SEARCHING FOR A 787 FIX

RICH MEDIA EXCLUSIVE

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Printed in the U.S.A.

February 4, 2013

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Volume 175 Number 4

AVIATION WEEK
& SPACE TECHNOLOGY

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UP FRONT

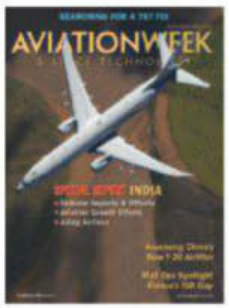
THE WORLD

787 GROUNDING

22 *The NTSB says the battery that caught fire at the Boston airport for the auxiliary power unit in a Japan Airlines Boeing 787 "spewed molten electrolyte" and damaged components and structure up to 20 in. away.*

DEFENSE

AIR TRANSPORT



COVER STORIES

With the Aero India show this week at Air Force Station Yelahanka in Bengaluru, all eyes are on the largest defense importer in the world and a commercial market of vast potential. Among a slew of aerospace and defense purchases that India is making is the Boeing P-8I maritime patrol aircraft—a variant of the U.S. Navy's P-8A. Boeing photo by Leo Dejillas.

26 *Successful development of the Y-20 airframe is in itself an important accomplishment for the Chinese industry.*

20 *Boeing remains adamant in its faith in the current lithium-ion technology.*

30 *A decade of meager investment in tactical surveillance catches up with France.*

Safran is recruiting engineers for some Very Important Missions

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KEY MISSIONS, KEY TECHNOLOGIES, KEY TALENTS

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On the Web

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

The FAA's grounding of the Boeing 787 was the first time the U.S. agency had grounded an entire commercial jet type since 1979, after a McDonnell Douglas **DC-10 crashed in Chicago** shortly after takeoff. David M. North, who became editor-in-chief in 1995, **reported extensively** on that grounding, which lasted 37 days. **Read his article** from June 11, 1979 and stay up to date throughout the week on developments concerning the battery problems that are keeping 787s out of service, at **AviationWeek.com/787**

The Dutch army stood up its new fire support command on Jan. 25. *ow.ly/hg1vT*

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JSF DEBATE

The American Enterprise Institute has joined the Joint Strike Fighter debate, detailing its case for the F-35. But **Senior International Defense Editor Bill Sweetman** takes issue with the institute's arguments. **Join the debate on our Ares blog.** *ow.ly/hg0F5*

READER COMMENT

Alexandre on **Boeing's 787 battery problems**: "Boeing should have stuck with **proven technologies** before putting new ones in design development and production." *ow.ly/hgMs6*

PREMIUM CONTENT

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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.

'SYSTEM'ATIC SAVINGS

I wonder why Michael Dyment, author of a recent Viewpoint (*AW&ST* Jan. 14, p. 54), did not mention the savings that would be realized by taking the money from the little-used WAAS (Wide-Area Augmentation System) and putting this toward NextGen. WAAS has not been used at all by commercial aviation in spite of the FAA trying to "hook" every system possible to it.

GPS III is already quietly at about 50% of the satellites needed, which is 20. It appears that people just want to gripe about more funding and never want to look at what is being wasted in the current budget.

A few years ago, an FAA employee in charge of instrument landing systems (ILS) told me he asked for four replacements, but received funding from Congress for 11. He said he was going to put ILS in places that had no use for them.

We need to look at deleting programs that are no longer necessary—and we need to do so quickly.

Phil Boughton
ALEXANDRIA, VA.

AGITATING OVER ADS

The Airbus/EADS advertisement that ran recently in successive issues (*AW&ST* Dec. 10/17/24, 2012, pp. 4-5) is low-class mudslinging, at best.

The fact that Boeing did not respond indicates its management's high business ethics and standards.

The fly-by-wire (FBW) technology that Airbus touts as its own was initially developed by the U.S. for military aircraft long before the French had the idea. I believe the technology was hastily implemented by Airbus and was one of the factors that led to the crash of an Air France Airbus A330-200 over the Atlantic Ocean in June 2009.

Spare your readers from such ads.

Dino Scanderbeg
VALENCIA , CALIF.

FBW BY THE NUMBERS

In a recent letter, reader Capt. (ret.) J. Lepkovsky inaccurately impugns the safety record of fly-by-wire (FBW) aircraft (*AW&ST* Jan. 14, p. 8).

With almost 25 years of in-service experience, the superior safety record of FBW aircraft has been demonstrated clearly and irrefutably. In fact, with about 200 million flight hours and 60 million cycles, the world's fourth-generation of jets—aircraft such as the FBW Airbus A320 family, A330, A380, and Boeing 777 and 787—have recorded an accident rate (one fatal accident per 10 million hours in the past 10 years) *half* that of the quite advanced third generation of commercial transports that preceded them, such as the A300/A310 and the Boeing 737/757/767 and, yes, even the Boeing 747-400, which Lepkovsky so proudly flew.

He's entitled to his opinion—but not to his own set of facts. The reality is: Today's newest, most modern aircraft take full benefit of modern FBW safety enhancements, and the facts show that they make flying increasingly safer for the world's travelers.

Bill Bozin, Vice President
Safety and Technical Affairs
Airbus Americas
WASHINGTON, D.C.

MERKEL AS A FORCE FOR GOOD

I am writing in response to your naming Angela Merkel as your Person of the Year—but citing her as a person of negative influence (*AW&ST* Jan. 14, p. 44).

I was surprised by how little your editorial tried to understand Merkel's viewpoint in the context of the recent global economic problems. The woman is responsible and accountable to 81 million Germans, and arguably many more people throughout Europe.

What the global financial crisis has partly illustrated to me is that a better balance needs to be struck between the wants of CEOs of large corporations and free marketeers, and what is best for nations and the general population (including millions of aerospace industry employees). European taxpayers will be footing the bill for a lack of regulation and irresponsible activity in certain industries long after EADS CEO Thomas Enders retires.

Is it really such a surprise that there is a lack of trust between big business and government (whether it be President Barack Obama or Chancellor Merkel) considering the recent history? Is it really sensible to create aerospace giants that are too big to fail, just like the often-discussed financial institutions?

Most Europeans want to retain the option of government intervention—only to be used in rare circumstances.

As an aerospace industry employee, I am also baffled by the apparent constant need of some senior executives to reorganize their companies. The EADS/BAE merger may have been too big a step for a company that has been recently managed in such an inefficient manner.

I am sure many EADS employees will prefer the opportunity to integrate their company better, rather than have to deal with a more radical merger and another reorganization.

Mark Gleeson
DUBLIN, IRELAND

MERKEL'S METRICS WORK

Your Person of the Year feature "Frau Nein," fails to grasp the historic underlying tension among the participants of Germany, France and the ever-vacillating U.K.!

Approving the EADS/BAE merger could have placed Deutsche Airbus and its employees in a potentially vulnerable position vis-a-vis France and Britain, since it could have lost control of its very survival in Germany.

Chancellor Merkel had no choice but to oppose the merger because—had it been consummated—Germany would have been odd-man-out, posing a potentially unacceptable risk of an ever-increasing out-of-country shift in jobs and expertise.

She did not take lightly the fate of tens of thousands of highly skilled countrymen, and neither would the U.S.

Karl Kettler
FLEMINGTON, N.J.

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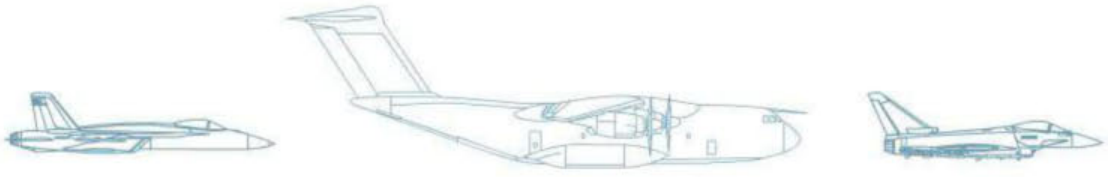

Who's Where

Sondra Barbour

Doreen Lawrence

Lorraine Murphy

P. V. Hammond

Peg Billson

Mary Hefty

K. B. Hutchison

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

Paul Adams has been appointed chief operating officer of East Hartford, Conn.-based *Pratt & Whitney*. He has held a leadership role in P&W's Engineering and Operations.

Sondra L. Barbour (see photo) has been named executive VP of Bethesda, Md.-based *Lockheed Martin Corp.'s* Information Systems & Global Solutions. She was senior VP and chief information officer. **Rick F. Ambrose** has been appointed executive VP of the Space Systems business after a tenure as VP and deputy. Barbour and Ambrose will succeed **Linda Gooden** and **Joanne McGuire**, respectively, both of whom plan to retire.

Torque Zubeck has become managing director-financial planning and analysis of *Alaska Airlines*. He was managing director of Alaska Air Cargo.

Doreen "Dola" Lawrence (see photo) has been appointed VP-inflight services at *Hawaiian Airlines*, succeeding **Louis Saint-Cyr**, who became VP-customer services last year. Lawrence was director of inflight and catering for Virgin America.

Sean McGeough has joined Cleveland-based *Nextant Aerospace* as president. He was senior executive for the Middle East, Africa and Europe at Hawker Beechcraft.

Kendell Pease, VP-government relations and communications for Falls Church, Va.-based *General Dynamics*, has retired after 15 years with the company.

Lorraine Murphy (see photo) has become chief people officer at *Air New Zealand*. She was VP-human resources for Campbell Soup Co.

Martin Assman has been appointed executive VP-civil sales of Paris-based *Sabena Technics*. He was chief marketing officer at Avtrade.

Pamela V. Hammond (see photo) has been appointed chair of the *National Institute of Aerospace*, Hampton, Va. She has been vice chair.

Steve Hollinshead has been named finance director of London-based *AJW Group*. He was group finance director at water utility Biwater.

Mark H. Lefever has been promoted to chief operating officer and **Richard W. Hildenbrand** to president of Burbank, Calif.-based *Avjet Corp*. Lefever was president and Hildenbrand executive VP.

David Parker has become the CEO of the *U.K. Space Agency*. He has been acting CEO since December.

Jim Blasingame has been appointed senior sales director at *Dallas Airmotive* in a restructuring of the U.S. sales organization. New territorial directors are **Jeff Turner,** Western U.S.; **Jeff Dunn,** Central U.S.; **Randy Sasser,** Southeast U.S.; and **Mike Frazier,** Northeast U.S. **Mark Russo** will become program director-APU products. He was sales director for the Honeywell program.

Peg Billson (see photo) has been named president and CEO of Chatsworth, Calif.-based *BBA Aviation's* Aftermarket Services. She was president of BBA Aviation Legacy Support.

Michael Schneider, founder of CVE Corp., has been named to the board of *Tamarack Aerospace Group*.

Mary Hefty (see photo) has been appointed managing director of station operations for *Horizon Air*. She was director of customer service-airports in the Western U.S.

George Kelemen has joined Washington-based *Airports Council International-North America* as senior VP-government and political affairs. He was senior director-external affairs for the American Cancer Society.

Scott Bousum has joined the global public sector policy team of Washington-based *TechAmerica* as an expert in defense and intelligence matters. He was a staffer for the House Armed Services Committee supporting the tactical air and land forces subcommittee.

Eric Hinson has been named president of Orlando, Fla.-based *SimCom Training Centers*. He was executive VP of FlightSafety International.

Michael DiGeorge has been appointed managing director of *Arinc Inc.'s* Asia Pacific Div., based in Singapore. He was senior director for E-enabled programs in Arinc's Hong Kong office.

Cameron Burr, founder of JetCapital Group, and **Glenn Leonard**, co-founder of Cavok, have been appointed to the board of directors of Ottawa-based *Mxi Technologies*.

Le Liotta has been named Northeast U.S. sales manager for Grand Junction, Colo.-based *West Star Aviation*. He was director of maintenance.

Amanda Brownfield has joined Chantilly, Va.-based *TASC* as VP of the Mission Analysis Business Unit. She was VP of a business unit supporting intelligence, defense and law enforcement customers for SAIC.

HONORS AND ELECTIONS

Former U.S. Sen. **Kay Bailey Hutchison** (R-Texas) (see photo) has been selected to receive the 2013 National Space Trophy, presented by the Houston-based *Rotary National Award for Space Achievement Foundation*. She is being cited for her promotion of the International Space Station program and her efforts to support the Orion Multi-Purpose Crew Vehicle, the Space Launch System and commercial space transportation.

Jeff Trauberman, VP-space, intelligence, missile defense and government operations at Boeing, has been elected board chairman of the Washington-based *Satellite Industry Association. Other news officers are:* **Bill Weller**, VP-marketing and sales at Space Systems/Loral, vice chairman; and **Stacy Fuller**, VP-regulatory affairs for DirecTV, treasurer.

AEROSPACE BUSINESS

Atomic Anne

France caused a flap last week with the public endorsement of Anne Lauvergeon as the potential new chairwoman of EADS, renewing doubts that efforts to curb government interference in the company's management will succeed. French Finance Minister Pierre Moscovici said Jan. 28 the ex-CEO of nuclear energy group Areva could play a "major role" at Airbus parent company EADS along with France's other board favorite, former European Central Bank President Jean-Claude Trichet. Moscovici's comments to France Info radio came just weeks after Paris and Berlin agreed to alter EADS's corporate governance following last year's failed attempt to merge with BAE Systems. But while France and Germany each have veto rights over three candidates to serve on the boards of two defense units, neither government can select board members. And despite an in-principle agreement that would balance the role of CEO Tom Enders, who is German, with the selection of a French chair, the choice is ultimately up to the new board.

Scaled Changes

Scaled Composites' veteran Kevin Mickey has been named president of the Northrop Grumman subsidiary, taking over from Doug Shane, who is assuming a special assignment to focus on completing the Virgin Galactic and Stratolaunch programs. The transition also sees Cory Bird, the current chief engineer on the Stratolaunch effort, become vice president. Mickey and Bird have risen through the ranks at the Mojave, Calif.-based company, both having been involved in projects such as the SpaceShipOne and SpaceShipTwo suborbital space vehicles as well as the WhiteKnight, WhiteKnightTwo and Proteus carrier aircraft developments. Shane, who was the first engineer hired by Scaled founder Burt Rutan in 1982, has been president since succeeding Rutan in 2008. Shane will oversee the transition to commercial operations for the Virgin and Stratolaunch programs.

F-35 Turnover

Tom Burbage, the single, consistent public face of Lockheed Martin's F-35 program since its inception, is retiring, according to program sources. He retires as the executive vice president and general manager of program integration for the F-35. Burbage was integral to capturing the F-35 business for the company in 2001 and keeping the international coalition behind the the aircraft despite cost and schedule problems. Burbage is the last of Lockheed's original F-35 leadership team to retire.

DEFENSE

Second Intercept Test

China has conducted its second ballistic missile interception test, state media report. The target was an intercontinental ballistic missile in the mid-course phase of its flight—after engine shutdown and before reentry. The Jan. 27 test met its goals and was defensive in nature, says the Xinhua news agency.

Missile Trials Completed

Russia's Tactical Missile Corp. has completed trials of the Kh-31PD, RVV-MD, RVV-SD and RVV-BD air-launched missiles, CEO Boris Obnosov tells Russian media. The Kh-31PD is the latest modification of the AS-17 Krypton family, powered by a combined rocket-ramjet engine. It is equipped with a passive radio homing head and can hit radar stations to a maximum range of 180-250 km (110-155 mi.). Obnosov also says the Kh-31AD anti-ship variant with an active seeker is in the final stages of testing. Both missiles can be used by the Sukhoi Su-30MK and Su-35 and MiG-29/35 fighters.

Maritime Hermes 900

Elbit Systems is launching a maritime configuration of its Hermes 900 medium-altitude, long-endurance UAV, aiming at the growing demand for unmanned aircraft in maritime missions worldwide, particularly in Asia. The company plans to unveil the configuration at the Aero India 2013 show in Bengaluru this week. Israel's recent discovery of offshore natural gas made maritime surveillance one of its top-priority missions. The Hermes 900 can carry payloads of up to 350 kg (770 lb.), including maritime surveillance radar, Automatic Identification System, an electro-optical multi-sensor payload and electronic surveillance systems.

Indian Iron Dome?

Israel's Rafael will spotlight its Iron Dome counter-rocket system at Aero India 2013. India has been showing

First New TDRS Satellite in Decade

The first of three advanced Tracking and Data Relay Satellite System (TDRSS) spacecraft, procured for $354 million each, is heading for checkout in a temporary geostationary slot after this Jan. 30 nighttime launch on an Atlas V from Cape Canaveral's Launch Complex 41.

The Boeing-built TDRS-K spacecraft marks the first addition in a decade to the aging, seven-spacecraft communications constellation that supports the K_a-, K_u- and S-band requirements of the International Space Station, Hubble Space Telescope and a growing fleet of multi-agency Earth-observation satellites. Boeing Satellite Systems will oversee 10-15 days of geosynchronous satellite transfer activities.

Once oversight is transferred to NASA's TDRS ground station at White Sands, N.M., a 2-3-month test and initial operations phase will follow with the spacecraft positioned at 149.8 deg. W. Long. From there it will be drifted to 171 deg. W., where it will remain while TDRSS managers decide which operational spacecraft it will replace. NASA plans to launch TDRS-L in early 2014 and TDRS-M no earlier than late 2015, replenishing the constellation for the long haul, says Jeffrey Gramling, NASA's TDRSS project manager.

BEN COOPER/AW&ST

In addition to upgraded electronics, TDRS-K features higher performance solar panels to accommodate growing S-band requirements, and a return to ground-based beam-forming for the multiple-access phased-array antennas that use S-band frequencies. That change, after experience with on-orbit beam-forming on the -H, -I and -J spacecraft, added weight to the payload carried on the Boeing 601 bus (*AW&ST* Jan. 28, p. 26). The 3,500-kg (7,700-lb.) TDRS-K spacecraft is designed for a 15-year lifetime.

interest in the combat-proven active defense system, which can intercept short-range artillery rockets. Rafael also will showcase David's Sling, the multi-mission, multi-platform interceptor; the Spyder short- and medium-range air defense systems; Python-5 air-to-air IR and air defense missiles; Derby beyond-visual-range range air-to-air and air defense missiles; and Modular, Integrated C4I Air & Missile Defense System, the company says.

No Team

Boeing will not be housing its new intelligence-gathering system, the medium-sized Maritime Surveillance Aircraft (MSA), on an Embraer platform, according to the Brazilian manufacturer's defense chief, Luiz Carlos Aguiar. He said the two companies are not in talks on the MSA project, despite an agreement on other programs, such as the KC-390. Boeing unveiled the MSA concept at the Farnborough air show last summer. Plans for a platform provider announcement were dashed at year-end.

SPACE

ISS Research Opportunities

NASA is casting a wide net as it offers research opportunities aboard the U.S. segment of the International Space Station to small businesses, industry, academia and other governmental agencies for projects with the potential to advance technologies critical to space exploration. Those technologies include in-space propulsion, space power and energy storage, closed-loop life support, thermal control, robotics and telerobotics and automated systems. The deadline is Sept. 30 for multi-phased, electronic white paper proposals in response to the NASA Research Announcement, "Soliciting Proposals for Exploration Technology Demonstration and National Lab Utilization Enhancements."

Successful Korean Launch

South Korea's STSAT 2C is operating nominally following the country's first successful launch from its Naro Space Center Jan. 30, according to the Korea Aerospace Research Institute. Succeeding on the third try with its two-stage KSLV-1 launcher, South Korea became the 11th nation to orbit its own spacecraft. The satellite will test space hardware and measure radiation levels from its elliptical polar orbit.

Andrews Nanosat for Army

Andrews Space will build an Earth-observing nanosat for the U.S. Army under a new contract with the Army Space and Missile Defense Command's Kestrel Eye program. Andrews says its 24-month contract calls for demonstration of "low-cost, commercial technologies to enable a new tier of reconnaissance capability."

Ball Expands Facilities

Ball Aerospace & Technologies has completed a $75 million, 90,000-sq-ft. expansion of its satellite-manufacturing facilities in Boulder, Colo. Clean-room space is 60% larger, and environmental testing systems have been upgraded to state of the art. The work also includes "build-out capacity for a larger thermal vacuum chamber," the company says.

Poland Widens Scope of Helicopter Shopping List

Poland has set its sights on a new fleet of heavy transport and attack helicopters as it renews its rotary-wing assets over the next decade.

On top of plans announced by the Polish ministry of defense in 2012 to purchase 70 medium utility helicopters beginning in 2014, Warsaw is planning to purchase a further 130 helicopters to replace its aging fleet of Polish and Russian-built rotorcraft. This helicopter procurement program will be the largest in Europe in more than a decade.

Under the initial phase of the plan, the first of the 70 utility aircraft will enter service in late 2014. Around 48 of the 70 will be configured for troop transport, 12 for naval anti-submarine warfare and search and rescue and the remaining 10 solely for SAR. Work will also begin on selecting a new attack helicopter to replace the Mil Mi-24 Hind. Twelve new attack helicopters will be purchased before 2018 to form the backbone of a special operations unit.

The bulk of the modernization will take place after 2018 with procurement of a further 20 attack helicopters, 54 medium rotorcraft and 24 heavy transports capable of carrying 30 troops or 5,000 kg (11,000 lb.) of payload.

Brig. Gen. Krzysztof Mitrega, commander of the Army's First Aviation Brigade, speaking at the International Military Helicopter Conference in London on Jan. 30, said replacing the Mi-24s would be the most challenging, as the Army appreciated their load-carrying capabilities as well as their armament, but that the choice of a new attack helicopter would also mean buying new weaponry and equipment.

Poland's armed forces currently operate 250 rotorcraft, the majority being Russian or Polish-built types such as the Mil Mi-2 and the PZL-Swidnik W-3 Sokol (above), although the navy does fly a handful of U.S.-made Kaman SH-2G Super SeaSprites.

Iran Launches And Recovers Monkey

PRESS TV IRAN

Iranian space officials say their nation's launch and recovery of a live monkey on a suborbital spaceflight advances the goal of an orbital human mission, but that day apparently is more distant than the stated 2020 date. The Iranian Space Agency is said to have used a variant of the Kavoshgar rocket for the 120-km (74-mi.) flight, following a 2011 test that reportedly carried a sealed biocapsule, but no monkey. The 22-meter-long (72-ft.) rocket is believed to have a payload capacity of 50 kg (110 lb.). Israel dismissed the flight as a "publicity stunt," while a U.S. State Department spokeswoman said it raised missile-proliferation concerns. Iranian television coverage reported that the monkey capsule included life-support equipment to produce oxygen and absorb carbon dioxide, as well as cameras and instruments to measure the animal's vital signs.

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By Madhu Unnikrishnan

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COMMENTARY

American's Pacific Problem

Merger would push European and Latin routes

Late last month, American Airlines CEO Tom Horton unveiled with great fanfare the airline's splashy new livery, the first update to the carrier's logo since 1968. But it will take more than a few gallons of silver paint to restore this U.S. icon to its former glory.

American has been operating under bankruptcy protection for 14 months and just asked the judge overseeing its case for an extension to file its final reorganization plan. Horton's standalone plan centers on targeting premium passengers from American's five hubs: Chicago, Dallas/Fort Worth, Los Angeles, New York and Miami. In the next few years, American will begin taking deliveries from its record-setting order for 460 jets, split between Boeing and Airbus. The airline also is debuting new cabins and updating the product it offers at the front of the airplane.

AMERICAN AIRLINES

Horton believes American can emerge from bankruptcy as a leaner, streamlined operation that can go it alone. But there is significant pressure for American to merge with US Airways. Its CEO, Doug Parker, is pushing hard for a tie-up and has the support of American's unions and US Airways' pilots. He argues that American and US Airways are too small to compete on their own against U.S. behemoths United Airlines and Delta Air Lines. Wall Street is also cheering for a merger.

Parker's plan would refocus the "New American's" routes on its East Coast strength, adding US Airways hubs in Philadelphia and Charlotte, N.C. US Airways' strong regional network would feed passengers to long-haul domestic and international flights from these hubs and Chicago. The merged carrier would be dominant on the East Coast of the U.S. and a strong player in the Midwest.

But New American's route network would have gaping holes on profitable international routes. Yes, it would be a leader in connecting U.S. cities with Latin America and a contender on routes to Europe. But Parker's plan essentially cedes Asia—the fastest growing economic region in the world—to Delta and United. "We would never be the size of Delta and United in Asia, which have the old Northwest Airlines and Pan Am routes," he admitted last year.

That's a huge disadvantage for American, says transportation consultant George Hamlin, one of the few skeptics of an American-US Airways merger. "It's a big structural problem to have no strength in the Pacific," he says. And while a merger would improve American's historically toxic relations with its employees, it would require raising salaries for US Airways employees, who currently work under lower pay scales. That is a costly proposition.

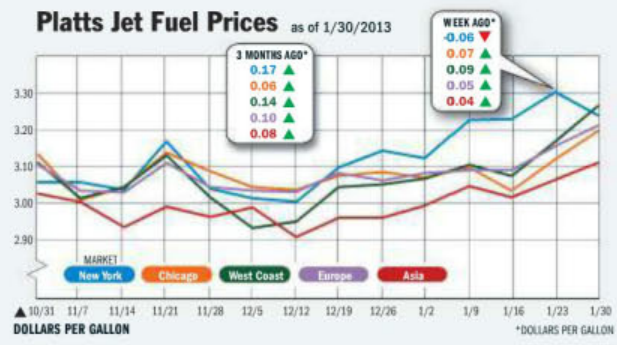
Finally, Hamlin questions the viability of maintaining so many hubs. "How will New York's Kennedy airport work with Philadelphia so close by?" he asks. "Will Phoenix and Dallas/Fort Worth compete for east-west traffic?" He believes some hubs would have to go.

