are also very thermally stable," says Klapproth. "Although you've got to still work with thermal distortion of the rotor," he adds the use of CMCs will help maintain tip clearances.

The low-pressure (LP) turbine is made up of five stages that, in rig tests, have demonstrated "very high efficiency," says Richards. "We have other rig tests ongoing, but we feel confident in our aerodynamics. We are seeing higher efficiency than in previous CFM products." The stages have fewer, more efficient, blades than current CFM56 engines, or so-called low-solidity. Following an LP turbine rig test in 2011, Klapproth says, "we were just ecstatic about the performance numbers that came in, and we have one more coming up in 2013.

"Performance is coming in right where we wanted it to come in," says Richards. "If you look at Leap, it's by far the most extensive test program we ever laid out."

With key testing of the entire engine still ahead, CFM is "confident of its performance predictions," Richards says. "Snecma has done a good job of the LP system. It's going to be a kick-ass engine."

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# Kim's Hoax? Don't Bet on It

BY UZI RUBIN

*Uzi Rubin, as head of Israel's Missile Defense Organization from 1991 to 1999, oversaw the development of the Arrow anti-missile system.*

Six huge, three-stage missiles on their giant 16-wheel transporter erector launchers (TELs) rolled through Pyonyang's Kim Il Sung Square on April 15, unleashing a blizzard of speculation in the West. Was this the fulfillment of former Defense Secretary Robert Gates's prediction of a new North Korean road-mobile ICBM? If so, this would vindicate the U.S. investments in the Ground-based Midcourse Defense system deployed in Alaska and California. No wonder some critics rushed to trivialize the parade and portray the missiles as crude props designed to impress the yahoos.

Indeed, it was clear that the missiles, denoted KN08s by some analysts, were first and foremost propaganda tools intended to send powerful messages at home and abroad. Unlike other missiles in the parade that were brilliant white with forest green TELs, the KN08s were mottled brown and their TELS were camouflaged all the way to the wheel hubs, evidently to extol their immunity to preemption when moving invisibly in the wild mountains of North Korea. At the same time, this gorgeous camouflage scheme was marred by three bright, metal, finished bands with no apparent function except to broadcast that the missiles have not one or two but three liquid-propellant stages, implying great ranges.

> "The fact that the North Koreans paraded mock-ups of three-stage KN08 missiles does not necessarily mean that real ones do not exist."

The eminent German analysts Robert Schmucker and Markus Schiller were quick to dismiss the items in the parade as dummies and questioned whether they represented a real missile program, implying it was a hoax. But this conclusion might be too hasty.

That the six KN08 units displayed in Pyongyang were partly or wholly dummies is generally accepted. But other missiles in the same parade were also represented by mock-ups, most noticeably the BM25s, whose existence is taken for granted by U.S. and Israeli sources. The fact that the North Koreans paraded mock-ups does not necessarily mean the real missiles do not exist, just that they were not paraded. The clues about whether the mock-ups represent a real program must be gained from the visual cues of the display. If the architecture of the missile they portrayed was unworkable, it could mean they were figments of some model maker's imagination rather than viable designs. Is this the case for the KN08?

Schmucker and Schiller contend that "rockets are always optimized for performance and designed as simple as possible." They point out several features in the KN08 that seem to be neither optimal nor simple—for example, the liquid propulsion and the number of stages. However, in real life, this is seldom true. Program managers must compromise among performance, costs and schedules. Simplicity is great—when affordable. In an isolated country like North Korea, designers must use what is available and stick to their previous experience, rather than break new ground. The result might be inelegant and cumbersome to our eyes but sensible enough under the constraints North Koreans face.

Second, it is argued that liquid propulsion does not make sense for a road-mobile missile. If based on nonstorable propellants requiring launch-site fuelling, the missile's survivability during the fueling operation is questionable. If based on storable fuels, as is the Soviet SSN6, then the nominal freezing point (-11C) of the oxidizer would preclude the missile from wintertime use.

Both arguments are less than convincing. Missiles and TELs could be stored in natural or man-made hiding places, fueled under cover and driven short distances to be fired. Saddam Hussein's troops did this successfully in 1991. As for the freezing point of the storable oxidizer, the same argument has been made about the road-mobile BM25, which uses the storable liquid fuels of the R27/SSN6 submarine-launched ballistic missile. Yet the BM25 is real, suggesting the oxidizer freezing point issue has been solved, probably by cutting it with nitrogen oxide.

Future findings might shed more light on this dispute. But as matters stand, there is no reason to dismiss the viability of the KN08. Between the theories of a hoax and a real missile, the balance is on the latter. Norbert Brugge, another noted German analyst, speculates that the KN08 is another case of pirated 1960s Russian technology, this time of the R29/SSN8, a two-stage 7,500-km (4,700-mi.) SLBM.

Obviously, the KN08 is a work in progress. But it is a program on which North Korea has already spent serious money for costly Chinese TELs. Most important, by displaying this prospective three-stage missile, the North Koreans made their next target clear. The U.S. would do well to hone its homeland missile defense against this looming threat.

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