So be wary of all the enthusiasm for an American-US Airways merger. It looks good on paper, but reality may be messier.

AW&ST/S&P Market Indices as of 1/30/2013

Source of data: Standard & Poor's and Capital IQ Inc. (a Division of Standard & Poor's).

Platts Jet Fuel Prices as of 1/30/2013



All data, except for Asia/Pacific, represent latest spot price data as of Wednesday. Asia/Pacific data represent latest spot price data as of Thursday.
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By Michael Mecham

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COMMENTARY

Swept Along

Battery proponents worry that the 787 will short-out their plans

Jim Wurth, a former Eastern Airlines pilot and Pratt & Whitney engineer, became interested in batteries when his MD-500 helicopter would not start after a night out in the cold in New Mexico years ago. He and a friend had camped in a remote area and faced a long walk out even to get cellphone coverage. Fortunately, a warming sun got them on their way that afternoon. But Wurth thought there had to be a better answer for batteries.

Fast forward to 1997, when he founded Start Pac to provide ground power units for executive jets and civil helicopters. His initial power source was a lead acid battery, similar to the one that got too cold to crank his helicopter in New Mexico, and he still sells them, mostly for aviation users but also for ground transportation. In 2009, he began building ground power units to jump-start diesel locomotives, and these now provide 15% of Start Pac's revenues. Aviation accounts for 55%; 90% of that is from helicopters. The rest is for defense applications.

Wurth likes lithium battery technology for the same reason that Boeing put lithium-ion cobalt batteries aboard the 787: they are a lightweight, high-energy power source. The cobalt technology has been in use longer than other types.

But as Wurth studied safety incidents—lithium-ion batteries are prime suspects in separate crashes involving two Boeing 747 freighters and a DC-8—he decided the design is too unstable because it is susceptible to thermal runaways that produce intense fires. They are the prime suspect in separate incidents involving All Nippon Airways and Japan Airlines aircraft that led to the global grounding of the 787 fleet. What caused the temperature buildup that led to the runaways has not been determined.

Wurth opted for a newer technology—lithium iron phosphate—which was not yet produced when Boeing was designing the 787. He cites physical and chemical stability as deciding factors. "You can shoot [lithium iron phosphate batteries] with a high-power rifle, you can throw them in a fire. If they overcharge, they just vent. They're not going to burn, they're not going to explode."

Not everyone agrees. Lewis Larsen, president and CEO of Lattice Energy LLC in Chicago, is a theoretical physicist pursuing portable and distributed power sources with an emphasis on how low-energy nuclear reaction might serve as a very powerful energy source, the kind NASA might be interested in for long-duration spaceflight.

"Lithium iron phosphates are less prone to runaways, but they have had them," Larsen says. "Vibration of nanostructures inside a battery can do it."

The best defense is to thermally isolate the battery by, essentially, putting it in a bathtub that will not melt to contain a burn and aggressively vent gases outside the aircraft. This can be done with a minimum weight penalty, Larsen says.

Start Pac is not the only small manufacturer interested in aviation. Valence Technology of Austin, Texas, makes 12-36-volt lithium iron magnesium phosphate batteries that are used in battery packs for medical carts and emergency power. Since 2005, it has been offering modules to power delivery trucks and counts UPS as one of its customers. Sales Manager Paul Malone says the phosphate technology is safe from runaways.

Valence is interested in aviation applications but, like Start Pac, is not FAA-certified. However, its batteries were used to provide power for Felix Baumgartner's supersonic skydive last October.

Las Vegas-based Start Pac is interested in expanding its product line to include flight-certified batteries. Various helicopter fleet operators and some executive jet operators carry Start Pac lithium-ion batteries aboard aircraft for use as emergency backups for ground-starts (see photo). Oil companies buy them for oil platforms in the Gulf of Mexico as helicopter ground-start backups, he says. Obviously, any further restrictions—or an outright ban—on transportation of lithium-ion batteries on aircraft would put a stop to that, not to mention transporting them as air cargo.

This week Start Pac will begin testing a production-grade lithium-ion battery for the Kestrel, the eight-place turboprop now in development.

Wurth's current lithium offerings for aircraft range from 24-28 volts and produce 1,000 amps. The 787 uses two 32-volt batteries. He says he can easily increase voltage; he is developing a 64-volt, 235-lb. unit to offer a large weight savings for locomotives, which now carry two 32-volt batteries hooked in a series. The current locomotive lead acid batteries weight a ton each.

He worries that the 787 investigation will tarnish prospects for any lithium-ion technology in aviation, even if it is not cobalt-based. "They're all nervous," he says of the aviation industry.

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COMMENTARY

Making Waves

Afloat with flourish, and expanding

Central Florida's Lake County is well named since it comprises 1,400 lakes and countless ponds, pools and puddles. This water wealth, combined with the region's abundance of sunshine and warm air year-round, make the place a magnet for fisherfolk, boaters, kayakers and other wet-setters. And that very much includes floatplane fliers.

While a hard count is elusive, it seems safe to say that thousands of float- and amphibious planes live or alight on the county's water runways annually. Indeed, the area is so popular among water wingers that Tavares, the county seat, touts itself as "America's Seaplane City," proudly posts that claim on city signs and vehicles, and promotes its in-town seaplane ramp as the place to see and be.

With that as background, this week's opening of a floatplane service and repair shop at nearby Leesburg International Airport makes good sense. And seemingly long overdue.

To the denizens of waterborne aviation, Wipaire is a name of daily discourse since the family-owned company manufactures the vast majority of certificated airplane floats today. What's not nearly so well known is that the Minnesota outfit is one of the founding suppliers to modern business aviation.

After being discharged from the Army Air Corps at the end of World War II, Ben Wiplinger set up shop at South St. Paul Airport to convert surplus military transports and bombers into executive aircraft, which served as the core of the post-war fleet. Minnesota Mining and Manufacturing Co.—today's 3M—bought its first corporate aircraft from him.

An irrepressible tinkerer and avid floatplane pilot, Wiplinger asked EDO, then the best known float maker in the world, to name him as a dealer. Denied, he decided to make his own floats, and that became his company's focus.

While delivering 2,000 sets of Wipline floats for aircraft ranging from Piper Cubs to Twin Otters since then, Wipaire has expanded into servicing

WIPAIRE

as well. Today in addition to manufacturing 10 lines of floats, the company's 135 employees also perform aircraft maintenance, modifications, painting and completions, including an executive interior for the DHC-6, thus returning to the company's origins. Those activities now account for half its revenue.

In my view, the most innovative of Wipaire's current offerings is Fire Boss. An Air Tractor 802F equipped with Wipline amphibious floats fitted with custom scoops, the PT6-powered aircraft can skim a small lake and within seconds upload 820 gal. of water that it uses to douse forest or building fires from overhead. Fifty of these initial attack fire suppression aircraft are in service in Europe, Australia and Canada. A few are based in the U.S., which is potentially a huge market but one where the scooper/bomber concept has yet to find wide favor.

With Chuck Wiplinger's elevation to president in 2011, the family's third generation is in control and continuing Wipaire's expansion. According to Marketing Manager Amy Gesch, the company is developing a composite float for the Cessna 182 and will eventually offer a full array of composite models to complement its aluminum floats. Also, it's now certifying floats for the Cessna Grand Caravan and will soon offer them for light sport aircraft, its smallest ever.

The Florida operation will be the company's first base outside of its home state. Considering Minnesota winters, where a day's high temperature might not rise past 0F, finding adequate staffing should pose little difficulty.

HIRED HAND

It is a standing joke that business aviation recycles its own, referring to the frequent movement of executives, sales people and managers from one company to another, but always within the community. This, I submit, is a result of the demanding nature of the segment's high-octane users and the infinite flexibility of its missions. Not many individuals thrive in that kind of environment, so there's a steady demand for those who do.

All that came to mind when I learned of Jim Christiansen's new position.

By way of background, Christiansen joined the U.S. Army as a teen and by age 22 had logged 1,350 hr. piloting Hueys in Vietnam, been awarded a chestful of combat medals and was looking for work stateside. Soon, he was captaining a BO105 for Executive Air Fleet where the bosses saw something special in him and started piling on extra duties. He rose to president while still in his 30s.

FLIGHTSAFETY INTERNATIONAL

The churn of business brings opportunity, and Christiansen made the most of his. He has served as president of Executive Jet International; president-Eastern Region for K-C Transportation; president of Wayfarer Aviation; COO of TAG Aviation USA; and president of NetJets. His most recent position, selling Hawkers, ended with the abrupt end of Hawker, but he was promptly tapped by FlightSafety International to head its international business development effort.

"Seems like I just can't keep a job," he laughs. Business aviation is all the better for it.

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COMMENTARY

Economies of Scale

The Middle East is one of the fastest-growing commercial air transport regions in the world, leading in capacity per departure and average stage length growth, according to Aviation Week data. As airlines there increase in size, it is natural that they leverage their scale to gain efficiencies. That comes from both purchasing power and the desire to bring higher-technology maintenance, repair and overhaul capability in-house—or at least in the region.

Emirates, the largest Middle East carrier, operates a technologically advanced aircraft maintenance operation with engineering support in eight hangars. Its engine shop replaces modules and performs minor repairs on Rolls-Royce, General Electric and CFM powerplants and Honeywell auxiliary power units. Its huge engine test cell, built in 2007, handles engines up to 150,000 lb. thrust. It also has avionics workshops that test and repair flight control, navigation and inflight entertainment systems.

As Emirates becomes more deeply involved in system and component maintenance, it infuses higher technology into its engineering organization and substantially lowers maintenance costs, says Abdullah Osman, vice president for engineering materials management.

At Aviation Week's MRO Middle East Conference in Dubai last month, many airlines and maintenance facilities in the region emphasized the need for more high-tech capabilities—beyond airframe—to reduce turnaround time, logistics concerns and shipping costs (*AW&ST* Jan. 28, p. 28).

Osman says Emirates' next steps are deciding whether to establish an in-house pneumatics and hydraulics MRO capability and reviewing its component outsourcing strategy.

Saudi Aerospace Engineering Industries also is examining its capabilities for supporting Saudi Arabian Airlines' fleet. CEO Nader Khalawi says its current facility will be demolished by 2016 to make way for a new cargo village at King Abdulaziz International Airport.

Designing a new facility is clearly a good time to examine capabilities and take advantage of finding ways to make operations more efficient. For Saudi Aerospace Engineering, it's also because "we need to bundle services and give customers something better," says Khalawi. He admits this is not an easy undertaking, "but we need to learn this because we're losing business to companies like Lufthansa Technik, for example, because we're not providing comprehensive services."

Khalawi wants third-party work to climb to 40% of Saudi Aerospace Engineering's work, which will force it to broaden its engineering offerings as well as lower the airline's costs.

EUAs Sink to New Low

The price of EU Allowances (EUA) under the European Union Emissions Trading System crashed to a new low for the December 2013 contract in January after an EU committee rejected a proposal to adjust auction timings to prop up prices.

EUAs for delivery in December 2013 collapsed to €3.97 per metric ton ($5.38) at the close on Jan. 29—an all-time low for the contract. That compares with a price as high as €7.40 in December and €9.45 in November.

The sharp drop came after the EU Parliament's Industry and Energy Committee rejected a proposal to change the timing of carbon auctions, a move proposed by the European Commission to curb the supply of new allowances entering an already oversupplied market.

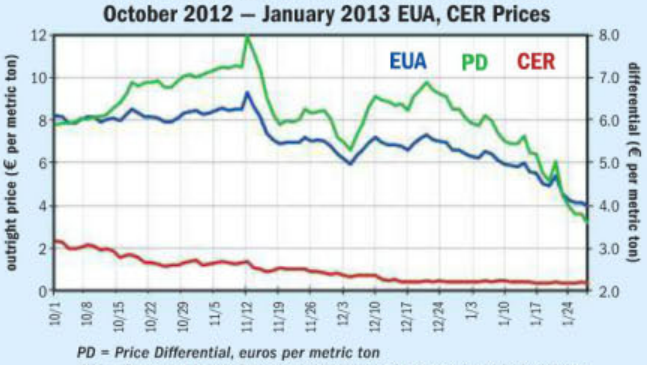
The committee "voted in favor of an amendment which asks to reject [the] commission's proposal to alter the timing of auctions of greenhouse gas allowances," it said in a statement.

The committee's advisory vote Jan. 24 is scheduled to be followed by another on Feb. 19 by the Parliament's Environment Committee, which is the lead panel on the proposal.

Carbon prices were propped up through most of 2012 on the market's belief that measures can be implemented to address a chronic oversupply of allowances.

EU member states appear to be divided on the EC's proposed market reforms. The U.K. government wants a tougher measure of 1.2 billion EUAs to be backloaded, while some other EU member states do not support market intervention at all, including Poland, and Germany has yet to communicate a unified position on the issue.

Daily Emissions Price Assessments
October 2012 – January 2013 EUA, CER Prices



PD = Price Differential, euros per metric ton
EUA = European Union Emissions Allowances for December 2013 delivery
CER = U.N. Certified Emission Reductions for December 2013 delivery
Source: Platts

With ongoing disagreement between EU member states on the EC's proposals, the latest developments have dashed hopes that a quick fix might be agreed to prop up prices.

The EU Parliament is set to vote on the issue in plenary on April 15.

Separately, EU Aviation Allowance futures for December 2013 delivery on the ICE Futures Europe exchange fell to an all-time low of €3.24 on Jan. 29, down from €5.97 on Dec. 28.

Frank Watson/Platts/London

For further information, please visit:
platts.com/ElectricPower/Resources/News Features/emission/index.xml

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COMMENTARY

Additive Advances

3-D printing moves onto the factory floor

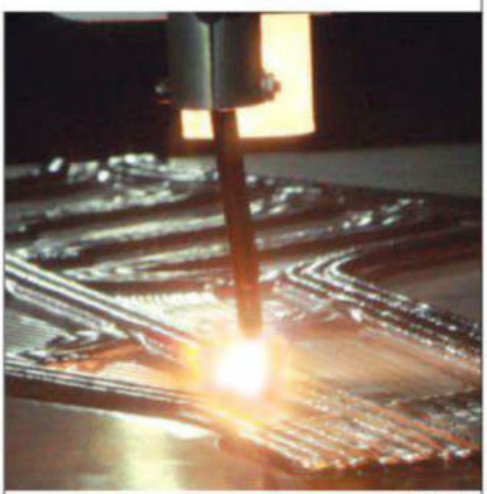
A technology that turns computer-aided design (CAD) drawings into tangible hardware has advanced far beyond producing toy rockets and airplanes from plastic as a Science Technology Engineering and Mathmatics hook for schoolchildren. Today advanced versions of what once was called 3-D printing, and now is more commonly termed additive manufacturing (AM), is well on its way to producing large flightworthy components for real rockets and aircraft. One Chicago-based company—Sciaky Inc.—has parlayed its longstanding expertise in electron-beam welding into a vacuum-based process that can generate metal preforms measuring as large as 19 X 4 X 4 ft., in a fraction of the time and cost of traditional aerospace forgings.

At the other end of the scale, AM applications include plastic structures for tiny cubesats that directly incorporate hybrid rocket motors. Instead of burning explosive fuel, the approach tackles the tricky problem of mounting propulsion systems on spacecraft that are launched piggyback to more expensive payloads by using part of the structure itself as fuel (*AW&ST* Aug. 20, 2012, p. 31).

AM also is used to produce some of the titanium impellers and other components that SpaceX uses in the Merlin rocket engines it builds in-house at its Hawthorne, Calif., factory to power the Falcon 9. The rocket already has delivered commercial cargo loads to the International Space Station, but at nine engines per rocket, the Merlin has presented a major bottleneck in the company's plan to launch the Falcon 9 at least seven times this year.

AM, which works by melting metallic powder or wire with CAD-guided lasers or other heat sources, can generate parts much faster than traditional forging and machining, and works well with SpaceX's practice of producing as much hardware as possible itself.

Tooling for AM is increasingly available, and is turning up in more aerospace machine shops as the price comes down while the capability goes up. Supplier services that use the techniques to produce aerospace components also are increasingly available for rapid prototyping and small-lot production. That will be one of the approaches Sciaky uses to market its ability to build large parts with an electron beam direct-manufacturing process, although the subsidiary of Phillips Service Industries also offers direct sale of the tools it has developed for the technique.



SCIAKY INC.

Central to Sciaky's AM process is a large vacuum chamber it built for Grumman in the 1970s, and then repurchased and modified. Originally the chamber was one of seven Sciaky sold for electron-beam welding on F-14 wingboxes. Now it provides the high vacuum necessary to build large parts using electron beam AM. Sciaky markets AM's capability on the basis of both cost and time savings.

"Parts that we can make in a matter of a couple of weeks have forging lead times that are often nine to 15 months," says Bob Salo, Sciaky's sales manager. "What we try to do is find the parts that have the right characteristics where we have a cost savings as well."

Savings come from reducing the buy-to-fly ratio dramatically, by building up components instead of using machine tools to cut it out of a larger block of material. The company is working with Lockheed Martin to qualify the process on F-35 components, starting with a flaperon spare (*AW&ST* May 7, 2012, p. 45).

The company has managed to find ways to gain efficiencies in titanium, nickel alloys and other high-value metals, both through software and in the use of wire as the starting point (see photo).

"What changed is we build up our parts, usually on a substrated plate, using wire," Salo says. "Many of the other additive technologies you may have looked at use powder. For doing large-scale work, and keeping things clean, there are a lot of process advantages to using wire over powder when you're using large volumes."

The Sciaky "direct manufacturing" techniques do not produce finished parts. Instead, they generate a preform that requires additional machining. But production times are dramatically faster than for traditional forgings, Salo says, and save money by creating less waste in the machining.

"We take that CAD model, we go through post processing in our control system, and we then determine the pass plan for laying down the layers on a substrate plate," says Kenn Lachenberg, who manages Sciaky's application engineering department. "And typically we have some additional real estate that we're adding with the wire to accommodate the envelope of the model."

In addition to Lockheed Martin, Salo says Sciaky is in discussions with "the next half-dozen largest aerospace companies" about ways they can take advantage of the company's AM processes in building fracture-critical titanium forgings.

"They have a lot of pain in that area; a lot of long, long lead times," he says.

By Jen DiMascio

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COMMENTARY

Rebuilding Year

New appropriations leaders face challenging times

The U.S. government spends more on weapons development than any other nation on the planet, but its plans for doing so are caught up in a larger financial debate.

That compounds what is already a budget season turned on its head. This is the time of year when lawmakers would typically be preparing to begin work on a budget request for the next fiscal year. But before the government can even contemplate plans for fiscal 2014, there is still the matter of nearly $1 trillion in across-the-board budget cuts scheduled to take effect March 1, and lawmakers are growing increasingly pessimistic that they can be avoided. Along with that, Congress still has not passed fresh appropriations for this year, and if Congress fails to agree to continue funding the government at 2012 levels or to draw up another spending bill for the remainder of fiscal 2013, the government will begin shutting down.

Meanwhile, the Senate committee in charge of writing government checks is in what sportswriters call a rebuilding year. The death of Senate Appropriations Chairman Sen. Daniel Inouye (D-Hawaii) and term limits led to top spots opening on the full committee and the defense subcommittee as well. Here's a look at the new team:

Sen. Barbara Mikulski

When Democratic Sens. Patrick Leahy (Vt.) and Tom Harkin (Iowa) passed up the opportunity to replace Inouye on the Appropriations Committee, some took that as a sign that a ban on earmarks and spending cuts had gutted the influence of the once-powerful committee.

As the new chairwoman, Sen. Barbara Mikulski (D-Md.) vows to restore the committee's glory. From all indications, she is likely to follow in Inouye's tradition as the self-described "king of pork"—but with her own distinct flair. The late Hawaii Senator was so gentlemanly that some had hoped he would push harder to pass spending bills. Mikulski, on the other hand, swats lanky reporters out of her path with a purse. A Senate aide predicts she will be nipping at the ankles of leadership to insure bills are on the schedule.

Mikulski will continue to lead the commerce, justice, science subcommittee that funds NASA. In that capacity, she has had harsh words for delays on the James Webb Space Telescope, being developed at the Goddard Space Flight Center in Maryland. Still, she secured funding for the project on which Northrop Grumman is the prime contractor. Northrop's electronic systems unit has a large presence in Maryland; the company's employees are among her top campaign contributors, providing $47,400 to her campaign accounts in the 2012 election cycle, according to the Center for Responsive Politics. Other top donors include Orbital Sciences Corp., Mantech International and SAIC.

Maryland is also home to the National Security Agency's largest presence at Fort Meade, as well as U.S. Cyber Command, and a host of aerospace installations including the Naval Air Station at Patuxent River. Also, as a senior member of the Senate Intelligence Committee, she is expected to direct dollars toward the NSA in her dual role.

Sen. Richard Shelby

Sen. Richard Shelby (R-Ala.) was a major power broker on the committee even before he became its top Republican. Republicans on the defense subcommittee will still be led by Sen. Thad Cochran (Miss.), who was forced out of his full committee post by Republican caucus term limits, but Shelby is bound to enjoy more increased leverage.

He already has loads. His influence helped keep funding alive for Lockheed Martin's Medium Air Defense System even when three other congressional defense committees voted to cancel it. He once placed a hold on scores of presidential nominations over an issue related to the Air Force tanker program that EADS had sought to build in Mobile, Ala.

He is also a defender of Alabama's space interests, pushing for a competition on Space Launch System propulsion. Development of the heavy-lift rocket is being conducted at the Marshall Space Flight Center near Huntsville.

Shelby says he and Mikulski are already planning to work together as a team. "Sen. Mikulski and I are going to do a lot of markups and work," Shelby says. "We can do it."

Sen. Richard Durbin

One of the biggest and most surprising changes was recently made official: Sen. Dick Durbin (D-Ill.) is replacing Inouye on the defense subcomittee. The panel, which oversees more than half a trillion dollars in annual spending, used to be one of the most coveted subcommittees. But Leahy and Harkin both passed on the job, leaving it to Durbin, whose interest in running the committee was greeted with grumbles from industry advocates.

The senator is hardly an advocate for robust defense spending. In fact, last June, Durbin stated plainly that a $1 trillion cut to defense spending over the decade would put it back in proportion to where it was relative to other government spending in 2001. In terms of home-state interests, Naval Station Great Lakes, Scott AFB and Rock Island Arsenal are all located in Illinois. And Boeing is headquartered in Chicago.

Charging On

Root cause and added containment question are key priorities as battery strip-down proceeds

Guy Norris Los Angeles and Jens Flottau Frankfurt and Kuala Lumpur

While the hunt for the root cause of the 787 battery problems continues, at least one aspect of Boeing's urgent recovery strategy is coming into sharper focus. The company remains adamant in its faith in the current lithium-ion technology and sees no fundamental reason to change its view as the pressure builds to return the airliner to service.

Despite the evidence from the Japan Airlines and All Nippon Airways aircraft incidents in January, the latest signs indicate Boeing believes its best option for recovery is to modify the existing battery. If this remains the case, even after the root causes are known, the questions become: What extra safeguards are required? Will those satisfy the regulatory authorities? And how quickly can they be implemented? Among the modifications being examined by Boeing is a containment system for the 63-lb. battery improved to endure prolonged exposure to fire, as well as additional temperature monitors.

Officially, however, as the batteries continue to be inspected and torn down by the U.S. NTSB and Japan Transport Safety Board (JTSB), solutions remain elusive. For Boeing, the specter of certifying a new or replacement battery system and supporting hardware lingers, along with the inevitable lengthy certification effort and cost impact to the program.

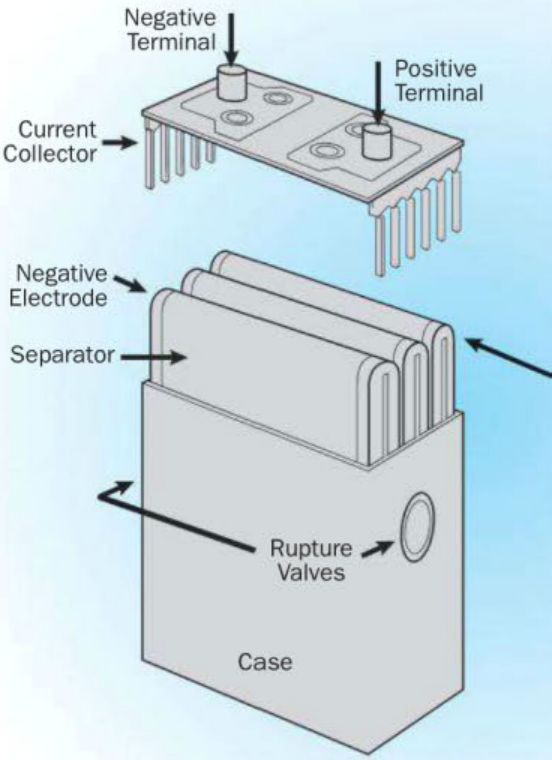
Boeing is intent on steering clear of this fate, as indicated by CEO James McNerney during the company's Jan. 30 fourth-quarter results call. "Nothing we've learned yet has told us that we have made the wrong choice on the battery technology," McNerney said, despite limitations imposed on him by the ongoing FAA, NTSB and JTSB investigations. "We feel good about the battery technology and its fit for the airplane."

According to airline officials, the grounding caught Boeing completely by surprise. Sources close to the company say top management did not expect the agency to take the step because the FAA was in agreement with earlier design decisions. Even after the initial action was taken, Boeing expected the aircraft to be back in the air after as little as three days. It also requested permission to ferry stranded 787s to a central location to facilitate testing, as there is insufficient equipment—or in some cases none—at the involved airports, but the FAA turned down the request.

Behind the scenes, Boeing is emphasizing to its 787 customers that there are positives to be taken from the JAL and ANA events, which McNerney describes as being "very different" from each other. Beyond the obvious points—the JAL event occurred post-flight on the ramp at Boston, and the ANA incident happened in mid-flight—McNerney is likely referring more specifically to what investigators are learning from each failure. The APU battery on JAL's aircraft caught fire, while the forward-located main battery on ANA's, although badly damaged by burned electrolyte, is not yet confirmed by the JTSB as having caught fire.

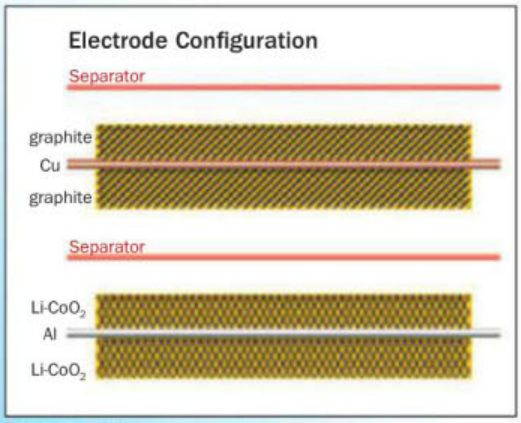
According to airline sources, Boeing is saying that the JAL event, for instance, does not in fact show evidence of a classic "thermal runaway," as described by the NTSB on Jan. 24, but was a more limited event in which only three of the battery's eight cells were involved in a chain reaction. Although the battery was completely gutted in the ensuing blaze, Boeing investigators believe the total damage resulted from long-term burning caused by the initial failure, not a full-scale thermal runaway.

Similarly, 787 operators have been briefed on the sequence of events in the ANA incident which, according to the aircraft maker, showed that the built-in safety systems worked as intended to warn the crew of the battery malfunction and vent smoke from the electronic/electrical equipment bay. The focus in that case is why the pre-



NTSB

This hole in an electrode from the failed Japan Airlines battery indicates an internal short circuit.



Investigators are focusing on how and why a short circuit developed between the positive and negative electrodes (above), which are tightly packaged in each cell (left).

cautionary system that is designed to prevent the battery from over-discharging evidently failed.

But with the fleet grounded, and 787s now coming off the production line at a rate of around six per month, Boeing's reassurances could be seen as mere semantics by airlines that have already endured 3-4 years of delays. The two serious failures and the unexpectedly high number of battery changeouts throughout the fleet—more than 100—prior to the groundings reveal a system that was less than robust, at best, and unstable, at worst.

Boeing has no plans to interrupt or slow the 787 production rate, which McNerney confirms is on track to reach seven per month by mid-year and 10 per month by year-end.

"I don't expect to hear anything in the next 3-6 months," says the CEO of one major Boeing supplier. In his view, it would be extremely challenging to ramp down production now only to increase rates again within a short period of time. The supply chain would have a hard time handling such fluctuations, he argues. And for Boeing it is probably easier to keep production on pace and put aircraft in storage than to perform constant change management.

Despite the fact that engineers have been pulled off their assignments to deal with the battery situation and consider possible implications for the electrical system, McNerney says this is "not a significant" drain on resources. Because the efforts are focused on the battery, he adds that there has been no chain reaction or knock-on effect to the build-up for the 787-9, final assembly of which is due to start in coming months.

"I can assure that there is a comprehensive root-cause analysis and related series of technical efforts that I am confident will identify the root cause of these incidents. And so confidence in the process, confidence in the right resources, confidence that it's not distracting to the balance of Boeing, and when we know the answer, we'll know the answer, and we'll act on it," McNerney says.

There are mixed signals as to whether ancillary charging control devices remain prime suspects along with the battery itself. Investigators are trying to determine if the short circuit, in the case of the JAL fire in particular, was caused by an undetected manufacturing flaw or something else, such as a foreign object.

Battery experts confirm to Aviation Week that NTSB testing at the Carderock Div. of the Naval Surface Warfare Center laboratories includes examination for signs of short-circuiting caused by the build-up of a structure inside the battery called a dendrite.

Compared to alternatives, the high power density of lithium-ion batteries makes them attractive for aerospace applications. The reference gas turbine is a GE90 engine.

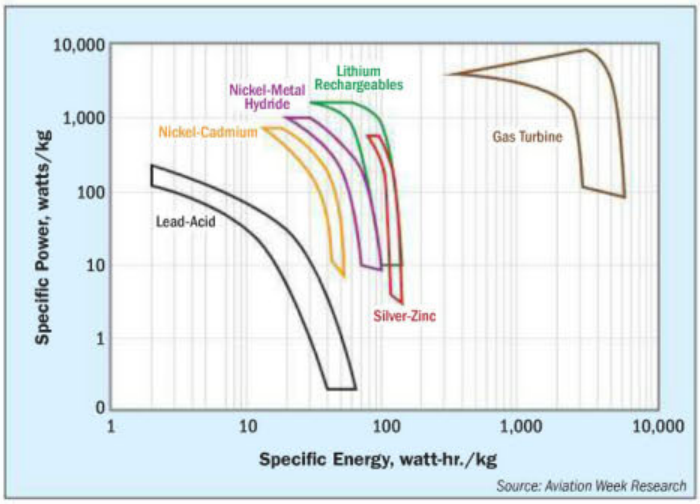
These accumulate in lithium batteries, usually through uneven absorption and desorption of lithium ions, and they can penetrate the inner membranes that divide the anode and cathode. The dendrite formations, which can also be triggered by foreign-object particles on the electrode surface, introduce a physical contact between the positive and negative electrodes, thereby generating a short circuit.

Japan Airlines Chairman Masaru Onishi tells Aviation Week that "there must be some kind of modification" to the battery and the electrical system. "System integration must deliver protection against something like a cell failure, so we must find some improvement," he says. Boeing has been constantly updating operators about the issues, Onishi says, and he believes that, while the manufacturer started with hundreds of possible root causes two weeks ago, "that has now been narrowed down to a short list of potential causes." He says "some good progress" has been made, allowing Boeing to focus on the remaining options.

Onishi concedes that the impact on the aircraft's image is "an important issue, so we must fix it as soon as possible." It is difficult to determine how long it will take to find a solution, though, he acknowledges. The operational impact on JAL will be limited because it has just six 787s, and it has seen no revenue loss, as the aircraft have been replaced by 777s and 767s. So far, JAL has not requested compensation for added costs, but Onishi does not rule it out, saying, "maybe at the next stage."

Cathay Pacific Airways CEO John Slosar also is confident that "Boeing will figure it out." Although Cathay has not ordered 787s, the Airbus A350-900s and -1000s it has on order are also designed to use lithium-ion batteries. Slosar says he expects that Airbus is closely watching the battery investigations so as to draw conclusions for its own system.

Read *AW&ST*'s report on the last FAA grounding of a commercial airliner fleet—in 1979—and stay up to date with developments in the Boeing 787 battery investigations in the digital edition of *AW&ST* on leading tablets and smartphones, or at AviationWeek.com/787



Definition Doubt

Testing waived for "extremely remote" failures

John Croft Washington

Forensic evidence uncovered by the NTSB will force the FAA to revisit whether Boeing met the agency's "special conditions" for certifying lithium-ion batteries on the 787. Included in the reassessment will be whether "extremely remote" failures of the charging and monitoring system, key safety components to prevent thermal runaway that can cause smoke and fires, were correctly identified.

Two of the nine 787 battery certification special conditions issued by the FAA in October 2007 allow for exceptions to normal safety protocols under "extremely remote" failures of the charging of battery monitoring systems. In one case, safe cell temperatures and pressures would not have to be maintained, and in the other, explosive or toxic gases could accumulate in hazardous quantities in the aircraft. The special conditions, issued by the FAA for a variety of primary and auxiliary uses of lithium-ion batteries, are meant to mitigate any overcharging, over-discharging and flammability concerns not covered by legacy rules. Other special conditions include designing the batteries to "preclude the occurrence of self-sustaining, uncontrolled increases in temperature and pressure;" incorporating a system to automatically control the charging rate of the battery, and providing a warning to the cockpit when the state of charge falls below acceptable levels for flight.

NTSB

By the FAA's definitions, extremely remote means a failure is not likely to occur "when considering the total operational life of all airplanes of the same type, but nevertheless has to be considered as being possible." Statistically, "extremely remote" translates to one failure in 10 million flights—the safety threshold generally linked to a hazardous failure.

Given the likelihood that two "extremely remote" events have already occurred early in the operational life of the aircraft—thermal runaway, short-circuits and fire in a Japan Air Lines 787 battery in Boston; and smoke and fumes in the cabin of an All Nippon Airways 787 in Takamatsu, Japan—questions are emerging as to why the multiple layers of backup protection may have failed. "The expectation in aviation is to never experience a fire onboard an aircraft," says NTSB Chairman Deborah Hersman. "We have to understand why this battery resulted in a fire when there were so many protections that were designed into the system."

A well-known example of how faulty assumptions about extremely remote failures occurred with the Federal Aviation Regulation (FAR) Part 29 certification of the Sikorsky S-92A heavy helicopter in 2002. Boeing and Sikorsky had agreed that the only plausible failures of the heavy helicopter's lubrication system in the main gearbox would occur with externally routed oil lines and protections were put in place in those locations. Starting in 2008, some S-92As began experiencing complete transmission failures due to a failure of an internal component—the oil filter assembly. The failure in one case precipitated a ditching off of Newfoundland in 2009 that resulted in deaths of 17 of the 18 passengers and crew on board, and the fleet was grounded. The FAA and Sikorsky later re-analyzed the transmission failure modes and effects analysis.

While the FAA and Boeing are not discussing the extremely remote failure assumptions or the testing protocol they agreed upon for the battery tests during the 787 certification, it is likely the work paralleled the regime developed by RTCA Special Committee 211 (SC-211), which was formed in 2006. That arm of the venerable government-industry group developed over two years a set of minimum operational performance standards (MOPS) for large rechargeable lithium batteries, including electrical qualification requirements and test procedures as well as environmental qualification regimes. RTCA recommends a battery-test program using eight batteries and a series of 42 tests or inspections.

The NTSB says the auxiliary power unit battery in the compromised Japan Airlines Boeing 787 "spewed molten electrolyte" and damaged components and structure up to 20 in. from the battery.

The 787 special conditions, though issued five months before SC-211's final report, are nearly identical to the broader set of guidelines in the MOPS, information the FAA later adopted as guidance material, as is typical of RTCA final study documents.

The MOPS have a higher threshold for failures than the 787 special conditions, however, as allowances for unsafe cell temperature and pressure excursions and explosive or toxic gas accumulation are made only for "extremely improbable" failures of the equipment, a threshold generally reserved for catastrophic failures. In FAA parlance, that equates to one failure in 1 billion flights, or 100 times more infrequent than the extremely remote failure case in the 787 special conditions.

Worst-case tests the RTCA recommends include an "induced destructive overcharge with protection disabled test" that looks for "any evidence" of flames from the battery for 3 hr. after the overcharge source is removed, and "effectiveness of the battery containment case to contain all debris resulting from any explosion during or after the test".

NO SLOWDOWN FOR 787 SUPPLIERS

Michael Mecham

Boeing is telling its 787 supply chain "business as usual" even as the aircraft—its highest-profile development effort—is in its third week of being grounded and deliveries have been suspended.

Suppliers are working on a seven-per-month build rate that Boeing's main 787 sites in Everett, Wash., and North Charleston, S.C., will not reach until mid-year. Regardless of the delivery stoppage that followed two battery-fire incidents on operational 787s last month, 60 787s are set to go to customers this year, CEO James McNerney said last week during a 2012 earnings call. Deliveries of all models are projected at 635-645.

The 787 delivery goal represents a modest increase over last year's 46, which included 23 in December alone. Boeing has 46 787s in process—either in build, undergoing post-production rework or awaiting delivery. It presented 32 that required rework to airlines last year and expects to hand over another nine this year.

The current emphasis on regaining the 787's flight status is not draining talent from other programs, McNerney insists. "This is a highly compartmentalized issue" and the company's "deep expertise"—and that of its suppliers—can tackle it without impacting development of the 737 MAX and the 787-9. Two potential additions, the 787-10 and 777X, are also proceeding without a hitch, he says.

Furthermore, Boeing has "enough experts available to keep looking at this issue" regardless of whether its unionized engineers reject the company's four-year contract offer and strike, he says. They vote in about two weeks.

MAX development is pacing toward its final configuration design milestone at mid-year. Meanwhile, the 787-9 is on track to enter final assembly on schedule mid-year.

The 787-10 has been "conditionally offered" to airlines and "the response has been very strong," McNerney says. But he did not say when it might be officially launched. Nor did he address a launch date for Boeing's most complex pending development, the 777X, a competitor to the Airbus A350-1000.

Last week, Boeing loaded wing spars for the first 737 NG to be built at a 38-per-month rate; the company expects to reach 42 per month by year-end for the 737 and 10 per month for the 787.

Cell Change

Gulfstream, Cessna shed lithium-ion batteries late in game

John Croft Washington and Fred George Savannah, Ga.

Two years ago, Boeing, Cessna and Gulfstream were the leading edge for introducing lithium-ion mainship batteries into new aircraft in the civil aviation market. But by late 2011, evidence had emerged that the technology was not yet mature, spurring business aircraft makers Gulfstream and Cessna to return to more traditional, lower-performance and heavier batteries for the G650 and CJ4, respectively. Boeing however went forward with its original choice of lithium-ion batteries for the 787 widebody, a decision that is now under the microscope given the grounding of the fleet (see p. 20).

Gulfstream decided to switch battery types barely a year before the G650's final FAA certification in September 2012, and Cessna abandoned the lithium-ion batteries on the nascent CJ4 fleet less than two years after first delivery. The abrupt reversal followed a November 2011 FAA emergency airworthiness directive (AD) involving a thermal runaway and fire in a CJ4 battery on the ground. Both Cessna and Gulfstream say they could revisit lithium-ion battery technologies

Groundings of U.S. Commercial Transports Are Rare

1931 The Commerce Department's Aeronautics Branch, the FAA's predecessor, suspends the certificate of the Fokker F-10A after a crash that kills Notre Dame football coach Knute Rockne. Investigators say moisture caused the aircraft's wooden wing to separate.

1946 The CAA grounds the Lockheed L-049 Constellation from July 11 to Aug. 24 so modifications to it's electrical system and powerplants could be made.

1947 The three airlines using DC-6 aircraft voluntarily withdrew them from service after the CAB determined that two inflight fires had been caused by fuel leaking into the cabin heater system through an air intake scoop. After the problem was remedied, the DC-6 returned to service in March 1948.

1948 The Martin 202 is voluntarily grounded after discovery of a structural problem with the wings. After extensive modification they returned to service on Sept. 1, 1950, with the designation 2-0-2A .

1979 FAA grounded the DC-10 on May 25 after one crashed shortly after takeoff in Chicago, until U.S. airlines completed certain visual inspections. The next day, after learning the checks had turned up potentially dangerous deficiencies in pylon mountings, FAA grounded the entire DC-10 fleet on May 26, pending more comprehensive inspections. The order included U.S.-certificated Airbus A300s because of the similarity of their pylon to the DC-10's. On June 5, FAA suspended the DC-10's type certificate indefinitely. Thirty-seven days later, FAA lifted the suspension.

1984 FAA grounds approximately 180 Sikorsky S-76A helicopters on Dec. 11, pending installation of a replacement part being developed by the engine manufacturer after an Oct. 31 accident in the South China Sea.

1985 FAA grounds all 10 of Arrow Air's DC-8s, pending replacement of unapproved spare parts after one crashed on takeoff from Gander, Newfounland. All 256 people aboard were killed, including 248 U.S. soldiers.

2013 The FAA grounds the Boeing 787 fleet operated by U.S. carriers after lithium-ion battery incidents on two 787s, operated by All Nippon Airways and Japan Airlines.

Source: Aviation Week archives (sourced to FAA)

in the future but offered no timetables.

They are not alone. Embraer too is planning to use lithium-ion batteries and associated electronics built by Meggitt subsidiary Securaplane on the new Legacy 500 and 450 business jets, slated for entry into service in late 2013 and 2014, respectively. Securaplane was also to be the supplier of lithium-ion batteries and systems for the G650. Embraer is holding to its plans at the moment, though officials say the company is watching closely the FAA's deliberations on the Boeing batteries.

Gulfstream's decision to switch batteries so close to the final certification of its flagship $65 million G650 ultra-long-range business jet surprised some industry insiders. The company had declared its intention to use lithium-ion batteries in marketing materials starting in 2008, and in June 2011 selected Securaplane to supply the main battery as well as the emergency and flight-control backups, along with integral charging and control electronics. In January 2012, the FAA granted "special conditions" that Gulfstream could use to certify the lithium-ion batteries, virtually the same nine conditions that Boeing had received for the 787 batteries in 2007 (see p. 22).

Gulfstream launched an internal battery-test program in parallel with a flight-test effort that used legacy nickel-cadmium batteries in the flight-test aircraft. According to Gulfstream officials, the lithium-ion battery could not pass the gauntlet of internal tests, and in late 2011, they decided the technology was too unstable. Securaplane documents show that Gulfstream was to use a lithium-iron-phosphate coating on the cathode and says the alternative nickel-cadmium batteries weigh 150 lb. more. The 787's batteries use a lithium-cobalt oxide powder as a cathode coating. As a comparison, a

CESSNA AIRCRAFT

Safety First

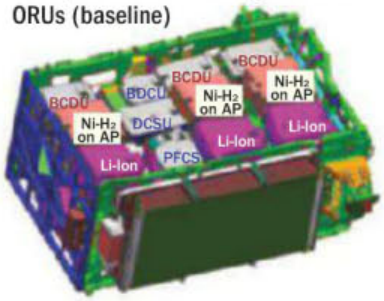
NASA applies its human-spaceflight standards to lithium-ion batteries

Frank Morring, Jr. Washington

Space station crews are set to replace aging nickel-hydrogen battery packs with new lithium-ion units in 2017. They are not particularly worried about the fire hazard from the technology that has grounded the Boeing 787.

NASA plans to use lithium-ion battery cells manufactured by the same company that built the 787 cells. But the agency has subjected them and the computerized control units that keep the cells from overheating to the same design oversight it uses to human-rate other space hardware. Space quality standards appear to be working as the technology moves into expensive unmanned spacecraft as well. SpaceX founder Elon Musk, who uses lithium-ion batteries in his Tesla electric automobiles as well as the Dragon autonomous cargo carrier, has offered to help Boeing solve its 787 problem.

"We have independent experts who review the whole design and implementation and hazard controls that we have on these," says Caris "Skip" Hatfield, manager of NASA's International Space Station (ISS) development projects office at Johnson Space Center (JSC). "Within the design itself, we've monitored the manufacturing process of the cells and have done audits of the cell manufacturing to make sure we're satisfied that at the cell level there are no design [or] process issues."



NASA/JSC

Boeing's ISS lithium-ion replacement batteries include storage space for the worn-out nickel-hydrogen units.

Boeing, NASA's ISS prime contractor, has a $208.8 million contract to deliver 27 of the batteries—24 for service on the station as orbital replacement units (ORUs), and three as ground spares. Weighing 425 lb. each, and measuring 39 X 39 X 18 in., the batteries include adaptor plates to store the worn-out nickel-hydrogen batteries they replace (see illustration). Batteries charge while the station's solar array wings are in sunlight, and discharge to provide power in darkness.

Lithium-ion batteries are used in human and robotic spacecraft for the same reasons that Boeing selected them for the 787—their high-power density and the weight savings it permits. They are used or planned on a variety of other high-value government and commercial spacecraft, including the James Webb Space Telescope. On the ISS, one lithium-ion battery will replace two nickel-hydrogen units in orbit, Hatfield says.

Precautions taken with space-qualified battery hardware have so far prevented "thermal runaway," the main risk. The NASA Engineering and Safety Center maintains guidelines to help spacecraft designers address the "inherent high-specific energy combined with flammable electrolytes" in the advanced battery cells.

The lithium-ion cells used in the new ISS batteries were manufactured by Japan's GS Yuansa, the same company that built the cells for the Boeing 787. Pratt & Whitney Rocketdyne is building the battery controllers, which ensure the chemical cells do not get out of balance.

"We have multiple layers of redundancy," says Eugene Schwanbeck, the ISS lithium-ion battery project manager at JSC. "There are controls at the battery subassembly level, the internal computer itself, then there are controls in what we call the battery charge/discharge unit, which is the physical piece of hardware that the battery talks to, and then there

In late 2011, the FAA mandated that Cessna CJ4 operators replace their lithium-ion batteries.

lithium-ion battery using a cobalt oxide cathode has five-times the energy density of a nickel-cadmium battery, though nickel-cadmium has twice as many cycles of battery life.

Like Gulfstream, Cessna knew the risks of lithium-ion batteries but believed that its chemical formula and extensive company-funded testing rendered them safe. In August 2009, the FAA approved special conditions allowing Cessna to certify the batteries, pending certification tests.

Post-Boeing's 787 battery incidents, Cessna has not commented on the type of lithium-ion battery it used for the CJ4. However, a research paper written in part by its then-principal engineer for technical development, John Gallman, discusses the nanoscale phosphate-based lithium-ion cathodes Cessna used and the rigorous ground- and flight-testing program it conducted. Testing was based on a modified version of RTCA guidelines for nickel-cadmium batteries as lithium-ion-specific guidelines had not yet been completed. The installed batteries and charging systems for the CJ4 were built by A123 Systems. Gallman left Cessna in 2011 to become division director of Mid-Continent Instruments' True Blue Power, a distributor of A123 batteries.

The CJ4's phosphate-based lithium-ion batteries weighed 30 lb. less than the equivalent nickel-cadmium battery that was available. Though packing about half the energy density of a cobalt oxide cathode battery, the phosphate-based chemistry has four-times the number of life cycles while having "inert" failure modes, according to Gallman.

The inertness of failure modes came into question however in the fall of 2011 when a maintenance worker hooked an "energized ground power unit" to a CJ4 battery and a fire reportedly broke out after thermal runaway in the battery. In early October that year, the FAA issued an emergency AD that required operators to replace lithium-ion batteries with the nickel-cadmium option.

are system-level controls that are monitored by software."

The Boeing-supplied batteries will be located outside the station's pressurized volume, where the biggest risk—aside from loss of function—is the potential for heat damage to structural elements. Lithium-ion batteries already are used inside the station, where fire and noxious fumes from battery-cell venting are a serious potential danger. In February 2011, the space shuttle Discovery delivered four lithium-ion battery assemblies built by ABSL Space Products to power U.S.-built spacesuits. The ubiquitous laptops that crewmembers use to control station systems also are powered by lithium-ion batteries.

"The EMU [battery] was designed for that application, so it's gone through many of the same hazard controls," says Hatfield. "[The laptop batteries] have gone through a screening process, and they control how we charge them to make sure that there is not an issue there."

The safety rules also apply to visiting vehicles that use lithium-ion batteries, including the SpaceX Dragon, which has started delivering cargo to the ISS and is in upgrade to carry humans. SpaceX chief Musk, whose Tesla Motors also uses lithium-ion batteries for its electric cars, says that while the space batteries meet "two-fault-tolerant" NASA redundancy requirements, the automotive environment can be more challenging because of the need for crashworthiness.

At present, the Dragon's three battery packs and the Tesla autos use the same lithium-ion cells, which Panasonic manufactures to company specifications. The 18-mm-dia. X 65-mm-tall cells are easier to protect against thermal runaway with the electronic control circuitry SpaceX manufactures in-house, Musk says. He believes that Boeing is having trouble with its 787 battery packs because of the size of its lithium-ion cells.

"They've got to ensure that they have a pack architecture that prevents cell-to-cell propagation of a thermal runaway event," Musk says. "So essentially they've got a terrible architecture. They're using these huge battery cells, which are more prone to thermal runaway events because it is very difficult to maintain an even temperature [with] such a big cell, because the distance from the center of the cell to the edge is quite large. So you can be hot in the center and cold on the outside, and you think your cell is fine."

Musk communicated his offer to lend his company's battery expertise to Boeing via Sir Richard Branson, chairman of the Virgin Group. "I said I think we could be helpful here, and come up with a solution, and create a new battery pack and charger for Boeing in probably a matter of weeks," Musk says. "So Branson conveyed that to Boeing, but Boeing has thus far not expressed any interest at all. It seems odd."

CHINESE INTERNET

Room for Improvement

As the Y-20 takes to the air, China is preparing engines that would make it much better

Bill Sweetman Washington and Bradley Perrett Beijing

The Y-20's wing features complex triple-slotted flaps and drooped ailerons for low-speed lift.

If ever there were an aircraft that should grow in capability, China's newly flown Y-20 airlifter would be it. The prototype that took to the air on Jan. 26 mates what looks like a modern airframe with obsolete 1960s-technology engines. Together, they probably represent no more than a serviceable design standard, offering only modest advances in capability over the Ilyushin Il-76 that China already operates.

But a better engine is under development for the Y-20. If and when China's technologically challenged aero-engine industry can get that high-bypass turbofan ready, then the airlifter should surge in performance. More distantly, a truly modern engine under development for the Comac C919 airliner could also be available.

Successful development of the Y-20 airframe is in itself an important accomplishment for the Chinese industry, which in more than six decades of Communist history has been only slowly and haltingly weaning itself from copying foreign types, mostly Soviet-era Russian designs. Underscoring this point, the Y-20 is the largest indigenous Chinese aircraft built so far, exceeding the unsuccessful Y-10 airliner tested in the early 1980s.

The Y-20 will not enter service before 2017, according to two Chinese military academics, Zhang He and Li Wei, writing in *China Youth Daily*, a major national newspaper. They also say that the Y-20 airframe incorporates composite materials (although most of it appears to be aluminum) and a "supercritical" wing. It is not clear whether the objective is to have a new engine ready by service entry.

The Y-20 is an entirely new design, even though it is close in size and shape to the Il-76, which uses the same Saturn D-30KP medium-bypass engine as the Chinese airlifter's prototype. Compared with the Il-76, the Y-20 has a shorter wingspan and a shorter, but slightly wider, fuselage. The Y-20 is larger than the Airbus A400M and has about the same fuselage diameter, but is much smaller than the Boeing C-17.

Specifications estimated by Aviation Week (see table) and including dimensions determined photometrically, vary from figures quoted by Zhang and Li. The academics say the Y-20's span is 45 meters (148 ft.), length 47 meters, height 15 meters, gross weight "over 200 tons" and payload 66 tons. They give no source, but their figures could be preliminary numbers estimated in 2006, when the project was launched after about 15 years of study. Comparison with the Il-76 suggests that the published weight and payload figures are too high for a version fitted with the D-30KP.

In late 2009, Hu Xiaofeng, the general manager of Avic Aircraft—the large-airplane specialist subsidiary of aeronautics group Avic—said the Y-20 was in the "200-ton class" and would be unveiled at the end of that year. But it was not unveiled then, suggesting that the airframe or engine program had hit trouble. The Xian Aircraft plant is building the Y-20, which was rolled out in December 2012.

The Y-20 follows the configuration set by the Lockheed C-141, with a high-mounted wing, moderately swept to combine good low-speed performance with reasonable cruising speed, fuselage-mounted landing gear and a T-tail. (Since the C-141, all successful jet airlifters have used that configuration, except the An-124, which has a low tail.) The Y-20's wing has full-span slats and triple-slotted trailing-edge flaps, the latter comprising two articulated segments with a fixed vane on the forward surface. The engines

are hung low as on the Il-76—in its current form at least, the Y-20 does not use externally blown flaps in the same way as the C-17.

The ailerons can also droop to increase lift at low speeds, and large spoilers are fitted for roll control and lift dumping. Like the C-17, the Y-20 has a four-piece rudder, with upper and lower double-hinged segments. This provides both redundancy and the ability to use higher deflection on the lower half than on the upper rudder panels, reducing loads on the vertical tail.

In comparison with the Il-76, a smaller cockpit for just three crew members should have helped designers to increase cargo volume. Chinese media stress that the aircraft is fatter than the Il-76, the skinniest of the strategic airlifters now in service, though the difference may not be great. Extra diameter should help in stowing outsize items such as helicopters and engineering vehicles, but the Y-20's cargo bay is shorter than the Il-76's.

The landing gear looks similar in layout to the A400M's, with three separate twin-wheel units on each side. Operating jet airlifters from truly unimproved surfaces is more spectacular than practicable, but the Y-20 should be as good as any of its contemporaries in this regard. Zhang and Li say it can operate from "relatively simple" fields. The nose wheel can pivot 90 deg., they add, giving a detail that suggests they have been well-briefed. (Zhang is on the faculty of the Command College of the Second Artillery and Li is of the National Defense University.)

The Y-20's overall size and weight are such that it could be an effective aircraft with D-30KP engines, which China already imports for its H-6K cruise-missile carrier. At least 20% more thrust will probably be available from the Chinese turbofan that Avic Engine is developing at Shenyang, possibly under the name WS-20. It is believed to be a derivative of the WS-10 Taihang fighter engine.

In contrast to the medium-bypass D-30KP, it will have a high bypass ratio, making it comparable with the CFM56, to which it may be related (*AW&ST* Nov. 7, 2011, p. 28). The Y-20 must have entered flight testing with the D-30KP because the Chinese engine was not ready—perhaps not fully developed or maybe just not trusted for early flights.

A more distant prospect is the CJ-1000, which Avic Commercial Aircraft Engines is developing for the Comac C919 airliner as an alternative to the CFM Leap-1 and with the aim of matching the performance of that Franco-U.S. engine. CJ-1000 development faces great technical challenges but is probably being well funded. With abundant thrust and, it is hoped, world-class efficiency, the CJ-1000 would transform the performance of the Y-20.

The prospective use of the Y-20 raises a contradiction that has become familiar as the Chinese navy has developed its amphibious assault capability and commissioned an aircraft carrier. China's government consistently downplays its interest in power projection. And, like all authoritarian states, it strongly promotes the principle of non-intervention in the internal affairs of other countries. No wonder, then, that state media stress the humanitarian and disaster-relief role of the Y-20. Those will undoubtedly be prominent roles of the Y-20, internationally as well as domestically, helping China's image abroad.

As a tool of power projection, the Y-20 will probably not worry China's neighbors too much, says Andrew Davies, an analyst with the Australian Strategic Policy Institute in Canberra. Naval forces, which can transport much more than aircraft can, are likely to be of greater concern. "The Y-20 is part of the bigger picture of Chinese power projection, but it is a less significant element," he says. Also, China is such a big country that the aircraft has obvious internal uses.

The country does, however, place strong emphasis on airborne forces, as Russia does. China has built a rapid reaction force around the 15th Airborne Corps, which is able to respond to crises within China and around its borders. It has continued to develop specialized combat vehicles designed to be air-dropped. The most recent type is the Norinco ZBD03, derived from the Russian BMD-3 and armed with a 30-mm 2A72 cannon. The 15th Airborne also operates with its own helicopter force, so the Y-20's relatively high and wide cabin will be useful in ferrying helicopters with minimal dismantling and reassembly. China's airborne force has been restricted in its mobility by the small available force of Chinese Il-76s.

The aircraft's full name is Y-20 Kunpeng, says the *China Daily*. "Kunpeng" is the Chinese word for roc, a giant mythical bird.

CHINESE INTERNET

Y-20 vs. IL-76T*

Wingspan	47.5 meters/156 ft.	50.5 meters/165 ft.
Length overall	44.1 meters/144.5 ft.	46.6 meters/153 ft.
Fuselage length	40 meters/131 ft.	43 meters/141 ft.
Fuselage diameter	5.4 meters/17.5 ft.	4.8 meters/15.7 ft.
Propulsion	4 x Saturn D-30KP, 12,000 kgf/ 26,500 lb. thrust	4 x Saturn D-30KP, 12,000 kgf/ 26,500 lb. thrust
Max takeoff weight	180 metric tons/395,000 lb.	170 metric tons/375,000 lb.
Max payload	40 metric tons/90,000 lb.	40 metric tons/90,000 lb.

* Standard military transport version

Sources: AW&ST research and manufacturer documents

Improving Guidance

Missile Defense Agency is optimistic after GBI returns to flight and preps for intercept

Amy Butler Washington

After two years on the ground for technical problems, an upgraded version of the system designed to protect the U.S. from ballistic missile attack is finally flying again. But the U.S. Missile Defense Agency (MDA) has significant challenges not only to employing the modernized Ground-based Midcourse Defense (GMD) system but also incrementally improving other systems that protect areas abroad.

The Boeing-led GMD missile shield executed a long-awaited flight test of the Ground-Based Interceptor (GBI), carrying an upgraded version of its hit-to-kill mechanism, after repeated slips. The Raytheon Exoatmospheric Kill Vehicle (EKV) Capability Enhancement 2 (CE 2) failed to intercept its first ballistic missile target during a December 2010 test, and since then engineers have been working to isolate and fix a high-frequency vibration issue that affected the upgraded EKV's guidance system.

The GBI launched Jan. 26 at 2 p.m. local time from Vandenberg AFB, Calif. and did not have a target to intercept. The objective was to fly the system and its kill vehicle through "stressing" conditions to collect data.

The MDA did not definitively say what went wrong with the guidance system during the December 2010 failure, but spokesman Rick Lehner said the problem "did not show itself during extensive pre-test ground testing and [occurred] only in a space environment." Boeing spokesman Scott Day says that "therein lies the demand and the challenge: developing a ground-test capability that could recreate a problem, which had only been observed in space, allowing us to understand the phenomenon and develop solutions."

Boeing actually had to build a ground-based system that could recreate the high-frequency vibration conditions "mimicking the stresses of space flight and EKV maneuvers outside the Earth's atmosphere and gravitational pull" (*AW&ST* Dec. 3, 2012, p. 28).

Greg Hyslop, vice president for Boeing's GMD program, calls the failure "one of the toughest challenges facing the aerospace industry," underscoring the complexity of the problem, especially given Boeing's challenges with lithium-ion batteries grounding its new 787 commercial airliner fleet (see page 20).

Early results of last month's flight test appear promising. Lehner says experts will pore through troves of telemetry data to assess the exact performance of the interceptor. "Data collected during the test will anchor digital and hardware-in-the-loop models for the EKV," he says.

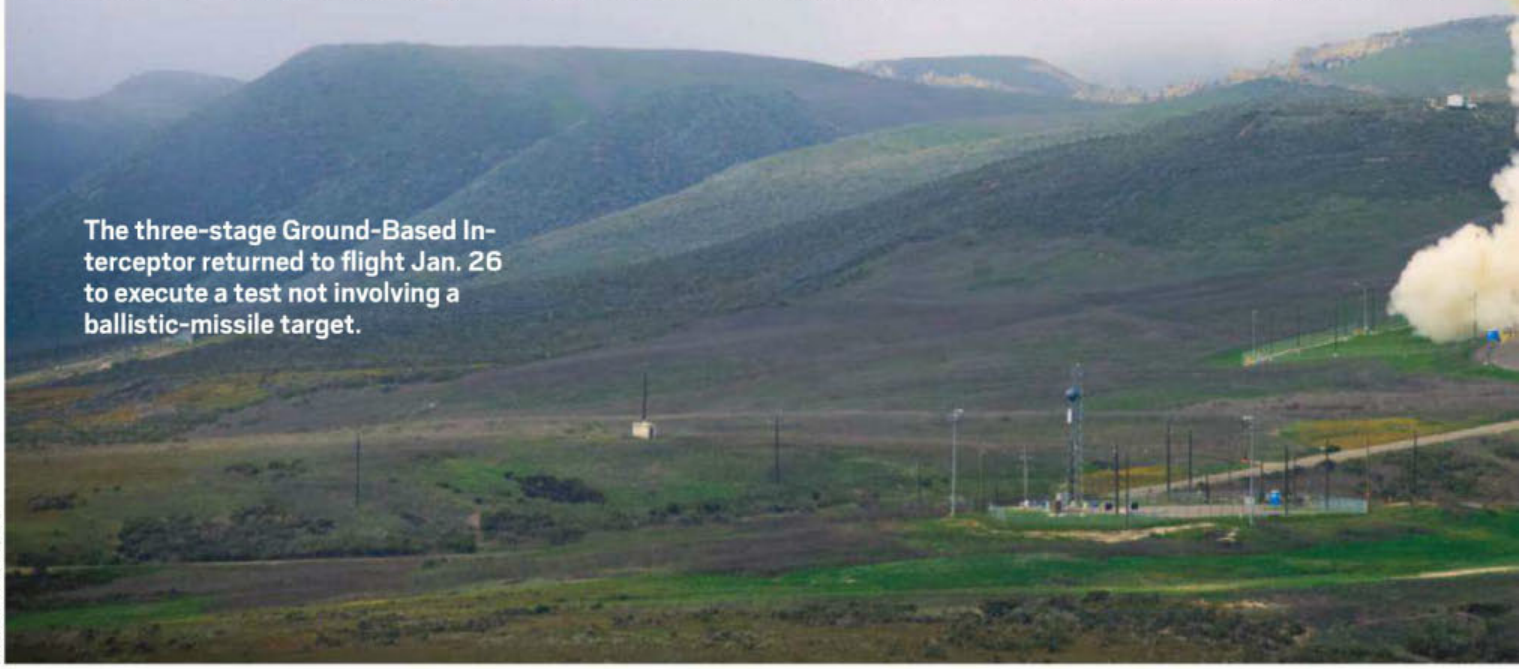
But the ultimate goal is to pit the GMD, with its upgraded kill vehicle, against a target. Prior to the flight test, the MDA had said it would conduct the intercept attempt between March and June; since then test officials have not said when this demonstration will take place.

Mating of the EKV CE2s with their boosters has been on hold while the government-industry team sorted through the technical issue.

Though the GDM and EKV CE 2 were grounded for two years, the legacy system in silos in Vandenberg AFB and Fort Greely, Alaska, remained on alert.

However, the return to flight for the GMD was a relief for many policymakers closely watching activities in North Korea. Pyongyang unleashed a rash of bellicose rhetoric, saying last month that it would target its maturing missile fleet against the U.S. and continue with nuclear tests. The GMD is specifically designed to counter an attack from North Korea, and it is only influential as a deterrent to aggression if it can intercept targets in flight testing.

While the flight test appears to put the GMD back on a growth path, the MDA still faces a host of challenges. A dearth of research expertise is among the top priorities that need to be addressed by the incoming director, Vice Adm. James Syring, according



The three-stage Ground-Based Interceptor returned to flight Jan. 26 to execute a test not involving a ballistic-missile target.

MISSILE DEFENSE AGENCY

to Philip Coyle, who was associate director for national security and international affairs in the White House Office of Science and Technology Policy in 2010-11 and previously was the Pentagon's chief tester.

Among the reasons for what some say is a "brain drain" at the MDA was the caustic management style of Syring's predecessor, Army Lt. Gen. Patrick O'Reilly. Industry officials note that some of the MDA's top experts left during O'Reilly's tenure due to his biting management and micromanaging.

Hand in hand with that problem is an overarching morale slump at the agency, as well, they say.

Syring will also have to make some tough calls about how to proceed programmatically. O'Reilly deviated from his predecessor, Air Fore Lt. Gen. Trey Obering, in doggedly pursuing technologies to achieve "early intercept" of ballistic missiles—a kill at or before a threat missile reaches apogee. In doing so, he proposed testing of Predator unmanned aircraft outfitted with modified Raytheon MTS-B electro-optical/infrared sensors to provide tracking data early after a threat missile's launch. O'Reilly also pushed the development of the Precision Tracking Space System (PTSS), a satellite constellation designed to track missiles from early after launch through their midcourse, as they cool in space.

Experts at the National Academies of Sciences proposed last September that the MDA terminate the PTSS because they questioned the system's capability, especially in light of the high cost of performing from space.

Coyle points out that determining what to do with these sensor systems will be among the issues facing Syring during his first budget cycle as MDA director.

The new director must also decide whether to move ahead with developing a so-called SM-3 IIB, a larger, faster, longer-range version of the SM-3 now used by Aegis ships at sea. The White House's Phased Adaptive Approach strategy to protect most of Europe and some of the U.S. from Iranian attack calls for this missile around 2020, but funding cuts could compromise the ability to meet such a schedule.

Indian Triad

With undersea launch, New Delhi secures third nuclear delivery capability

Jay Menon New Delhi

India has moved a significant step closer in integrating its strategic submarines with ballistic missiles after the test launch of a medium-range missile from a submerged platform in the Bay of Bengal.

The 10-meter-tall (33-ft.) nuclear-capable missile was launched from a depth of about 50 meters Jan. 27, says Defense Research and Development Organization Director General V.K. Saraswat. It met "every" mission objective, he says.

The submarine-launched ballistic missile (SLBM), designated K-15, performed well in more than a dozen earlier launch tests, but in secret. This latest salvo—the last trial in the development phase—saw it rise to an altitude of 12 mi. and reach a distance of nearly 434 mi. before it fell into the Bay of Bengal.

"With the completion of developmental trials, the process of integrating SLBM with INS Arihant, the indigenously built nuclear submarine, will commence soon," Saraswat says.

According to Indian scientists, as many as 12 nuclear-capable missiles, each weighing 6 tons, will be integrated with Arihant, which will be powered by an 80-megawatt thermal reactor that employs uranium as fuel and light water as coolant and moderator. The reactor has been integrated with the submarine. Harbor trials are expected to begin in June.

A.K. Chakrabarty, chief scientist who designed the SLBM and director of the Hyderabad-based Defense Research and Development Laboratory, says the next big challenge will be to test the missile when it is fitted on Arihant in the next few months.

"Development of [the] missile system is an ongoing process. So many other tests are to be done yet," Chakrabarty says.

Defense Minister A.K. Antony told India's parliament last May that Arihant might enter service in the first half of this year.

This capability would complete India's nuclear triad, making the country capable of launching missiles from air, land and sea. Its Agni land-launched missile has a range up to 3,106 mi., and its Mirage 2000, Su-30MKI and MiG-29 fighters can carry air-launched cruise missiles or gravity bombs.

Indian defense scientists are developing another SLBM (K-5) with a range of nearly 1,864 mi. India has tested several weapons in the past few years as part of its missile program, which began in the 1960s. Last April, it test-fired a long-range intercontinental ballistic missile capable of reaching as far as Northern China and Eastern Europe.


U.S. AIR FORCE

At least six fueldraulic lines in the F-35B were improperly crimped by manufacturer Stratoflex, prompting the fleet to be grounded for inspection.

Bad Lines

Improper installation of fueldraulic tubes grounds Marine Corps' F-35B fleet

Amy Butler Washington

Investigators are inspecting the young U.S. Marine Corps fleet of F-35Bs after a manufacturing defect was found in a number of fueldraulic lines, but program officials suggest the grounding of the short-takeoff-and-vertical-landing (Stovl) aircraft will not last long.

Officials have found six fueldraulic lines with manufacturing defects thus far in the Pentagon's 25 flyable F-35Bs. The lines carry fuel rather than traditional hydraulic fluid to enable actuator movements for F-35B's vectoring exhaust system. The aircraft, slated to be a Harrier replacement, was grounded Jan. 18 after a pilot was forced to abort a conventional takeoff during an incident at Eglin AFB, Fla., where pilots and maintenance staff are trained. Inspection later revealed a detached fueldraulic line on this aircraft, according to Matthew Bates, a spokesman for Pratt & Whitney, which makes the F135 powerplant.

The "non-compliant" units have been removed from aircraft and will be replaced, says Joe Dellavedova, the Pentagon's F-35 spokesman. Stratoflex, a division of Parker Aerospace, manufactures the fueldraulic lines. The F-35 Joint Program Office plans to fully inspect all F-35Bs for this problem.

At issue are tubes that were manufactured to the design specifications but not crimped properly, Bates says. Program sources indicate that the company has narrowed the defect to specific lots and are able to inspect first those tubes considered most suspect.

Meanwhile, the companies are implementing corrective actions to improve quality control in building the fueldraulic lines, Dellavedova says.

Neither Bates nor Dellavedova said who will pay for the repairs. But Pentagon officials typically look to the contractor to pick up the tab in the case of a defect, as with Martin-Baker ejection seats, which last year were found to have been packed backward. Some seats were recalled for rework.

The Marine Corps, the U.K. and Italy are slated to buy the F-35B.

Though the grounding is expected to be temporary, this further delays flight-testing of the B model. The Marine Corps is the customer most eager to field the aircraft, and it is first in line to declare initial operational capability, a date that has slipped repeatedly because of technical challenges or defects found in flight testing.

ISR Lag

A decade of meager investment in tactical surveillance catches up with France

Tony Osborne London and Amy Svitak Brussels

The French request for a British Sentinel radar surveillance aircraft to support Operation Serval in Mali highlights France's shortage of tactical intelligence assets, which have advanced little beyond helicopters and targeting pods on jets, despite years of experience in Afghanistan.

The Sentinel's Jan. 25 deployment to Dakar, Senegal, came at a turning point in the fight against Al Qaeda-linked insurgents in France's former West African colony. With the system's ground station situated in the Malian capital, Bamako, Sentinel aided in the retaking of key cities in the country's center, where French commanders are using the Sentinel's Raytheon-built Airborne Stand-Off Reconnaissance (Astor) radar feed to locate rebel fighters across vast swaths of the Malian desert.

Since Jan. 11, when the French intervention began at the Malian government's request, France has relied on aircraft such as Dassault Aviation's Mirage 2000D and Rafale fighter-bombers equipped with podded reconnaissance and targeting systems—including the Thales-made Damocles—for intelligence, surveillance and reconnaissance (ISR) of targets. They perform well but have low endurance and persistence, needing frequent aerial refueling.

As a result, the persistent ISR role over Mali shifted to the French navy's Atlantique 2 maritime patrollers and two of the air force's EADS Harfang unmanned aerial vehicles that are based on the Israel Aerospace Industries (IAI) Heron UAV, which has no means to deliver weaponry should a target appear.

"There is a general scarcity of ISR assets—tactical, theater and strategic—within Europe, and even those countries that do have some such capabilities have them in limited numbers," says Douglas Barrie, an analyst with the International Institute for Strategic Studies in London. "The provision of a

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A Rafale fighter, winner of the MMRCA competition, is framed by India's Sarang helicopter team.

India Is No.1 Arms Importer

India is now the world's leading arms importer, with a military budget that's expected to reach $50 billion in the next fiscal year.

The Stockholm International Peace Research Institute, a Swedish think tank that monitors global arms sales, notes India's weapons imports have overtaken China's, which are now in second place with 6% of global imports, as Beijing continues to build up its domestic arms industry.

India accounted for 9% of all international arms imports in 2006-10, and it is expected to keep the top spot for the foreseeable future.

As one of the largest defense equipment markets in the world, India is expected to spend about $120 billion on capital acquisition alone during the next five years. The major portion of India's expenditure will be for aircraft, with spending expected to reach $15 billion in the next couple of years.

Sharklets for IndiGo

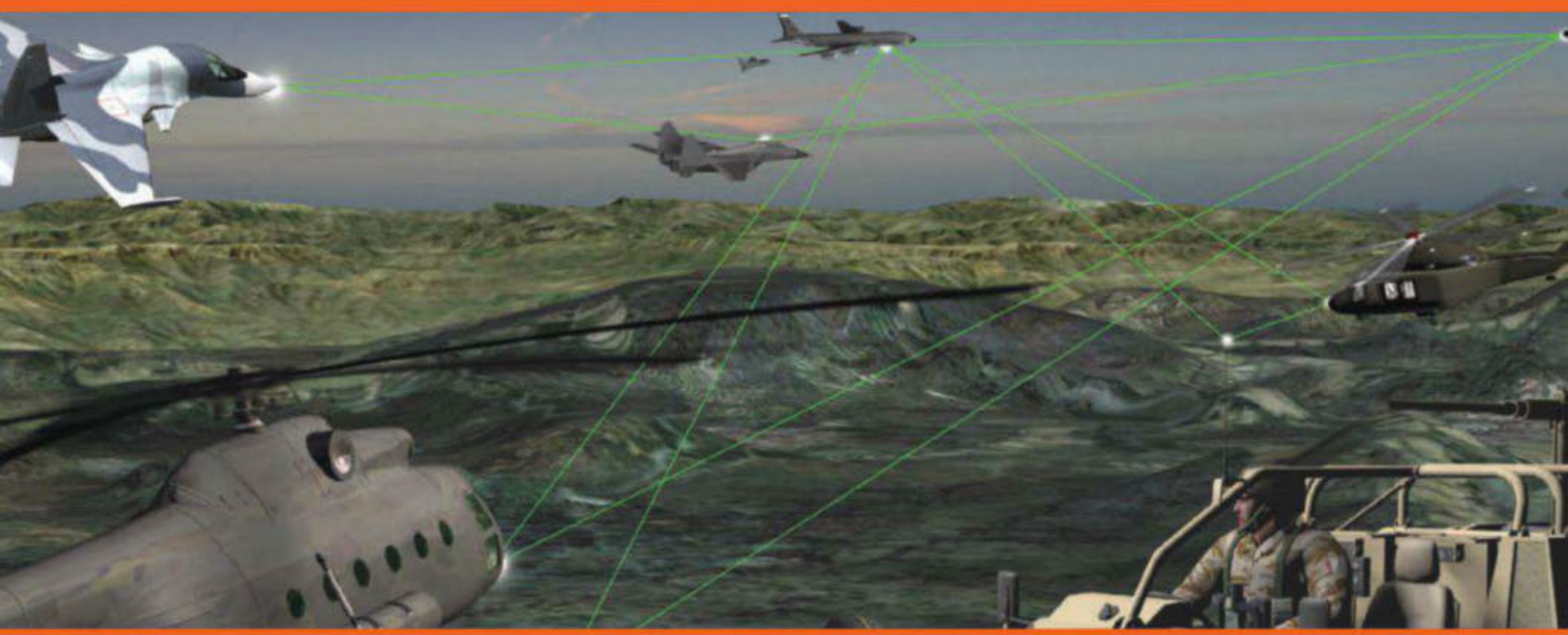
Sharklets add 100 nmi range or 450 kg more payload.

Airbus's fuel-saving Sharklet wingtips have arrived in India with the delivery of the first so-equipped A320 to IndiGo, the country's largest low-cost airline.

All future A320 aircraft for IndiGo will be fitted with the Sharklet wingtips.

IndiGo ordered 100 A320 aircraft in 2005, plus 150 A320neo and 30 A320s in 2011. It currently has a fleet of 62 Airbus A320s.

Interoperability prevails here.



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Cassidian Says India Will Be the Center For Its Growth in Asia

India will become a regional hub for Cassidian's defense and homeland security businesses, despite its Eurofighter losing to the Dassault Rafale in the MMRCA competition for 126 fighter aircraft.

"We intend to use our India operations as a springboard to establish further bases across the Asian region," says Dr. Peter Gutsmiedl, Cassidian's newly-appointed Head of Asia & CEO India. "In my new role, I am now looking after expansion of the Indian operations into a regional hub and overseeing Cassidian's growth in Asia.

Dr. Peter Gutsmiedl

"India's strategic significance for Cassidian goes far beyond the outcome of any single tender, even if it is the MMRCA."

Cassidian will build on its existing base here – two years ago it opened an engineering center in Bangalore, and is developing indigenous products with India's Defense Research Development Organization (DRDO). "Our aim is to firmly embed Bengaluru in Cassidian's global technology network and develop the center as a single source supplier of certain cutting-edge defense and security technologies to all its global initiatives," says Gutsmiedl.

The center has already designed and engineered a high accuracy air pressure measurement system critical to providing pilots with highly accurate altitude readings, and a structurally integrated airframe-conformal antenna for satellite and GPS communication in aircraft. Both are on show here at Aero India.

With the DRDO, Cassidian has developed a missile approach warning system (MAWS) for Indian rotary and wide-body aircraft. The sensor has been certified 'indigenous' by Indian authorities and is expected to be produced locally for integration into India's helicopter fleet.

India Seeks Bids for 56 Cargo Aircraft

India will spend up to $2 billion for 56 cargo aircraft to replace its 30 elderly Avro 748Ms, a defense ministry official told *Aviation Week*. The first 16 will be supplied complete, and an Indian partner will manufacture the rest with the first 16 built in-country having 30% indigenous content, and the last 24 with 60%. Contenders are the Ilyushin IL114, Antonov An148, Airbus Military C295 and Alenia C27J Spartan.

Aero India Is a Smaller Show this Year

Fewer aircraft and exhibitors are coming to Aero India this year after the hype that surrounded the MMRCA competition for 126 fighter aircraft during the event two years ago. However, "The show has its own merits for development of defense industry in the country, and is not MMRCA centric," says India's Defense Production Secretary R.K. Mathur. Exhibitors dropped this year to 607 from 675, and show aircraft to 52 from 63.

Textron Systems Delivers Sensor Fuzed Weapons

Textron Systems' new president and CEO Ellen Lord will attend Aero India to help celebrate the first deliveries to the Indian Air Force of 512 CBU105 sensor fuzed weapons (SFW) for the Jaguar aircraft, plus 44 training bombs, worth $257.7 million. "Textron Systems has established strong relationships with the Indian government, armed forces and security agencies, as well as industry partners," she notes.

Ellen Lord

CAE JV Directs Offsets Into Training

Simulator and training specialist CAE hopes soon to announce the first client for its Rossell Limited India joint venture set up last year to facilitate offset obligations for foreign OEMs. Owned 26% by CAE and 74% by Rossell, the jv is bidding on training platforms for several programs including the C-17, according to Ananth Ramaswami, managing director of CAE India. Foreign OEMs must offset 30% of contracts over $55 million into India's defense industry.

Collins Eyes Gvt. Communications Programs

Rockwell Collins targeted India for its engineers, rather than sales potential, setting up a multimillion-dollar design center five years ago in Hyderabad. It employs 500 engineers, and will hire 100 more this coming year, says Ram Prasad, Rockwell Collins' managing director for India. "Most companies did it the other way around." Now Collins is leveraging that base, taking aim at the network centric communications modernization requirements of India's Air Force, Army and Navy.

India Means Aviation And a Lot More To Saab of Sweden

India is now one of Saab's home markets, says Lars-Olof Lindgren, former Swedish ambassador and, since December 2012, head of market area India for Saab. The company, he notes, is looking to "build business in partnership with reliable Indian partners across the entire hierarchy of manufacturers – all the way from strategic partners to sub-component suppliers to communities."

One example includes the recent joint venture with QuEST Global to manufacture and supply commercial aerostructures, in which Saab has 26%.

Lars-Olof Lindgren

Other deals include an MoU for strategic investment and a technical partnership agreement with Pipavav Defence and Offshore Engineering.

With maritime security now a major focus for India, Saab and Elcome Marine Services have implemented the National Automatic Identification System along the Indian coastline for the Directorate General of Lighthouses and Lightships. It will also be used by the Indian Navy and Coast Guard.

"Our main theme for Aero India 2013 is 'Teaming Up With India on Defense and Security'" says Lindgren.

Sea Gripen for India?

Last September Saab's Sea Gripen carrier-fighter concept reached the end of an intensive 12-month final design phase, and Indian Navy interest remains high. "We are formally engaged in discussions with the Indian Navy," says Saab's Tony Ogilvy, who headed the Sea Gripen design project. "We briefed them last year, and they are still in the data-gathering phase."

Rafale In India: The Deal Is Not Yet Sealed

As India and Dassault hammer out the commercial details behind the landmark order for 126 Rafale combat aircraft, Indian Foreign Minister Salman Khurshid observed "We know a good French wine takes time to mature and so do good contracts." Local industry has little capacity to absorb the scale of work that India insists on receiving as offsets; and defining the role of HAL is sure to be one of the toughest negotiations.

New Pilatus Trainers to Arrive in March

Last May the IAF signed a landmark deal worth more than $530 million with Pilatus for 75 PC-7 Mk II turboprop trainers, together with an integrated ground-based training system and logistics package. Coupled with the contract was the establishment of new in-country depot level maintenance facilities at HAL, to support a planned service life of over 30 years. The first PC-7 Mk IIs are to be delivered in March 2013.

Jaguars Just Get Better and Better

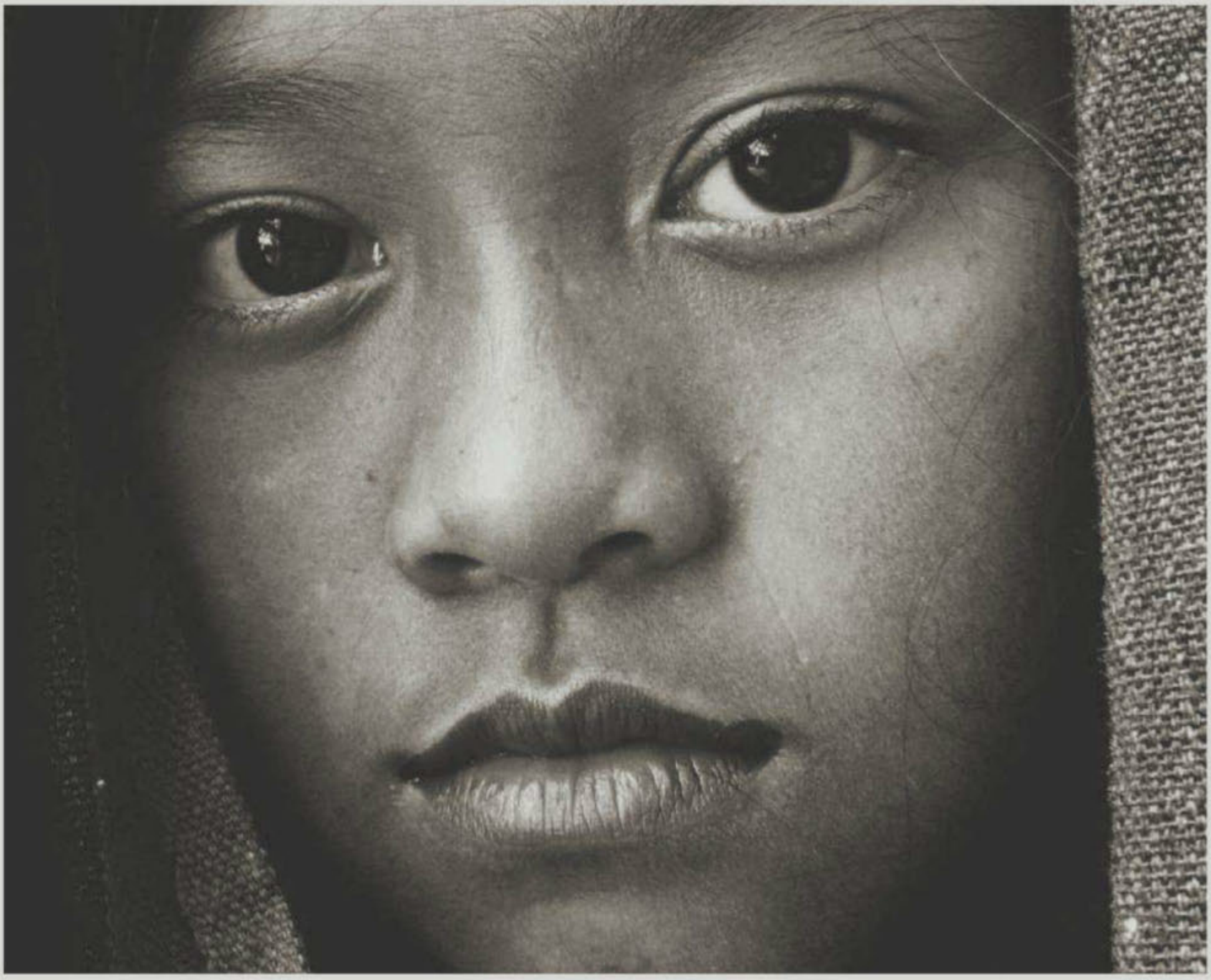
Feared and respected as a low-level strike aircraft, the 120+ HAL Jaguars of the Indian Air Force and Navy are getting new cockpits and systems. In November, HAL flew its DARIN III Jaguar, the latest in this multi-stage program. IAF jets will get the Textron Sensor Fuzed Weapon, and naval Jaguar Ms the Boeing Harpoon anti-ship missile. Last October, the IAF asked Honeywell for proposals on replacing Rolls-Royce/Turbomeca Adour engines with the F125IN turbofan.

Hawks to Re-Equip Surya Kiran Jet Team

BAE Systems' Hawk is becoming India's main advanced jet trainer: In 2004 the IAF ordered 66 Hawk Mk 132s, another 40 in 2010, and the Indian Navy 17. Despite some public wrangling over spares and support, the IAF has requested 20 more to replace the elderly HJT-16 Kiran jets of the Surya Kiran display team. HAL builds the Hawk under license; Indian sources report another 40 Hawks may yet be required.

Mirage 2000 Upgrade Is Underway

Work is underway in France on the first two of 51 Mirage 2000H upgrades for the Indian Air Force, expanding their all-round combat capability and extending their lives to 2025. Suppliers include Dassault, Snecma and Thales. The upgrade includes a new glass cockpit, helmet-mounted sight, and improved RDY multi-mode radar plus new communications, navigation and defensive systems. New weapons will include the Mica active-radar air-to-air missile.



In a world where natural disasters have affected over 2 billion people in the last decade,* the Airbus A400M gives military and political leaders the chance to respond faster and more effectively.

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*Figures from the International Committee of the Red Cross.

Raytheon Hopes To Leverage Black Box Into Weapons Sales

They say the best things come in small packages and that's true for Raytheon in India, where the U.S. company's little Munitions Control Unit (MCU) box is at the heart of a major expansion in weapons capability for the HAL Jaguar. India has acquired the Textron CBU-105 Sensor Fuzed Weapon (SFW) – a wide-area smart munition for tank killing – but integrating it on the Jaguar requires the MCU to be incorporated in India's Jaguar upgrade package (known as DARIN). A contract to build the MCU was awarded in 2011 with funding authorized in 2012. Now manufacturing has begun on 146 MCUs for India with final deliveries due in 2015.

Raytheon's MCU.

The Jaguar/MCU project, says Bradley Watters, Raytheon's international program manager for joint standoff weapons (JSOW), "is a gateway to other aircraft such as the Hawk, the Tejas LCA and even the Mirage 2000. The MCU would be a facilitator to add other Raytheon precision weapons on some of those older platforms."

Separately, Watters believes that India's Navy could follow the U.S. Navy in integrating the JSOW-C1 on its P-8I patrol aircraft, supplementing the Boeing Harpoon anti-ship missile with a flexible land attack and a maritime moving-target attack capability.

AGM-154 JSOW

The JSOW is a hot topic for the Indian Air Force too, adds Watters. "It gives the Jaguar an ability to engage a target from 60 nautical miles away, and hit within 5 ft of the intended target. If you look at the needs of India's Western Command with its mountainous borders, there is a lot of interest in a weapon like JSOW."

Boeing Leads U.S. Defense Wins in India

Boeing has been the major U.S. beneficiary of Indian defense contracts since the two countries thawed relations, with deals potentially worth $8.6 billion to the U.S. for aircraft, helicopters and missiles, and support and training. Wins include 10 C-17 strategic transports ($4.1 billion), 12 P-8I maritime patrol aircraft ($2.1 billion), 22 Apache attack helicopters ($1.4 billion), 15 Chinook heavy-lift helicopters ($1 billion), and Harpoon Block III anti-ship missiles for the IAF's Jaguar maritime strike jets.

India's C-17s Move Closer to Operations

On January 22 India's first Boeing C-17 strategic airlifter was flown to Edwards AFB, California, to begin flight-testing. It is the first of 10 ordered by India under a deal worth $4.1 billion. Boeing says it will deliver five aircraft to the Indian Air Force this year and the remaining five in 2014. India will then have the world's second largest C-17 fleet, after the United States.

India Confirms Apache Choice…

Contract negotiations will begin soon on India's new attack helicopter, Boeing's Block III Apache Longbow (newly redesignated AH-64E). Selection was announced late last year by Indian Air Force commander Air Chief Marshal N. A. K. Browne after a three-year competition. The acquisition provoked a high-profile dispute between the IAF and Army over future ownership of the 22 AH-64Es, which appears now to have been resolved in the Air Force's favor.

…As Chinook Emerges Victorious in Heavylift Battle

The Indian Ministry of Defence and Boeing are now in negotiations over a contract to acquire 15 CH-47F Chinook heavylift helicopters, following the aircraft's selection over the Russian Mi-26T2. The much larger, and in some ways more capable, Mil Mi-26 is already in Indian service, but the Chinook's overall performance and support package was deemed to be superior – and the CH-47F can be carried by India's new C-17 transport aircraft.

P-8I Pair Delivered to Plan

The Indian Navy accepted its second Boeing P-8I maritime patrol aircraft on December 19. P-8I Nos 3 and 4 will be rolled out this year and the fifth is already on the Seattle production line. India plans to acquire eight of the long-range maritime reconnaissance and anti-submarine aircraft. The official delivery of the first P-8I to India will take place later this year once flight-testing has been concluded.

Jaguar would mount ASRAAMS over its wings.

MBDA Takes Aim At Major Programs For Missiles in India

MBDA comes to Aero India claiming to be the only manufacturer with a product line capable of meeting the guided-weapons requirements of all three armed services: air, land and sea. Perhaps its biggest program in India today is the Maitri short-range surface-to-air missile (SR-SAM) project being jointly developed with India's DRDO and BDL. Prominently displayed at Bangalore is a model of the SR-SAM missile, which, says MBDA, has potential tri-service applications in India.

Air weapons capabilities are also to the fore, and MBDA is looking to play a leading role in enhancing the operational capabilities of the IAF's fleet of Jaguar and Mirage aircraft, as well as arming the Dassault Rafale. The MICA active-radar air-to-air missile has already been ordered for the IAF's Mirage upgrade.

In what is now a long-running but still active program, the ASRAAM dogfight missile is still being discussed as a potential weapon for the IAF's Jaguar fleet.

Other airborne weapons on show and available to India include the Meteor very long-range ramjet-powered air-to-air missile, which is a future option for the Rafale (and Gripen and Eurofighter).

A major talking point at the show will be the turbojet-powered extended-range MBDA Marte ER anti-ship missile. Its new engine takes the 300-kg missile's range out to over 100 km, and, with the Indian Navy looking for weapons for the Sea King Mid Life Update, plus the new MRH and IMRH programs, it has potential as a common missile for light anti-ship applications.

Airbus Wins India Tanker Bid

India last month selected Airbus Military over Ilyushin as preferred bidder to supply six tanker aircraft to the Indian Air Force in a deal reportedly valued at $1.5 billion. A final contract is expected later this year for the A330 MRTT multirole tanker transports, which beat the Russian Ilyushin Il-78 in extensive refuelling trials. India will be the fifth nation to fly the MRTT, following Australia, Saudi Arabia, the UAE and the UK.

India Buys More C-130s, Makes Parts

The U.S. has approved India's 2011 request for six additional Lockheed Martin C-130J airlifters for the Indian Air Force. They will join six C-130J-30s ordered in 2008 and already in service. That order was the first major military contract between the U.S. and India in more than 40 years. Now Lockheed Martin and Tata Advanced Systems have formed a joint venture, Tata Lockheed Martin Aerostructures, manufacturing airframe components for the C-130J.

India's Trainers In Doubt

India's programs to produce indigenous aircraft across the training spectrum have been troublesome. The HJT-36 Sitara (the Intermediate Jet Trainer, IJT) has been under development for 10 years, but still is notionally required to transition pilots from the Pilatus PC-7 to the Hawk. HAL also has a primary trainer project, the HTT-40, but its future is somewhat in doubt following India's decision to acquire the Swiss Pilatus aircraft.

Raytheon's Fish Hawk Could Find Favor

Raytheon says that India maintains a strong interest in its Fish Hawk concept for a guided, gliding torpedo system capable of release by the P-8I maritime patrol aircraft from altitudes higher than all conventional torpedoes. "Progress is being made," says Mark Borup, Raytheon business development manager, "We all know that government-to-government approvals are a requirement for this level of technology and we are certain that this process will continue with India."

BrahMos Air Launch Test Delayed One Year

The long-awaited test launch of the air version of the BrahMos supersonic cruise missile has been further delayed, and now India hopes to undertake drop trials by December 2013. The missile is already over three years behind schedule. The launch will likely be from a Sukhoi Su-30MKI aircraft, two of which are being modified with stronger landing gear by Hindustan Aeronautics Limited (HAL) at its Nashik facility.

Israel's Rafael Seeks Closer Ties With Indian Companies

Israel's Rafael has won significant orders from India and, anticipating more, it is preparing to expand its sourcing and cooperation there as its offset obligations grow.

India requires offsets investments into its defense industry of 30% on contracts of more than three billion rupees ($55 million).

"Rafael is interested in partnerships and cooperation where we can transfer some of our technologies and production capabilities," Oron Oriol, Rafael's vice president for marketing and business development, tells *ShowNews*.

Oron Oriol

Rafael is working with several companies in India, including Bharat Dynamics Limited (BDL), which will assume local support for Rafael's missile systems. Oriol says Rafael is not limiting its cooperation to the public sector units and is in discussions with a number of other companies in India, but as yet hasn't reached any agreements on partnerships or joint ventures.

One of Rafael's strengths in international cooperation, according to Oriol, is its flexibility in adapting to local conditions. "You must know how to adjust to your customer's local environment, and not demand him to adjust to you." Oriol adds.

Part of this adjustment is Rafael's 'design to cost' approach, which, selectively implemented in major programs in recent years, has also become a critical advantage when facing growing competition, he says.

"We embraced this concept in several successful programs," says Oriol. "The most recent was 'Iron Dome', where a complete weapon system was developed and fielded in record time, within budget, following methodical 'design to cost' principles."

This air defense system, on show for the first time at Aero India, "was economical, and proved itself in combat, scoring over 80% success in more than 500 interceptions of enemy rockets and missiles," he notes.

—Noam Eshel

Rafael Focuses On Air Defense

"For the first time we are displaying our air defense weapons systems, both in the halls and at the outdoor area," Yedidiya 'Didi' Yaari, Rafael president and CEO, tells *ShowNews*. "We consider India an important market, following our initial success with the Spyder SR [short-range surface-to-air defense] system. Other Indian requirements are well addressed within Rafael and we intend to compete on some of these programs with our local partners."

IAI Debuts 'Skimmer' for Naval Helicopters

Israel Aerospace Industries (IAI) is introducing here an integrated maritime mission system for naval helicopters. 'Skimmer' integrates sensors, communications and weapons for most mission requirements, and is available for new or used platforms. System elements include radar, electronic warfare support measures, electro optic payloads, datalink, communication intelligence, sonar, sonics, mission management and monitoring systems, anti ship missiles and other weapons. Experienced naval helicopter pilots contributed to the design and integration.

Skimmer for India's Ka-28?

Rafael Offers BNet SDR Radio to India

Rafael is offering the Indian Air Force its next generation airborne communications network based on BNet and software-defined radio (SDR) technology. The new radios form ad-hoc networks through a flexible, real-time process, transferring data including voice, data, high-resolution video and images over broadband. In 2012 Rafael won similar tenders in Brazil and Colombia. Rafael has already won a pilot program to demonstrate advanced airborne datalinks for IAF strike fighters.

Elbit Adds Ship Intelligence to Hermes 900

Elbit Systems and Windward Ltd. debut an integrated maritime security solution with the addition of Windward's MarInt satellite-based analytics system to Elbit's Hermes 900 UAS. MarInt maps global maritime activity in unprecedented detail, and, coupled with a maritime security command and control offering, performs deep behavior analysis on each ship to detect anomalous and suspicious behavior. The cooperation between the two companies addresses specific geographical regions, including India.

Israel Plans Satcom Coverage for India

Spacecom, Israel's satellite communications provider, is planning to launch communications services in Russia, India and the Middle East based on its latest satellite, Amos 4. Launch is planned for June 2013 from Baikonur, Kazakhstan. Once positioned at 65°E it will cover Russia, India and the Middle East with multiple Ku and Ka transponders. Amos 4 is the most advanced communications satellite built in Israel.

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CAE India Grows Training, Services And Simulators

Predicting that Indian military and commercial operators will add 1,000 helicopters over the next several years, CAE is planning on expanding its training facilities. The CAE-Hindustan Aeronautics Limited (HAL) center at Bangalore, dubbed HATSOFF (the Helicopter Academy to Train by Simulation of Flying) opened in July 2010 and expects demand to grow to 1,800 hours of "flying time" this fiscal year from just a few hundred the year before.

It now has three cockpit simulators – The Bell 412, Eurocopter AS365 N3 Dauphin, and civil/convention Dhruv – and plans to add an Army/Air Force Dhruv next year, says Ananth Ramaswami, managing director of CAE India. "We won a significant Indian Air Force order in December, and the Army has started training with us, too," he adds.

Ananth Ramaswami

HATSOFF features a full-motion, full-mission "mothership" that utilizes CAE's roll-on roll-off cockpits; when one is in action the others can be used as training devices, thus keeping costs down and utilization up.

Elsewhere, CAE just closed its biggest Indian contract to date, for $9.5 million, to maintain the Air Force's Hawk simulators for BAE Systems. It now provides on-site maintenance and support services at 17 locations throughout India to support simulators operated by the Air Force, Army and Navy. "These are often competitors' simulators," says Ramaswami. "We support them and guarantee a certain uptime."

On the commercial aviation side CAE will open its fifth managed training facility in India in May, a joint venture in New Delhi with InterGlobe Enterprises, with two Airbus simulators. It already has an airline simulator and training center in Bangalore, and manages two ab initio flight schools.

"CAE currently has a 15% share in India's market for commercial pilot training," says Ramaswami.

India Wants Several Hundred Helicopters

India plans to buy hundreds of helicopters over the next few years. Among them: another 71 Mi-17V-5s for $1.34 billion, bringing its fleet to 151; 197 light surveillance and reconnaissance helicopters (RSH) – 133 for the Army and 64 for the Air Force for $700 million; 56 light utility rotorcraft for up to $1 billion for the Indian Navy's NUH requirement; 16 multirole helicopters (MRH) worth up to $1 billion for the Navy; 75 follow-on MRHs to replace the Sea King fleet; and 187 light utility helicopters (LUH) for the three armed forces to be made by HAL.

Russian Helicopters Plans Indian Production

Russian Helicopters will set up a facility in India to manufacture Russian Mil and Kamov helicopters in a joint venture with Elcom Systems. The jv will produce aerostructures and carry out final assembly, as well as ground and flight testing. The first product is expected to be the multirole Ka226T, which is competing against the Eurocopter AS550 C3 Fennec in the $700 million bid to supply India with 197 surveillance and reconnaissance helicopters.

Bell Looks to Assembly in India

Bell Helicopter is evaluating India's Dynamatic Technologies Ltd. to assemble helicopter cabins for its 407 helicopters, as well as airframe components and details. "The estimated business volume of the work proposed is approximately $243 million over a 10-year period," Bridget Bishop, communications analyst at Bell Helicopter, tells *Aviation Week*.

Eurocopter Claims Biggest Market Share

Eurocopter claims to lead India's civil helicopter market for the third year running with a 43% share of registered deliveries, and says it supplied three out of four helicopters in the single and medium class last year. Industrial partners are Hindustan Aeronautics Ltd. (HAL) and the Mahindra Group; HAL has now manufactured more than 600 helicopters of the Alouette 3 and Lama types since 1962.

India Receives Its First Two AW101s

AgustaWestland has delivered the first two of 12 AW101s to the Indian Air Force India for VIP/Head of State missions. The Indian government ordered the helicopters in March 2010 as part of a $754 million contract. The purchase of the AW101 has proven highly controversial amid allegations of kickbacks, but Indian Defense Minister A.K. Antony says no credible evidence has emerged. Deliveries should be completed by 2014.

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Red Tape Is Strangling Business Aviation in India, Says Advocacy Group

Importing business aircraft into India is becoming more difficult because of increased bureaucracy. As well as the monthly aircraft acquisition committee meeting, India's Civil Aviation Minister is now said to be scrutinizing every application personally. Rohit Kapur, president of the Business Aviation Operators Association of India (BAOA) says this has been going on for about five or six months and the backlog has reached around 40 aircraft.

BAOA's Rohit Kapur

This figure covers all civil aircraft applying for Indian registration from airliners to business aircraft to general aviation. "Business aviation has always been lumped in with them [airlines and GA aircraft] but the BAOA is trying to change this."

Kapur says he understands why the Ministry gets involved in airliner acquisitions as it is trying to guide operators of regional aircraft to help open up India's interior. But he says business aviation is a totally different case. "If a private company wants to buy the most efficient aircraft, why should it matter to the Minister whether it buys a Gulfstream or a Bombardier? We want a simpler process."

According to India's DGCA website, 39 aircraft were registered between August 1st and the end of November including 10 business aviation related aircraft with the remainder being Airbus and Boeing airliners, regional aircraft, helicopters, and a number of flight training aircraft and personal light aircraft.

The BAOA also aims to narrow the disparity between import duty on private (nearly 25%) and commercial aircraft (2.5%). "There were some loopholes in the law and some companies were importing under Part 135 and using them privately," said Kumar.

Despite the BAOA's frustrations, Kapur still has a sense of humor, "The British taught us the art of bureaucracy but India has perfected it!"

—Mike Vines

India Sees Slow Business Aviation Growth

The business and general aviation fleet registered in India comprised 137 business jets and 94 turboprops at the end of November, according to data from Jetnet LLC. Of the 223 turbine helicopters registered, only a few are used for VIP work. Just ten aircraft were added in the business aviation category in the four months through November: a Hawker 800XP and a Challenger 300, five turboprops and three helicopters.

Empire Launches Aircraft Management…

Bangalore-based Empire Aviation, set up last year after Indian MRO specialist Air Works made a $30 million strategic investment in Empire's parent company in Dubai, has taken its first business jet under management – a Challenger 300 that flies from HAL Airport. It is in discussions for three more aircraft, and plans to have five under management in India by the middle of this year.

…As It Positions for Future Bizjet Growth

Empire executive directors Steve Hartley and Paras Dhamecha.

Challenges facing the development of private aviation in India include tough regulations on aircraft importation and ownership, says Paras Dhamecha, executive director of Empire Aviation. "These are slowing market development, and airports are becoming busier and running close to capacity," leaving little room for business aviation, he adds. Yet the market is growing "and we see a healthy future demand for our services…which can simplify the ownership process and experience for owners."

Air Works Aims for Business Jet Interiors

Indian MRO specialist Air Works plans to expand into cabin refurbishment for business jets over the next two years, adding to its MRO expertise on numerous types of business aircraft. The activity will be based at its Mumbai hangar in Chembur. It will, the company says, be the first-of-its-kind interiors facility in India. Last year Air Works unveiled a prototype midsized aircraft interior in conjunction with auto icon Dilip Chhabria Design.

GippsAERO/Mahindra Gears Up for New Aircraft

GippsAERO GA18TP Nomad

Indian-owned GippsAERO/Mahindra Aerospace achieved numerous milestones in 2012 that will underpin its expansion into larger aircraft. The year marked the first flight of its Rolls-Royce turboprop-powered GA10 evolution of the GA8, and the opening of the manufacturing hangar in Traralgon, Australia, for the GA18TP development of the twin-engined GAF Nomad. In addition, the 175th GA8 Airvan rolled off the production line, taking the record for the most Australian-produced civil certified aircraft.

Royal Air Force Sentinel Mk. 1 for air-to-ground surveillance as part of Operation Serval can be seen in this context."

Until 2008, France utilized its Horizon synthetic aperture radar/moving target indicator program, based on Eurocopter-built Puma helicopters, to provide battlefield targeting and ISR support. Developed during the Cold War to assist artillery in identifying vehicle targets, Horizon marked the advent of radar-equipped UAV systems in Europe. But France withdrew it from service five years ago to save costs.

"We have had to make difficult choices because of financial and budgetary problems," says one French defense ministry official, adding that France still boasts a number of capabilities for tactical intelligence, including ground-based radars, electronic intelligence assets, satellite phones and aircraft, notably the Atlantique 2 and Harfang UAV.

"Intelligence is a fusion of various assets, including human, electronic and imaging capabilities, and Horizon was just one," he says. "In Mali, we have a good panoply of assets."

In the past two decades, France has invested heavily in strategic assets to meet ISR needs, including the Helios high-resolution military surveillance system and EADS Astrium's twin Pleiades Earth-observation satellites, which provide imagery of any point on the globe daily at a resolution of less than 1 meter (3.3 ft.).

More recently, French defense procurement agency DGA announced plans to study the next generation of Damocles targeting pods for the Rafale, awarding Thales a €55 million ($74 million) contract for the next five years. But, as Operation Serval illustrates, in the absence of new capabilities, France has had to rely on allies to assist with battlefield intelligence.

"It has been a serious failure of the defense strategy not to acquire drones, which are emerging as the weapon of choice for the kind of war that advanced Western countries will have to fight," says Alain Dupas, an aerospace and defense industry consultant in Paris. "The forthcoming defense strategy will put this in perspective, but drones should be a big priority."

For years, Paris dithered with unmanned-aircraft plans until then-President Nicolas Sarkozy decided in 2011 to field the IAI Heron-TP. The drone was offered through Dassault Aviation as an interim measure, with Dassault and BAE Systems cooperating on the Telemos UAV to develop a long-term, medium-altitude, long-endurance (MALE) unmanned vehicle. But new President Francois Hollande shelved those plans while his administration draws up a new defense strategy and budget, expected to be released in the coming weeks.

Last October, DGA chief Laurent Collet-Billon told French lawmakers that France is pursuing options for a MALE UAV. However, he noted, "if we want to equip our forces quickly with operational means, the only source is the U.S." Collet-Billon added that the agency is discussing the purchase of General Atomics-built Reaper drones that he said could be equipped with European sensors and weapons.

In the meantime, the Sentinel's deployment to Mali adds another feather in the cap of the heavily modified Bombardier Global Express business jet, which is slated to retire when combat operations in Afghanistan end in 2015. France gained experience with Sentinel and its Astor radar system during the NATO-led Operation Unified Protector over Libya in 2011.

"The French were very impressed by the capabilities of Sentinel during Libya," says Elizabeth Quintana, an expert in air power at the U.K.'s Royal United Service Institute (RUSI) think tank. "Now, with the insurgents leaving the cities, the aircraft will be searching the desert and handing off targets to systems with a narrower field of view to get that information."

Since the Sentinel's deployment, Britain has announced it will send up to 40 personnel to support a headquarters or training role in Mali. The Defense Ministry says it could send as many as 200 troops, depending on the needs of an African-led intervention force. It also plans a three-month extension of participation of its C-17 transport aircraft in the operation.

"The [Sentinel] will provide intelligence and surveillance support to the French forces on request," the U.K. Defense Ministry said Jan. 30, adding that while there are no plans to provide more aircraft, any request from France would be "looked at sympathetically."

In the meantime, U.S. Africa Command has strengthened its role in the campaign, and aerial refueling tankers are supporting the operation from an airbase in Spain. U.S intelligence-gathering aircraft are also reportedly involved, including Lockheed U-2s and EP-3 Aries and the RQ-4 Global Hawk.

The U.S. has also entered into a status of forces agreement with Niger, which borders eastern Mali. "We are . . . looking to work with them to define precisely what kind of military presence we may have in Niger in the future," Pentagon spokesman George Little said Jan. 30.

The French navy is flying Atlantique 2 aircraft for ISR and targeting support over Mali as part of Operation Serval.

TONY OSBORNE/AWAST

Emerging Optimism

Largest U.S. carriers see positive financial signs in mergers and capacity restraint

Andrew Compart Washington

After a year in which their travails and fortunes ranged from an ongoing journey through bankruptcy court protection to a $1 billion profit, the biggest U.S. carriers seem united in their expectation for better—or even better—financial results in 2013. They are optimistic about demand, although wary about the impact on some consumers of expired tax cuts, and believe carriers have learned their lessons about adding too much capacity when business is improving.

They also are beginning their new financial year in various stages of merger negotiation or integration—save for one big exception.

Delta Air Lines already has navigated those waters, having largely completed its integration with Northwest Airlines by late 2010, and its $1 billion profit in 2012 led the U.S. airline industry. The Atlanta-based airline's executives could spend the conference call on the airline's fourth quarter and full-year 2012 earnings talking about non-merger matters such as Delta's investment in an oil refinery and in U.K. carrier Virgin Atlantic, as well as the lead Delta has taken in restructuring regional carrier Pinnacle Airlines to be a low-cost partner for operating 76-seat jets.

On the refinery, Hurricane Sandy forced a temporary reduction in fuel production that contributed to a $63 million loss for the facility in the fourth quarter—adding 7 cents per gallon to the carrier's jet fuel costs. But Delta says it expects the refinery to post a "modest profit" in first-quarter 2013 and become financially stronger during the year.

Delta also talked about more mundane but equally important matters, such as the capacity discipline it believes has been the key to the U.S. airline industry's general recovery. In that respect, at least, CEO Richard Anderson says an American Airlines-US Airways merger would be a positive development because it would strengthen the industry's capacity restraint.

Delta President Ed Bastian sees "prudent capacity deployment" as one of the key factors in the airline's results, especially on the transatlantic services, which included a 7% year-over-year capacity reduction in the fourth quarter of 2012 and an 8-10% cut in the first quarter of 2013.

Even though Delta is optimistic on future demand, it continues to see strong corporate bookings and expects unit revenues to increase 4-6% in the first quarter, its first-quarter capacity will be down 2-4%—with a bigger cut for international than domestic—and may be flat for the full year.

Other than Delta, the waters are churning for the other biggest players in the U.S. market.

Nowhere is that more evident than at United Continental Holdings, the parent company for United Airlines. United paid a heavy price for the operational issues and integration costs from the United-Continental merger, posting a $723 million loss for 2012. It incurred $739 million in costs for items such as systems integration and training, aircraft repainting and other rebranding activities, and the unified labor agreement reached in August with United and Continental pilots included $454 million for lump-sum cash payments.

United is looking to 2013 to put its troubles behind it.

"We have addressed the operational issues we faced last summer," CFO John Rainey says. "Given our improved operations and increased customer satisfaction scores, we expect our revenue performance to improve this year."

The country's largest carrier, however, will not be expanding. Citing concerns about global economic growth, the airline expects a 1.5% decline in its full-year capacity after a first-quarter cut of 4.1-5.1%. "We're committed to capacity discipline and achieving our

United Airlines believes earnings will take off this year after a rough and money-losing 2012, when it struggled with the integration of United and Continental Airlines.

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Major U.S. Airlines' 2012 Full-Year Results

AIRLINE	PROFIT/(LOSS)	% CHANGE	OPERATING INCOME	OPERATING MARGIN
United Continental Holdings	($723 million)	N/A*	$39 million	0.1%
Delta Air Lines	$1 billion	18%	$2.2 billion	5.9%
AMR Corp. (American Airlines)	($1.9 billion)	-5%	$107 million	0.4%
Southwest Airlines	$421 million	137%	$623 million	3.6%
US Airways	$637 million	797%	$856 million	6.2%

**2011 profit of $840 million* Source: Airline financial reports

return-on-invested-capital goal," Chief Revenue Officer Jim Compton says.

US Airways is coming off a strong financial year, with a $637 million profit, and predicting robust growth and a 3% full-year capacity increase as it takes delivery on fleet replacements that have higher seat counts—namely, 16 Airbus A321s and five A330-200s. US Airways plans to retire 21 aircraft this year: 18 Boeing 737-400s and three Airbus A320s.

Total domestic capacity in 2013 is expected to grow 2.7%, while international capacity could increase as much as 3.6%.

Of course, a merger with American Airlines could alter those plans. American, which lost nearly $2 billion in 2012 largely because of Chapter 11 bankruptcy restructuring costs but achieved an operating profit, is trimming capacity in the first quarter but is not saying what will happen after that.

The country's largest low-cost carrier, Southwest Airlines, also has post-merger integration on its mind after reporting its 40th consecutive profitable year: $421 million in 2012.

Southwest's code-sharing and network integration with its AirTran Airways will be phased in by April, allowing single-ticket itineraries that combine travel on both carriers. That will provide a big revenue boost for the remainder of the year, Southwest believes, contributing to its goal for a $1.1 billion increase in annual revenue and 15% return on invested capital. That return was just 7% in 2012.

Southwest's 2013 capacity will be only about 2% higher than in 2012, and that increase will come mainly from the six additional seats it is installing on its Boeing 737-700s and its receipt of larger 737-800s. In terms of trips, Southwest's operations actually will decline 2-3% this year.

This capacity constraint at the largest U.S. carriers—and, in some cases, capacity and route cuts—is encouraging some smaller competitors to take advantage. One of them is New York-based low-cost carrier JetBlue Airways, a smaller but major carrier that, like Delta, does not have merger concerns on its plate.

At $128 million, the carrier's 2012 profit was one of the highest annual tallies in its history in spite of a $30 million hit from the affects of Hurricane Sandy on the New York metropolitan area.

JetBlue's leaders are optimistic about 2013, and the carrier is expanding its capacity by 5.5-7.5% this year, led by increases of 15% in Boston and 10% on Caribbean and Latin American routes.

With the capacity additions, "we're taking advantage of opportunities that are unprecedented," Hayes proclaims, citing capacity reductions by competitors in markets such as Boston and Puerto Rico—the latter of which has seen American greatly reduce its presence.

AviationWeek.com/awst

Rescue Attempts

Europe's regional airlines downsize to survive, but no turn of fortunes is in sight

Jens Flottau Frankfurt and Cathy Buyck Brussels and Paris

Air France has just revealed its new regional division with great fanfare. But it could be its last attempt to retain a serious presence in that segment. Experience in other parts of Europe has shown that matters could become much worse in the sector.

A combination of macroeconomic factors such as little or no growth combined with high fuel prices, rampant taxes and pressure on yields is threatening a growing number of Europe's regional carriers. Those under the umbrella of a larger group have some certainty of survival at least in the short to medium term. But the number of regional airline collapses is also on the rise, particularly in Germany. And even large and formerly successful regionals such as Flybe are forced to launch restructuring programs while stretching the business model to include contract flying.

The latest figures released by the European Regions Airline Association (ERA) show a contracting industry. Demand as measured in passenger miles was down by a massive 6.1% in the first nine months of 2012, the number of passengers carried decreased by 4%. The only good news is that overall the industry reacted aggressively in cutting capacity by 8.1%, thus managing to at least keep load factors in the high 60% range.

Airlines also tried to counteract the trend by using significantly larger aircraft. The average aircraft size including turboprops rose to 86 seats from 78 within a year, reflecting the broader use of types such as the Embraer 190 and Bombardier CRJ900. But even though there has been some fleet renewal activity, a more fundamental replacement cycle is nearing, particularly for turboprops: Their average age has now reached 15.8 years. But given the dire overall situation: How will airlines fund the investment?

Air France, struggling to reduce losses in its short-haul network, is trying a fundamental relaunch of its three regional French airlines under a single management and one brand, HOP! The

AIR FRANCE

Air France is revamping its French regional airlines as Hop!

merger of Regional Compagnie Aerienne Europeenne (Regional), Brit Air and Airlinair will result in the loss of 190 jobs. Lionel Guerin, formerly CEO of Transavia.com France and Airlinair, has been appointed CEO of HOP!

The group's Irish regional subsidiary, CityJet is not part of HOP! "because its main operating base is outside of France, at London City Airport, and the airline is proceeding with its own restructuring program," Air France Chairman/CEO Alexandre de Juniac tells Aviation Week. But he adds that "we are still considering all options for CityJet." Options include a possible sale.

HOP! will take to the skies on March 31, with a fleet of 98 regional aircraft operating 530 daily flights on 104 routes across France and Europe. It will also operate 32 routes to Paris Charles de Gaulle Airport under a wet-lease ACMI (aircraft, crew, maintenance and insurance) contract for Air France. The three airlines will retain their air operating certificates, but HOP! flights will appear in the reservation systems with a single IATA designator code—that of the current Airlinair's A5 code.

Air France decided against a full merger of the three airlines as "too complex and with no benefit for the customer." Synergies are expected from combining sales, purchase, marketing and head office functions. Coinciding with the new structure and branding, Air France is further reducing the fleet and network. Between 2011-14 approximately 37 routes will be trimmed and the fleet will be reduced by 21 aircraft. ATR aircraft will probably remain, but Bombardier CRJ100s and most Embraer ERJ 135/145s will be phased out.

Airlinair operates 24 ATR 42/72s, Regional operates Embraer aircraft of various types (ERJ 135/145, E-170 and E-190), and Brit Air's fleet comprises Bombardier CRJ100/700/1000s.

"The business plan of HOP! identifies the need for a larger regional aircraft than we currently deploy. But this will not be before 2016," de Juniac says. Brit Air's CRJ1000s and Regional's E-190s are configured with 100 seats.

The new HOP! structure and branding exercise is part of the Air France KLM Group's Transform 2015 restructuring plan, which seeks to restore profitability and reduce expenses by €2 billion ($271 billion). The plan includes repositioning Air France's heavily loss-making short- and medium-haul operations into three units—Air France mainline, Transavia.com and HOP!

Transavia.com France caters specifically to the leisure segment and offers low-cost flights. Earlier this month, Air France announced a revamp of the pricing structure and service offering of the short- and medium-haul Air France flights from/to Paris Orly and its provincial bases at Marseille, Nice and Toulouse. HOP! will have a similar fare structure and the lowest-fare class offers no free frequent-flier miles or complimentary checked baggage.

Air France will simultaneously become the sole shareholder of Airlinair and acquire the 60% stake held by Financiere Linair, the company controlled by Lionel Guerin who founded the airline in 1998. Air France's wholly owned subsidiary Brit Air holds 40% of Airlinair.

At the same time, more and more independent regionals are disappearing. OLT Express halted flight operations Jan. 27 after a last-ditch effort to finance a turnaround plan failed. OLT stated that its new owner, Panta Holdings, did not accept a restructuring strategy that management and employees had agreed on.

OLT is the latest victim in the moribund German regional airlines sector and at least one more carrier is expected to exit the scene later this year. Cirrus Airlines was the first to declare bankruptcy last year. Eurowings, a Lufthansa subsidiary, was forced to seriously downsize its fleet. Similar steps were taken at Lufthansa CityLine. Later, Stuttgart-based Contact Air lost its wet-lease flying for Lufthansa and was close to being shut down, only to be picked up by OLT Express late last year.

OLT Express itself was formerly a small carrier serving the German islands in the North Sea with small aircraft, but later turned into a regional carrier. It was bought by a Polish private equity firm in 2012, which collapsed subsequently, and was rescued by Dutch investor Panta Holdings soon after.

The airline was managed by Joachim Klein, a former Eurowings executive. He tried to build an independent regional network based on markets that have been neglected by other regionals and low-fare airlines. But the takeover of Contact Air and the start-up losses on new routes, many of them between Germany and Austria, proved too much of a financial burden. OLT closed down several of its newly launched routes in December.

Panta not only owns OLT, but also Dutch ad-hoc charter carrier Denim Air and Mass Jet Lease, which owns most of OLT's fleet. The carrier operated 10 Fokker 100s, three Saab 2000s and one Saab 340. The carrier's problems had been aggravated by the loss of its last wet-lease contract (for two Fokker 100s that it operated for Swiss).

Augsburg Airways is another German regional carrier that is facing a potential closing. The airline has been operating as part of Lufthansa's regional network, but the group decided not to renew a contract that will expire next fall. Augsburg's owner has indicated he is likely to shut down the carrier and has already ruled out continuing operations as an independent carrier.

Even Flybe, one of the more successful regional airlines of late, has been forced to make draconian cuts. The airline decided to go ahead with a two-year restructuring program that includes a steep reduction in staff: 300 positions or around 10% of the U.K.-based jobs, mainly in Exeter, Manchester and Newcastle, are lost. The airline plans to focus on U.K. scheduled flying and contract business such as the Embraer 190 operation for Finnair that has been placed into the Flybe Nordic joint venture. Flybe posted a £4.9 million ($7.7 million) loss in 2011-12 and has also been in the red a year earlier. Flybe Chief Executive Jim French cites the U.K. air passenger duty (APD) as a key component of its troubles. Eighteen percent of ticket revenues now flow through to the government in the form of APD. According to French, that number is at around 6% for other British carriers with less U.K.-originating traffic.

Untangling the EU ETS

The clock has stopped (for now) on Europe's Emissions Trading System, but legal uncertainty remains

JOEPRIESAVIATION.NET

Cathy Buyck Brussels

The European Commission (EC) in November proposed to temporarily exempt non-European flights from the European Union's Emissions Trading System (EU ETS), but the 27 member states and the European Parliament (EP) must endorse the deal. More worrisome is that many airlines operating to Europe might have misinterpreted the buoyant "stop the clock" message of EU Climate Action Commissioner Connie Hedegaard and wrongly believe that they are no longer required to comply with the system at all.

All airlines operating to, from and between European airports however do have to comply with the EU ETS regulation and respect the Feb. 15 deadline set by the European Commission to apply to make use of the derogation, a spokesman for Hedegaard confirms to Aviation Week. The national competent authorities (CA) notified aircraft operators that they must confirm by Feb. 15 whether they intend to take advantage of the one-year derogation.

There is no automatic suspension of the requirement to surrender CO_2 allowances on flights to/from European airports operated in 2012, and in theory a CA could request an airline to surrender the respective carbon credits if it did not apply for the derogation in a timely manner. Fines or penalties for noncompliance are possible.

The spokesman tells Aviation Week the commission's climate action directorate general "expects that all concerned airlines will apply to make use of the derogation," adding that situation will be reassessed after the Feb. 15 deadline. Also, "for the moment, the rules are clear and that based on the reply by the aircraft operator, verification of 2012 emissions shall be either carried out for the non-exempted flights only or for both non-exempted and exempted flights."

The proposed derogation will effectively remove sanctions associated with reporting of emissions and surrender of allowances for exempted flights, namely flights from European airports to third countries and from third countries to European airports operated in 2012.

The EC has defined European airports as located in countries of the member states of the EU and the European Economic Area (EEA) and their respective dependencies and territories. Flights between EU/EAA airports and Switzerland and Croatia also fall under the scope, according to a brief on its website. Flights between Geneva and Frankfurt, the U.K. and Bermuda and between the Netherlands and Aruba are thus not exempted.

The EU ETS will continue to apply in full to intra-European traffic so both European and non-European operators are still required to verify CO_2 emissions data on flights between European airports by March 31 and surrender the required carbon permits by April 30.

Because the freeze of compliance on part of the EU ETS directive was only for one year (2012), airlines must continue to monitor their fuel burn and emissions for all flights carried out in 2013, the climate action spokesman confirms. Hedegaard has made it clear that the full scope of the EU ETS would be reinstated on Jan. 1, 2014, if the International Civil Aviation Organization (ICAO) Assembly this September/October fails to deliver an agreement on "meaningful international action" over aviation emissions. In absence of an ICAO deal, operators would have to submit their verified emissions report for all flights in 2013 to their respective CA by March 31, 2014, and surrender sufficient allowances in the Union Registry to cover the 2013 annual reportable emissions by April 30, 2014. The EC has said that free allowances for 2013 are to be allocated this month.

The commission's "stop the clock" proposal has to be approved by its council and the EP. The EP's influential Committee on the Environment, Public Health and Food Safety (ENVI) is the lead legislative committee and will consider the opinion of the Committee on Transport and Tourism (TRAN). The ENVI delegate on the EU ETS derogation Peter Liese and his TRAN colleague Mathieu Grosch have "in principle" welcomed the Ccommission's proposal, arguing it is in line with Europe's desire for an international agreement.

The EU's aviation ETS continues to cause controversy for airlines worldwide.

Their support has strings attached. Both Liese and Grosch have proposed amendments stipulating that an application of the ETS only inside the EU "cannot be an option for more than one year." This limitation is also important to minimize concerns about possible market distortions that have been raised, they note. Any prolongation of excluding flights that enter or leave the European area while continuing to apply the ETS to those within Europe could cause "significant distortion of competition and would not be environmentally ambitious enough."

Liese also wants a clarification on what the EU expects from the ICAO Assembly because not "any result can be seen as a satisfactory result." His draft report seeks to include in the EC proposal that "the European Union expects the ICAO Assembly to agree on a global market-based measure (MBM) with a realistic timetable for implementation and on a framework for facilitating comprehensive application of national and regional MBMs to international aviation, pending application of the global MBM." Insiders widely see this requirement as unrealistic. The EC is more yielding in its expectations.

The European Parliament in 2008 overwhelmingly supported the legislation including aviation in the EU ETS, with more than 90% of the votes. If members of the EP are willing to change their strict stance will become clear on April 15 when they vote on the

"stop the clock" proposal in plenary session in Strasbourg, France.

Meanwhile, airlines are in legal limbo. By April 30, airlines must surrender their allowances but the legislative procedure might not be concluded before this date. The commission has said it will not require member states to take enforcement actions against aircraft operators in respect of reporting emissions or surrendering allowances in respect of flights to or from third countries and European airports pending completion of the legislative process. "Deciding whether or not to fulfill a financial transaction that involves considerable amounts of money on a press release or an informal statement is not an acceptable business practice," an airline executive says.

It is also unclear when airlines have to return the free allowances they received. Operators can only defer the compliance obligations if they return their share of the 2012 free allowances granted. But nobody wants to return these without legal backing.

ADMINISTRATIVE BURDEN

Cathy Buyck Brussels

The temporary change of the geographical scope of the EU Emissions Trading System (ETS) obligation has averted a trade war with key air transport partners such as China, India and the U.S., but airlines now have to amend their verified 2012 emissions plan and separate emissions from intra-European flights operated in 2012 from the flights between Europe and third countries. On the latter, operators do not have to surrender CO_2 allowances if they opt to use the one-year derogation.

"It creates additional work, but technically it is not difficult to separate the fuel burn of the non-exempted flights from the total flights we operated in 2012," Jaime García Blazquez, manager of corporate responsibility and environment at Iberia, tells Aviation Week. Blazquez admits that initially Iberia had a "hard time" putting procedures and tools in place to measure the fuel consumption according to the very specific guidelines of the European Commission and the EU ETS directive, but this methodology is firmly in place. "We do not have to change the template of the emissions reporting, we simply have to report emissions on a smaller percentage of flights. The accredited verifier [is due in late] January and we do not expect problems." Blazquez also expects no problems with defining how many of the free allowances that Iberia was granted for 2012 it has to return. "We have to do the calculations over based on a lower number of tonne kilometers flown. There was some ambiguity over the benchmark, but it seems that the original benchmark [2010] will be maintained," he says, adding: "I have to emphasize 'seems' because the European Commission issued a couple of informative notes on its 'stop the clock' proposal; there is no regulation."

"It's a mess," an executive of a major European network carrier remarks. "Of course we can extrapolate the emissions of intra-European flights and define how much of the free allowances we have to return, but it is work-intensive. We have to allocate internal resources and this adds costs."

Meanwhile some EU airlines strongly criticize the partial suspension of the EU ETS, arguing that the full scope should be pulled. Europe's hubs come away "empty-handed," Lufthansa Group reasons in a recent policy brief. "Intra-European long-haul feeder flights, say, from Copenhagen or Hamburg to the Lufthansa hub in Frankfurt, are burdened by the costs of emissions trading, while feeder flights to hubs outside Europe, for example, to Dubai, are excluded from the system. This leads to serious distortions of competition in the intercontinental air travel business at the expense of the EU airlines."

SUKHOI SUCCESSION

Maxim Pyadushkin Moscow

Sukhoi Civil Aircraft Co. (SCAC), the designer and manufacturer of Russia's new Superjet 100 regional aircraft, is undergoing a leadership transition following the rocky start of series production.

The company's board appointed Andrey Kalinovsky, a former vice president of production and director of SCAC Komsomolsk-on-Amur facility, to serve as president, effective Feb. 1. Kalinovsky has been CEO of another Sukhoi subsidiary—the Novosibirsk-based NAPO facility, where he played a key role in launching the manufacturing of the SSJ 100 components as well as in the start of the aircraft assembly in Komsomolsk-on-Amur.

Vladimir Prisyazhnyuk, SCAC president since July 2009 will become vice president of civil programs in the parent company Sukhoi. SCAC stated that the changes in the company's management reflect the fact that the SSJ 100 program has entered a new stage. "The program's focus now will be [to increase] the output rate and improving the product's quality."

The 98-seat SSJ 100 was certified by the Russian aviation authorities in February 2011 and received European Aviation Safety Agency approval a year later. Deliveries started in 2011. In 2012 SCAC rolled out 12 SSJ 100s and delivered eight. Aeroflot received six aircraft, bringing its fleet to 10. Another Russian airline, Yakutia, received its first SSJ 100 while one more aircraft was formally handed over to Indonesia's Sky Aviation.

Selling to Oneself

Turboprop operator Hefei Airlines set to fly by year-end, side-stepping high-speed rail

Bradley Perrett Beijing

While the Chinese city Hefei has a big new airport that it would like to keep busy, aircraft maker Avic has a turboprop airliner plant that is not busy enough. Each of these state entities is making a small contribution to solving the other's problem.

Short-haul carrier Hefei Airlines, with the city and Avic as ultimate owners, should begin flying by the end of the year, using Avic MA60 (or MA600) turboprops. It is not the first time Avic has sold aircraft to itself: In 2008 it set up Joy Air as an MA60 operator, partly to help Avic become schooled in the intricacies of customer support (*AW&ST* Jan. 16, 2012, p. 35). Representing Avic, Joy Air will be part owner of Hefei Airlines.

Establishment of Hefei Airlines, proposed last year, has now been formally agreed, says the government of the inland city about 300 km (200 mi.) west of Shanghai. The carrier will start services with three aircraft and is looking for 300 employees, says Yang Youchang, the general manager of Joy Air. Hefei will use the same Chinese turboprop types as Joy, says an airline industry official. The case for setting up another customer as a learning mechanism is less clear this time. More likely, Avic just sees Hefei Airlines as a way of shifting product.

By 2020 the fleet should have grown to 30 with 50-70 routes, Yang says. Initial services will connect Hefei's five million people with such cities as Hangzhou, Zhengzhou, Taiyuan and Xian, the latter the home of MA60 and MA600 production. The aim is to set up a network 650 km around Hefei, the chairman of Anhui Civil Aviation Airport Group, Jiang Houyu, tells state media, while Yang emphasizes that the carrier will avoid competition with high-speed trains by flying routes that they do not directly serve. In China, as elsewhere, the challenge from high-speed trains is strongest over route lengths normally flown by turboprops.

Later Shanghai, Beijing and Guangzhou will be added and eventually Hefei Airlines will fly international services—presumably with jets. The main competitor will be China Eastern, which has a base at Hefei. Joy Air and Hefei will coordinate their networks.

The new carrier is part of a strong trend for Chinese city and provincial governments to provide capital and other inducements for outside airlines to establish local offshoots (*AW&ST* Dec. 10, 2012, p. 44). The aim is to promote local development, and politically it does not hurt that the offshoots, always named after their local government sponsor, are high-profile businesses.

In this case the government is also keen to create activity at Hefei Xinqiao International Airport, which it says will open soon. The airport's first stage will have a designed capacity of 11 million passengers per year, a volume that is due to be reached in 2020. The old airport handled 5 million passengers last year, the city says. Xinqiao is designed for ultimate expansion to 42 million passengers a year, a figure that the city believes might be reached in 2040. Hefei, long considered a backward town, has enjoyed robust growth in the past decade or so.

For Avic, delivering 30 MA60s to Hefei Airlines in the next seven years will contribute to a planned production rate of 10-15 turboprop airliners a year up to 2015 and then 25-35 a year, including the forthcoming MA700, in the following five years. For the moment, only 36 MA60s are in service, with four in storage, according to Aviation Week data. The type, also marketed as the MA600 with some improvements, is a modern derivative of the Antonov An-24 but has a market severely limited by its lack of Western endorsement of its Chinese certification. The MA700 is supposed to get such endorsement.

As at Hefei, the MA60's foreign sales have tended to have government connections. At least two operators, Zest Air of the Philippines and Lao of Laos, are interested in converting their aircraft into freighters—usually a sign that a type lacks competitiveness in high-frequency operations.

China's high-speed trains have undermined the domestic market for Avic Aircraft's MA60s. Hefei Airlines, an offshoot of Joy Air, will fly the type but avoid rail competition.

HUANG XIANGRUI/AIRLINERSGALLERY.COM

Act of Desperation

Volga-Dnepr explores options for An-124 production restart

Maxim Pyadushkin Moscow

KEITH GASKELL

Two Volga-Dnepr Antonov An-124s are currently based at Leipzig/Halle, Germany.

Volga-Dnepr Group has been pushing United Aircraft Corp. (UAC) and Antonov to restart production of its An-124 Ruslan freighter for years. With no additional orders in sight, the operator may take the project into its own hands.

Alexey Isaikin, head of Volga-Dnepr Group—the largest commercial operator of An-124s—says his company may launch the aircraft assembly outside of Russia and the Ukraine, where Antonov is based. One possible site is in Leipzig, Germany, where its Volga-Dnepr Technics subsidiary opened an MRO hangar this month. The 8,500-sq.-meter (91,493-sq.-ft.) facility, located at Leipzig/Halle airport, is designed to house heavy transport aircraft such as the An-124-100, Ilyushin Il-76TD and Boeing 747. The company has agreed to a 30-year lease for the building with the airport operator. Two An-124s are permanently based in Leipzig for the Salis (Strategic Airlift Interim Solution) operation. But German industry sources say they have not heard anything concrete regarding possible An-124 manufacturing.

Volga-Dnepr plans to assemble a modernized version of the An-124 equipped with Western avionics and engines. Isaikin says the location could be chosen because of German government support for the project, while multiyear negotiations with Russia's UAC to resume An-124 production in Ulyanovsk produced no results.

The production revival of the An-124 is increasingly doubtful because its expected launch customer—the Russian air force—postponed the purchases. In the meantime, commercial operators are looking for alternative options to secure new aircraft.

Volga-Dnepr unit Air Bridge Cargo has moved to a Boeing 747F fleet, including the 747-8F, for its international long-haul freighter business. But sister company Volga-Dnepr Airlines has specialized in outsize cargo transport in operationally difficult places, for which the An-124 is the only suitable aircraft.

The An-124 was initially designed to carry ICBM launchers, and made its first flight in December 1982. Its commercial variant, the An-124-100, was certified in 1992. It is powered by four Ivchenko D-18T turbofans. The maximum takeoff weight is 392 tons, and the aircraft can carry a 120-ton payload.

The last two An-124s were assembled in 2004 at the Ulyanovsk-based Aviastar-SP plant, now a subsidiary of UAC, and delivered to Volga-Dnepr and another local operator, Polet Airlines. Volga-Dnepr has 10 Ruslans that are used for oversize cargo transportation globally. Polet operates four aircraft, while Ukraine's Antonov Airlines has seven Ruslans. Volga-Dnepr and Antonov jointly provide their An-124s to NATO members under the Salis program. In December 2012, the NATO contract was extended through 2014.

For the past few years, Volga-Dnepr was a main driving force behind plans to restore Ruslan's assembly in Ulyanovsk. In 2011, airline officials announced they were ready to contract UAC for 20 aircraft with 20 options, with deliveries through 2030. At the time, UAC officials were saying that the assembly line could be restarted, provided there were orders for 50-60 planes to cover expenses for development work, investment in tooling and upfront expenses.

UAC representatives now say this is impossible without government support and a Russian air force launch order. "The main issue is financing. The main goal of UAC now is to start making profits. We cannot afford to operate at a loss," they say. Ukraine's Antonov, the An-124 designer, declined to comment on Volga-Dnepr's initiative.

The new Russian rearmament program for 2011-20 reportedly includes the purchase of 25 upgraded Ruslans for the air force, with plans to buy 15 more airframes after 2020. But industry sources say the military ordered no design work for the An-124 in 2012. That effectively leads provisional delivery dates to slip beyond 2020.

Aviastar-SP currently conducts only repairs of in-service Ruslans for the Russian air force, while focusing on setting up production of another upgraded transport—the Ilyushin Il-76MD-90A, also known as Il-476. This freighter made its first flight in September 2012. The Russian air force has already placed an order for 39 of the aircraft.

If Volga-Dnepr's fails in its efforts to restart Ruslan production, the airline will still be able to operate its current fleet for an extended period. In 2011, Russia's aviation authorities issued a supplemental type certificate that allows the An-124's service life to last up to 50,000 flight hours, 10,000 cycles and 45 years. The airline's oldest aircraft were produced in the early 1990s.

Airtanker Angst

Protests and delays hamper U.S. efforts to modernize its aging aerial firefighting fleet

Paul Seidenman and David J. Spanovich San Francisco

The U.S. will be facing yet another fire season with a dwindling number of aging airtankers. More than a year after the release of a solicitation for Next Generation Airtanker Services by the U.S. Forest Service (USFS), progress toward a fleet of modern firefighting aircraft, adequate to meet the growing threat of increasingly destructive wildland fires, has been limited. The USFS has estimated a requirement for 24-28 next-generation airtankers within five years.

Under the Nov. 30, 2011, request for proposals (RFP), the Fire Service planned to award exclusive-use operating contracts of up to five years to companies providing land-based, turbine-powered airtankers. The USFS specified an aircraft with at least a 300-kt. cruise speed and a minimum dispensable payload of 2,400 gal. of fire retardant—on takeoff on an ISA+30F day at sea level and zero wind—with a 6,000-ft. maximum ground roll on take off. The agency also mandated aircraft still supported by the original manufacturer.

Nine companies responded to the RFP by its closing date in February 2012. In June, the USFS announced its intent to award contracts to Missoula, Mont.-based Neptune Aviation Services; Minden Air Corp., in Minden, Nev.; Aero Flite of Kingman, Fla., and Aero Air of Hillsboro, Ore. The four companies were to provide a total of seven next-generation airtankers, a mix of modified ex-airline BAe 146s and McDonnell Douglas MD-87s—with three in 2012 and four more in 2013. But almost immediately protests were filed with the Government Accountability Office (GAO) by two losing companies--10 Tanker Air Carrier of Adelanto, Calif., and Coulson Aviation (USA) of Port Alberni, British Columbia.

The Fire Service had budgeted $261 million for the seven airtankers, based on 250 flight hours a year per aircraft. Neptune Aviation and Minden Air were each to supply two BAe 146s, while Aero Air was to provide two MD-87s, and Aero-Flite was to operate a single Avro RJ85, a version of the BAe 146.

Rick Hatton, 10 Tanker Air Carrier president, argues that because of the limitations the USFS imposed on the aircraft's retardant capacity, it effectively disqualified his company's two modified McDonnell Douglas DC-10s, each with an 11,600-gal. capacity. "Our argument was that we were being penalized because our aircraft had more capacity than they could use, which totally disregards the economies of scale and efficiencies this excess capability would provide," he says.

The GAO dismissed the protests in September, when the Forest Service agreed that certain points in the solicitation were in need of clarification and issued a new RFP to the nine bidders—with any original or revised proposals due Nov. 1, 2012. Those proposals are currently under evaluation and no decision date has been announced. According to a USFS spokeswoman, the decision, when it comes, could spark a new round of protests, further delaying a contract award.

With a looming fire season, the U.S. fleet of large airtankers, which numbered 41 in 2004, is down to 10, according to Dan Snyder, chief operating officer of Neptune Aviation. The current fleet, he explains, includes seven Neptune-operated former U.S. Navy Lockheed P2V Neptune patrol aircraft and two BAe 146 regional airliners that have been modified as airtankers, with 3,000-gal. tanks. An additional P2V is operated by Minden Air.

To date, Neptune Aviation Services is the only operator which has successfully fielded a modern airtanker with its two BAe 146 jets, Snyder says, and is bringing on additional aircraft even without a multi-year USFS contract.

During the 2012 fire season, both aircraft flew a total of 300 hr., dropping 1.5 million gal. of fire retardant. As Snyder points out, during this period, Neptune Aviation gained "significant operational experience" with the aircraft, which have been flying under an interim USFS certification. "Significant improvements have been made to the aircraft's tanking and retardant delivery system, and we expect full USFS certification—with the changes—by June of this year," he says.

Neptune Aviation expects to have five BAe 146s by early summer. All of the airframes have been acquired from Tronosjet Maintenance of Prince Edward Island, Canada, which also supplied the engineering and tanking system modification for the first two aircraft. However, for all additional tankers, Neptune Aviation will perform the tank system installations, in-house, at its Missoula facility. Tronosjet will continue to supply the airframes, and assist in an engineering and maintenance support role. Long term, the operator is projecting 11-15 BAe 146 tankers, contingent upon Forest Service needs.

"We know that a requirement for a next-generation tanker fleet exists. We will have six remaining P2Vs left in our fleet after March, and they have five to six years of useful structural life left," says Snyder.

Neptune Aviation Services has two modified ex-airline BAe 146s flying for the U.S. Fire Service under interim contracts.

NEPTUNE AVIATION

Networking

With new hires hard to come by, suppliers bring skills to the classroom

Michael Mecham

Rebounding quickly from the 2008-09 recession, passenger travel fed a big appetite for new aircraft. By 2010 suppliers were seeing good times ahead as Boeing planned four years of steadily increasing production rates.

Like many, AIM Aerospace scurried for new workers, providing on-the-job training (OJT) at its four factories in Seattle's Puget Sound region to keep pace with Boeing's demand for lavatories, seat shells, ceiling panels, ducting and other cabin parts. But by 2012, says AIM's vice president for operations, Jeff Moore, the company was in trouble. "Between February and May we hired and processed 437 employees through temporary agency-to-hire services in order to retain 100," he recalls.

Boeing hired 4,355 employees in Washington state last year, nearly all of them in the Puget Sound area. Although AIM offers a 401(k) retirement plan, vacation pay and other benefits, it was losing some of its best employees to Boeing because it cannot match the behemoth's pay scales. Moore says AIM has learned to cope. "We developed processes that [new hires] can learning quickly."

AIM is based in Pierce County, population 800,000 and home to Tacoma, the state's third-largest city. Although Boeing's big Seattle, Renton and Everett factories are to the north in King and Snohomish counties, Pierce is populated with aerospace suppliers. It also is home to Boeing's Frederickson-based factory, an advanced machining center whose output includes the composite empennage for the 777. The county relies heavily on input from employers for a series of overlapping training programs aimed at providing skilled new hires and apprenticeships for a talent pool that it hopes will help keep aviation jobs from drifting away. The strategy is a microcosm of efforts being made across North America.

It is surprising how often job seekers and students overlook aerospace as a career in favor of new industries, such as software, says Bruce Kendall, president and CEO of the Economic Development Board for Tacoma-Pierce County. "You'd think it would be second nature [to students] because we are the home of Bill Boeing."

But it is not, and that is where government programs such as the Pierce County Skills Center come in. With the board's backing, it was started during the recession to help high school juniors and seniors learn job skills. Always looking for new opportunities, the center turned to Moore last fall to help it set up a composites program. He began by teaching lead instructor Greg Rohr AIM's composite techniques and assembly processes so classroom instruction is "as close as we can get to industry standard," Rohr says.

Director Michelle Ledbetter notes that the regular classroom visits by Moore and others help acclimate students to a real-life work experience, as do shop floor field trips. "Students are surprised at how much of what we do is the exact thing at Boeing," she says. "It has a profound impact on them."

Bates Technical College and the Aerospace Joint Apprenticeship Committee (AJAC) have taken the lead in pairing industry and frustrated job seekers by creating a Manufacturing Academy to offer a nine-week, 35-credit program to train certificated workers. Of 30 who take a week-long screening test, the 17 with the best computing skills and basic workplace knowledge—be on time, work well in teams—are selected. Their 8-hr. workday is set up like a job, "so they are in that mode," says Workforce Development Manager Jessica Neal-Smith. The goal is to produce graduates who "can walk onto a manufacturing floor and know exactly what they're looking at and how to use it," she says.

Student ages range from 19-60, but the majority are in their 30s. The academy, which is now starting its fourth apprentice group this month, boasts an 85% placement rate.

AIM AEROSPACE

AIM Aerospace VP Jeff Moore (in suit jacket) and Pierce County Skills Center instructor Greg Rohr lead high school students on a factory tour.

BATES TECHNICAL COLLEGE

AJAC works statewide as a matchmaking service to where employers can find academy graduates to renew industry skill levels as baby boomers retire, says Executive Director Laura Hopkins. While most of the county's programs welcome Boeing, AJAC works only for smaller employers. "It's the suppliers who keep losing their people to Boeing that we're trying to help," she says.

Even after being hired, AJAC graduates continue taking night courses skewed to the academic needs of their new jobs. It will take a composite technician another two years, and a machinist four, to earn a journey-level certificate. "That's the really big deal, getting that certificate," Hopkins says.

"There are a lot of people who have been in the industry for 15-20 years who want that certificate."

Five years ago, there were 15 apprentices at Bates. Now there are 55, says Vice President of Instruction Cheri Loiland. Besides newcomers, the classes serve veterans who need to sharpen their skills. Many students start by earning a CNC operator certificate, a 1.5-year endeavor that tells employers that they know how to load a computer numerical controlled machine, type in code, monitor the work and complete basic post-machining work such as drilling holes, says machinist instructor Bob Storrar.

JWD Machine, a multi-axis milling specialist, of Fife, Wash., supports Bates Technical College's apprenticeship program.

General Plastics Manufacturing Co. Vice President Eric Hahn has worked closely with Clover Park Technical College and Workforce Central, a county administrator of federal jobs development funds, because he also needed workers to meet Boeing's and Airbus's rate build-ups. The company was hit hard by the recession but has filled about half the 80 jobs lost, relying on recalls for half of them. Now new recruits are his problem. About 60% of those hired do not last 90 days. Many cannot pass a basic grade 7 math test. Partnering with Clover and Workforce Central has been a big help. "It's a great example of a public-private partnership that really works," he says.

Technology Dean Andy Bird says Clover Park offers training in 11 aviation fields, the most of any technical college in the state. Courses range from traditional maintenance and pilot training to recent high-demand areas such as non-destructive testing (NDT) and composites.

It was Boeing Frederickson that bolstered the school's 2.5-year composites course. "We were trying to take control of our own destiny," says Operations Leader Steve Brewer, a member of Clover Park's board of directors. Attrition and transfers were eroding Frederickson's composite skills base, a key factor in 777 empennage work. To get Clover Park's composite courses started, Boeing provided internal training documents and advice on tools selection. The payback has been a "significant" shortening of its OJT times by using the school's graduates.

Other top suppliers, including Hexcel, AIM and General Plastics, followed Boeing to Clover Park. The school's 80 annual graduates earn certificates as aerospace composite technicians or the equivalent in NDT. Fifty-year-old students study alongside high schoolers in a "running-start program."

While Pierce County is showing progress in its industry training partnerships, Neal-Smith says financing is always an issue. So far, Manufacturing Academy programs are free for participating companies. But state legislators anticipate that companies will begin to provide financial support. Without it, the programs are vulnerable to budget cuts, she says.

Capital Crisis

Helo operators concerned London crash could lead to stricter measures

Tony Osborne London

Getting stuck traveling on the roads in and out of Central London at rush hour is a frustrating experience.

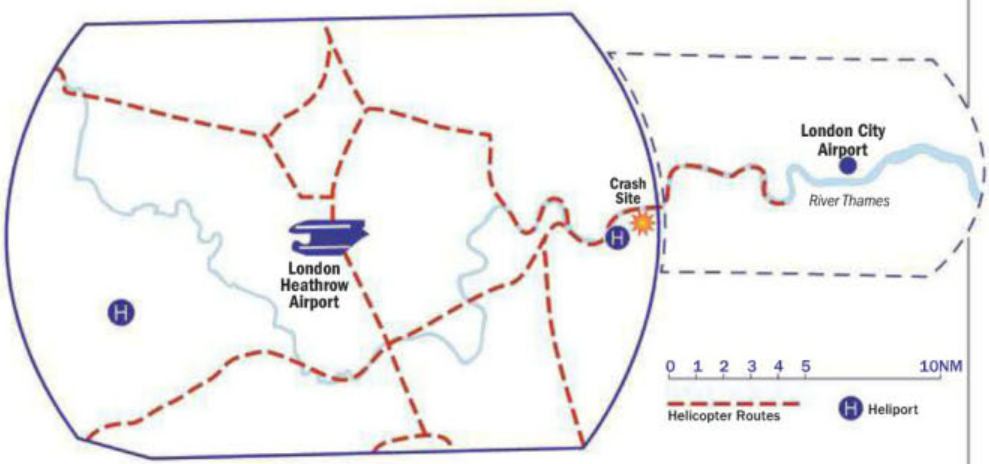
With 8 million people living in the city and another 1 million commuting to work each day, it is no wonder that some people have decided that taking to the air by helicopter is an excellent way to escape the congestion. So, as in many cities across the world, wealthy individuals and business executives increasingly use helicopters to ensure that their time and money is not wasted in traffic jams. The work is a critical source of income relied upon by helicopter charter operators.

But now there are concerns that these operators could face pressure if tighter restrictions come into play. Politicians in London, including Mayor Boris Johnson, have called for a review of helicopter operations over the city following the fatal crash of an Agusta A109 helo on Jan. 16. Two people, including the pilot, were killed and several more on the ground were injured when the aircraft—operated by executive charter company Rotormotion Ltd.—struck a tower crane in poor visibility as it was diverting into the London Heliport in Battersea. Video footage and images on social media websites showed chaotic scenes of burning wreckage and flame-charred vehicles.

Although an interim report by U.K. accident investigators highlights that the operator's client that day suggested abandoning the flight because of inclement weather, companies understandably fear that any review coming out of such high-exposure events can bring tightened regulations that further squeeze their operations, which have already dwindled in the wake of the U.K.'s economic woes.

And their fears are well-founded. When a light aircraft flew into an apartment building in New York in 2006, the FAA placed tougher restrictions on light aircraft using some aviation corridors around the city.

According to Civil Aviation Authority statistics, helicopter traffic across London has dropped compared with 2007 and 2008. In July 2008, the number of helicopter movements traveling through or using the heliport was more than 4,300, while the highest recorded in 2012 was less than half that, with just more than 2,000 movements.



Londoners already hate helicopters, a view shared by residents of New York, Los Angeles and other major cities worldwide. This dislike has been further heightened by concerns over the recent crash, despite it being the first helicopter accident ever recorded in urban London.

"Any review raised over helicopter operations in London is a knee-jerk reaction," says Michael Hampton, managing director of helicopter operator Capital Air Services. "London's airspace is extremely well-controlled and tightly regulated and the helicopter routes are very well-defined.

"Any changes or reductions from a review would be very damaging to the helicopter charter industry, which depends on flying customers into London. We are only just getting over the impact of the economic downturn of 2008, and more recently the Olympics, which forced a reduction in helicopter operations into London. It would also send a very sad message to the business community and rest of the world," adds Hampton.

Helicopter operations over London are among the most tightly controlled in Europe and the world. Busy airspace over the city means helicopters are required to use heli-lanes that follow the River Thames. There are limits imposed on capacity, timing and routes, while local authorities routinely hold statutory consultative committee meetings to air any specific concerns. Single-engine helicopters face restrictions and can operate only a short distance away from the river as a precaution against engine failure. Twin-engine types have greater freedom of operation, and so are used by the Metropolitan Police and London's Air Ambulance. But even these vital services are criticized for their noise levels. The Metropolitan Police Air Support Unit has a Twitter account to justify the noise it makes to upset Londoners.

London's strictly controlled heli-lanes follow the River Thames.

Politicians have tried to regulate the use of helicopters over the city in the past. In 1991, a parliamentary bill was tabled to create greater planning controls on heliports, to restrict noise levels and control the use of helicopters. Back then the concern was the increase in ad-hoc landing sites appearing across the city, while planning committees in different parts of London were investigating the potential for more heliport locations, such was the demand for helicopters.

The bill was unsuccessful, but so too was the plan to build more heliports, leaving Battersea Heliport, now known as the London Heliport, to deal with the inbound helicopter traffic alone. U.K. operators and those in other major cities anxiously await any review of regulations.

Dazzled by Science

Cassidian experts believe dazzling missile operators with light could defeat laser-beam-riding SAMs

Tony Osborne London

German engineers working on a system to defeat laser-beam-riding weapons say a countermeasure could be available for operations in four to five years.

The use of lasers on the battlefield has been troubling German defense officials for several years. Helicopter crews have suffered sight damage after laser pointers were shined into their eyes by insurgents in Afghanistan, and there is concern laser-guided surface-to-air missiles could proliferate, making transport aircraft and helicopters highly vulnerable to attack. While laser-beam-riding weapons have proved effective against armored vehicles, defeating them has been relatively easy through the development of laser warning systems and the ability to lay a thick smokescreen when those beams are detected. But the development of surface-to-air missile (SAM) systems using the same guidance method has created a new headache for commanders and one that is extremely difficult to overcome.

Dazzling the operator could provide a targeted aircraft an extra critical few seconds to escape the missile envelope.

Countermeasures such as chaff and infrared decoy flares have no effect against SAMs such as the Thales-made Starstreak HVM, Saab RBS-70 and other laser-guided SAMs. Indeed, pilots can only hope that the operator is not very skilled or that the aircraft receives ample warning of the threat—either from laser or missile launch warning sensors—so the pilots can put distance, altitude, high ground or even clouds between themselves and the launcher before the weapon hits.

Now, engineers at EADS defense and security arm, Cassidian, have tested a system in conjunction with the German armed forces that effectively defeats such a weapon in the moments before it is fired or sends it off course during an engagement. Rather than trying to beat the missile, engineers have focused on targeting the operator making the engagement. Beam-riding weapons rely on the operator keeping his eyes, and consequently the laser, on the target until the weapon hits.

"These are not fire-and-forget weapons. They must always have a man in the loop, and that is the weakness we wanted to exploit," said Oliver Rudow, product manager of countermeasures at Cassidian in Germany, in an interview with Aviation Week.

EADS CASSIDIAN

A series of tests conducted in Germany used an off-the-shelf lighting system to focus an intense beam of light at the launcher. According to Rudow, the light—while safe on the eyes—would act as an irritant, dazzling and forcing the operator to look away from the sight for several seconds and stopping him from aiming the weapon or halting the launch completely. The light source is also multispectral, allowing it to dazzle even those personnel wearing protective goggles.

The company worked with the German air force's Institute of Aviation Medicine, and carried out a medicinal study to demonstrate that the dazzle effect falls below the radiant flux density that is permissible for eyes. This is a point of critical importance, as Geneva Convention protocols specifically prohibit the use of systems that could damage eyesight or blind combatants. But the company also says the eye-safe element is important in order to use the system in a civil environment.

"We tested the system with German army snipers, and they told us afterward that the beam was difficult to look at for more than a few seconds, forcing them to look away," said Rudow. "We think this would give enough time for an aircraft or helicopter to escape."

Rudow says that a dazzling countermeasure could be installed and integrated into a self-defense suite on an aircraft or helicopter. He envisages the whole process to be similar to that used on the current generation of directed infrared countermeasure systems on transport aircraft and large helicopters. Laser warning systems can detect a laser beam pointed at an aircraft and cue the dazzling device to the approximate location of the launcher. The warning system would then hand off data to the sensor and let the countermeasure system focus on the target before triggering the dazzling beam.

"The technical demonstrations were a great success," said Rudow. "But we need more trials before we can integrate and certify this product for a platform. With the right support, this could be a product in four to five years."

The system would probably be most beneficial on large transport aircraft or helicopters, whose slow speed and size make them more vulnerable to such weaponry. But Cassidian believes the technology can also be applied to vehicles and ships. The company already markets a system for vehicles called MUSS, which acts like an aircraft defensive suite, ejecting smoke if missile guidance beams are detected.

Target: India

As the global leader in defense imports, India is becoming an arms bazaar

Dassualt's Rafale has led recent major export opportunities: India is spending $20 billion to procure 126 of the multirole combat aircraft from the French manufacturer.

INDIAN DEFENSE MINISTRY

Jay Menon New Delhi

The growth in the Indian defense sector is surging, and the U.S. is jostling with traditional arms suppliers Russia, Israel and France for a prominent space in the South Asian nation's military modernization plans.

The mad rush to get a piece of the Indian defense pie is evident from the fact that over 600 companies around the world are participating and vying to sell their products at the ninth Aero India show in Bengaluru Feb. 6-10.

Among them, 67 armament and aviation companies are from the U.S., followed by 49 from France and 33 from the U.K., along with 29 manufacturers from Russia and 18 from Israel.

These aerospace and defense companies are taking all possible steps to update their business strategies and operations to seize opportunities in this highly competitive, lucrative and rapidly expanding market.

"With India's defense budgetary allocation expected to touch $50 billion in the next fiscal year, beginning April 1, 2013, nobody wants to miss the bus," says a senior Indian defense ministry official.

The major portion of India's expenditure on new procurements will go to air platforms in the near term, with spending expected to exceed $15 billion in the next couple of years.

In the fight for major aircraft deals for the Indian air force, American companies currently have an edge over the Russians. U.S. aircraft makers, having lost out on the multibillion-dollar Medium Multirole Combat Aircraft (MMRCA), have been trying to convince Indian authorities to replace Russian equipment, and they have been surprisingly successful.

Despite Indian authorities' hesitance to buy systems from the U.S. due to American dual-use technology export control restrictions, U.S. companies have notched orders worth $8 billion in India in the last few years and deals worth over $10 billion are in the pipeline.

The latest announcement from the Indian air force late last year was the selection of Boeing's Apache AH-64D to meet its requirement for 22 multirole combat helicopters.

Boeing submitted proposals to offer the latest Block III version of Apache to India in 2009. Russia, which had bid the Mi-28, announced late in 2011 that it was out of the estimated $1.4 billion deal after failing to meet several of the air force's technical requirements.

Close on the heels of the Apache deal, Boeing got another boost when the air force opted for Chinook CH-47F to fulfill its requirement for 15 heavy-lift helicopters. Boeing emerged as the lowest bidder when life-cycle costs were calculated, edging out a proposal for the Russian Mi-26.

"These deals, estimated at around $2.5 billion [together], are expected to be signed in 2013," the Indian defense ministry official notes.

Another major Boeing contract is the $4 billion deal to supply 10 C-17 Globemaster III strategic airlift aircraft. "The first C-17 aircraft will be delivered to India in May or June 2013, and by mid-2014 all 10 aircraft are likely to be with the [air force]," says Patrick Druez, head of business development for Boeing Military Aircraft's Mobility Div. in Northern Europe and India.

India will also receive the first three of its eight contracted P-8Is long-range maritime reconnaissance and anti-submarine warfare aircraft this year. "The program is progressing on schedule as Boeing assembles the fourth and fifth P-8Is," Dennis Swanson, a vice president at Boeing Defense, Space & Security, tells Aviation Week.

Under a $2 billion contract signed in 2009, Boeing will deliver eight of the long-range maritime reconnaissance and anti-submarine warfare aircraft to India starting in the first half of this year, with an option for four more. India is the launch customer for the P-8I, a variant of the U.S. Navy's P-8A Poseidon.

"With 7,500 kilometers of coastline and three aircraft carriers, the Indian navy is going to have a tremendous need for . . . maritime and surveillance aircraft," says Carl Lang, Boeing's P-8I program manager. "So we expect that once the navy starts using the P-8I, the demand may go up to 30 or more."

The air force is also planning to exercise its option for another six C-130J Super Hercules transport aircraft from Lockheed Martin, in a bid to complete the full squadron of 12 Hercules in its transport fleet.

As it seeks to reach its sanctioned strength of 42 squadrons by 2022, up from its current 34, the air force is advancing its modernization process. Under its 15-year Long-Term Integrated Perspective Plan 2002-17, the service is buying fighters, transport aircraft, helicopters, radars and missile systems in a phased manner.

"We are on a path of modernizing our assets. In the last five-year plan [2007-12], the [air force] procurements were around $27 billion. We envisage procuring assets worth more than $37 billion over the next two plan periods [by 2022]," says the air force deputy chief, Air Marshal R.K. Sharma.

Several megadeals could reach the signing table this year, including the estimated $20 billion MMRCA project with Dassault to supply 126 Rafales to the air force.

"Termed as one of the largest defense deals in the world, the fighter deal is large enough to change the face of the defense industry in India and France," says Gurpal Singh, deputy director general of the Confederation of Indian Industry, who heads its defense, aerospace and security group.

Some of the other big-ticket contracts in the offing include the 214 units of fifth-generation fighters to be jointly developed by India and Russia, as well as the Swiss Pilatus PC-7 Mk. II turboprop aircraft.

In addition, the air force has plans to buy around 220 Tejas Light Combat Aircraft (LCA), orders for the initial 20 of which have been placed with an Indian consortium led by Hindustan Aeronautics Ltd.

The air force is progressively introducing BAE Systems Hawk advanced trainers, 123 of which were ordered in two contracts inked in March 2004 and July 2010 totaling 160 billion rupees ($3.2 billion).

India has signed a $2.4 billion contract with Thales and Dassault to upgrade its 51 Mirage 2000 combat jets that were acquired in the 1980s. Plans also are underway to modernize Su-30MKI fighters deployed by the air force with certain so-called fifth-generation aircraft characteristics to convert them into "Super Sukhois."

And the air force plans to buy an additional 59 Russian-made Mi-17 V5 helicopters; it ordered 80 in 2008.

"Most of these deals are expected to take a final shape in 2013," says the Indian defense ministry official.

The air force is also likely to take delivery of the two remaining Embraer 145 AEW&C aircraft on order from Brazil's Embraer Defense and Security toward year-end. India received the first last August under an agreement worth more than $200 million signed in 2008 to jointly integrate the indigenously developed AEW&C systems onto three of the modified regional jets. The aircraft carries the Indian Active Array Antenna Units developed by the Defense Research and Development Organization (DRDO).

The Indian government is expected to choose the winner of a 197-helicopter competition this year. The Eurocopter AS350 Fennec and Russian Kamov Ka-226 Sergei are vying for the contract expected to be worth over $2 billion. The army will take delivery of 133 of the helicopters and the rest would go to the air force.

Moreover, India may sign a final deal with Airbus Military to supply A330 MRTT Multirole Tanker Transport for its new midair refueling tankers. "Detailed negotiations will now begin, which is expected will lead to the award of a final production contract for an envisaged six aircraft in 2013," an Airbus Military official says.

The twin-engine MRTT was competing with the Russian Ilyushin IL 78 Midas; the air force operates six IL 78 refuelers now. The Airbus Military official estimates the value of the project is about $1.55 billion.

The defense outlay for the current fiscal year, which ends March 31, constitutes 1.9% of the country's gross domestic product (estimated to be 101.6 trillion rupees), a marginal increase from the 1.83% of the GDP in 2011-12.

As one of the largest defense equipment markets in the world, India is expected to spend about $120 billion on capital acquisition alone during the next five years.

"We are in one of the world's most dangerous regions, with two nuclear-armed neighbors," the Indian defense ministry official says. "The rising military might of China and threats from Pakistan, along with an underdeveloped aerospace industry, have by default made us the world's leading weapons importer."

Meanwhile, a report by Deloitte Aerospace & Defense on the 2013 outlook says India is poised to become a favorite destination for global defense sector players with total offset opportunity for the commercial segment in the country set to cross the $10 billion mark this year. According

BOEING

Boeing's growing list of sales to India includes the Apache attack helicopter. It will build 22 AH-64Ds for the Indian air force under a contract valued at $1.4 billion.

to the report, while the global defense industry is expected to shrink, India continues to be one of the promising A&D markets in the world, due to its armed forces' increasing demand for A&D equipment.

"Due to the huge offset requirement and the Indian government's objective of building up an indigenous manufacturing base, the global industry has an opportunity to integrate with the Indian industry to set up their manufacturing lines in India," says Nidhi Goyal, director at Deloitte India. "This could be achieved either through joint ventures or collaborations."

While the Indian defense market is providing new opportunities for foreign defense companies, the government is well aware of the importance of building up its internal industrial defense base. As a result, it has introduced stringent offset requirements and insists on transfers of technology under the Defense Procurement Procedures. It recently announced a new strategy, "Buy Indian, Make Indian," in an effort to keep production local.

Offset contracts valued at more than $4.5-5 billion have been signed by Indian and foreign companies since the offset policy came into effect in 2005. However, with the new 2012 guidelines and the assumption of a formal civil policy, the total offset opportunity for the commercial segment is estimated at $10-15 billion.

Current procurement rules require any foreign vendor receiving an Indian defense deal worth more than 3 billion rupees to reinvest 30% of the value into the country's industry. In 2012, the rules were revised to put a 20% cap on the penalty for foreign companies that fail to fulfill their defense offset requirements within the set time frame.

Indian companies will likely succeed with the help of foreign companies, benefitting both. Once indigenous manufacturing takes root, research and development for the Indian military and civil aircraft sectors is likely to be the government's next focus area.

The Indian defense ministry official points out that there is "a lot of scope for both public and private sector" players to participate in the air force's upgrade plans. "The Indian aerospace industry will have to focus on developing in-house infrastructure, training and R&D capabilities to energize this sector," he says.

AERONAUTICAL DEVELOPMENT AGENCY

Developing the Tejas Light Combat Aircraft has given India experience with carbon-fiber composites, fly-by-wire controls and glass-cockpit avionics.

Rising Ambition

State-owned to private-sector and military to commercial, India's industry is moving

Graham Warwick Washington

India is spending billions on defense procurements, bringing with them massive packages of offset work for its industry, but the country's ambitions to become a major player in commercial aerospace manufacturing are still in their early stages.

Already significant providers of engineering services, including complete aerostructures design packages for Western airframers, several of India's private-sector companies are making a push into manufacturing.

But progress is being hindered by the lack of a national vision for aerospace, such as exists in China, and the absence of a complete "ecosystem" of suppliers to support the emerging major players such as the Mahindra and Tata groups.

The main drivers of India's aerospace industry growth have been major military programs and the offset obligations attached to offshore procurements. But more companies are looking for not only market access to India and more widely to Southeast Asia, but also a partner with engineering and manufacturing capability.

"What is bringing work into India is changing," says Ramaseshan Satagopan, head of the aerospace engineering practice at Mahindra Satyam, the Indian conglomerate's engineering-services subsidiary. "Five to 10 years ago, cost was the major thing driving outsourcing. Now market access in this region is the prime driver, offset-related work is second, and third is cost and the availability of capability."

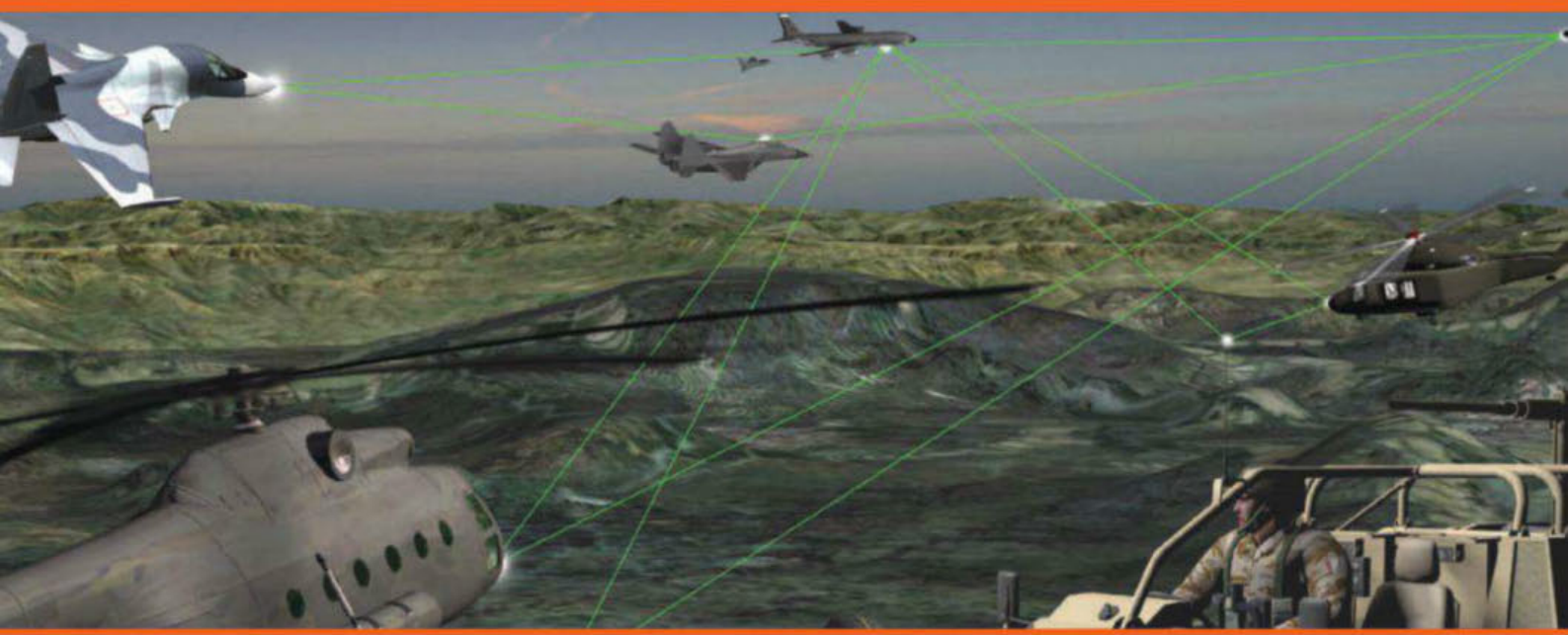
Outside perceptions of India's aerospace industry are that it is bureaucratic and painfully slow in developing aircraft that, when produced, fall short of the customers' requirements and the standards of Western manufacturers. While not disputing that characterization, Satagopan argues the view from outside does not recognize the challenges India has faced in building an industry.

"India's aerospace industry is only 40-50 years old in terms of technology, and still far way in terms of very advanced technologies in sensors, etc.," he says. "In engines there is R&D going on, but we have yet to see a final product. Engines are 3-4 times more complex than other technologies, and do not come cheap. We have still to catch up."

The Tejas Light Combat Aircraft (LCA), which is to become fully operational with the Indian air force this year after almost 20 years in design and development, is the country's most ambitious indigenous aerospace program since the HF-24 Marut jet fighter of the early 1960s, Satagopan points out.

In addition to the 40-year gap between first flights of the Marut and Tejas, India was hit by U.S. sanctions following its 1998 nuclear tests, which blocked access to many of the offshore technologies planned for the LCA. The arms ban forced India to develop its own alternatives, and delayed the program further.

Interoperability prevails here.



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While the Tejas Mk. 1 is overweight and underpowered, necessitating an improved Mk. 2 version, India through its development has acquired valuable experience with composite structures, fly-by-wire flight controls, glass cockpits and other technologies. This is expertise that can be accessed by private-sector industry to help it become a global player, says Satagopan.

"We had a lot of technologies thrown at us [with LCA]. Composites had never been developed in India, and it was the first time India had to develop its own critical hardware and software for fly-by-wire control," he says. "We know it takes time, but today India can do co-cured and co-bonded carbon-fiber wings. We developed that on our own, and understand the design, manufacturing and certification process."

AERONAUTICAL DEVELOPMENT AGENCY

The HAL Tejas Mk.1 is India's most ambitions indigenous design and development program since the HAL HF-24 Marut jet fighter of the 1960s.

The LCA program is managed by the government's Aeronautical Development Agency, formed for the task in 1984. State-owned Hindustan Aeronautics Ltd. (HAL) heads development and production. The Indian air force has ordered 40 series-production Tejas Mk. 1s, with deliveries to begin this year.

Bengaluru-headquartered HAL has designed and developed most of India's indigenous aircraft and license-produced those acquired from overseas. So, HAL is almost solely responsible for the industry's reputation for slowness. The company is tackling this problem by forming joint ventures with the private sector.

There have been a few forays into civil aviation in the past (see AviationWeek.com/indianaviation), but HAL has focused on military aircraft and its workload is growing. In addition to the Tejas, the company produces the indigenously developed Dhruv Advanced Light Helicopter and its armed version, the Rudra, and is flight-testing an attack derivative, the Light Combat Helicopter. HAL is also developing the smaller, single-engine Light Utility Helicopter, with a first flight planned this year.

At the same time the state-owned manufacturer is license-producing the Sukhoi Su-30MKI heavy fighter and BAE Systems' Hawk advanced jet trainer. A contract has yet to be signed, but the company also is expected to produce 108 of the 126 Dassault Rafale Medium Multi-Role Combat Aircraft (MMRCA) planned for the air force.

HAL also produces avionics, engines and systems. If there is an area where India still struggles, it is engines. Intended for the LCA, the Kaveri afterburning turbofan under development by India's Gas Turbine Research Establishment is short on thrust and has been deemed unsuitable to power the Tejas. But India may yet use the engine in unreheated form to power a planned unmanned combat aircraft.

LCA is not the only indigenous program to have problems. HAL's HTP-32 Deepak basic trainer has been grounded since 2009 after crashes caused by engine failures, forcing India to buy Pilatus PC-7s. Now the company is struggling to complete development of the HJT-36 Sitara intermediate jet trainer, which first flew in 2003. HAL performs some commercial subcontract work, including Airbus A320 passenger doors, Boeing 777 flaperons and Embraer Legacy 450/500 doors.

The Indian government has made several recent moves to open up its aerospace industry, to improve performance and increase competition. These steps have begun with the privatization of HAL; the government put an initial 10% stake up for sale this year. New Delhi has also changed the offset rules, allowing foreign companies to work with the private sector and not just state-owned entities, says Lakesh Srivastava, CEO of Tata HAL Technologies.

Private-sector companies are being encouraged to work with India's national laboratories as well. "The labs are still a bit bureaucratic," Srivastava says. "But they are allowing the private sector to come in with foreign OEMs, which qualify with a multiplier for offsets, to force performance into the system."

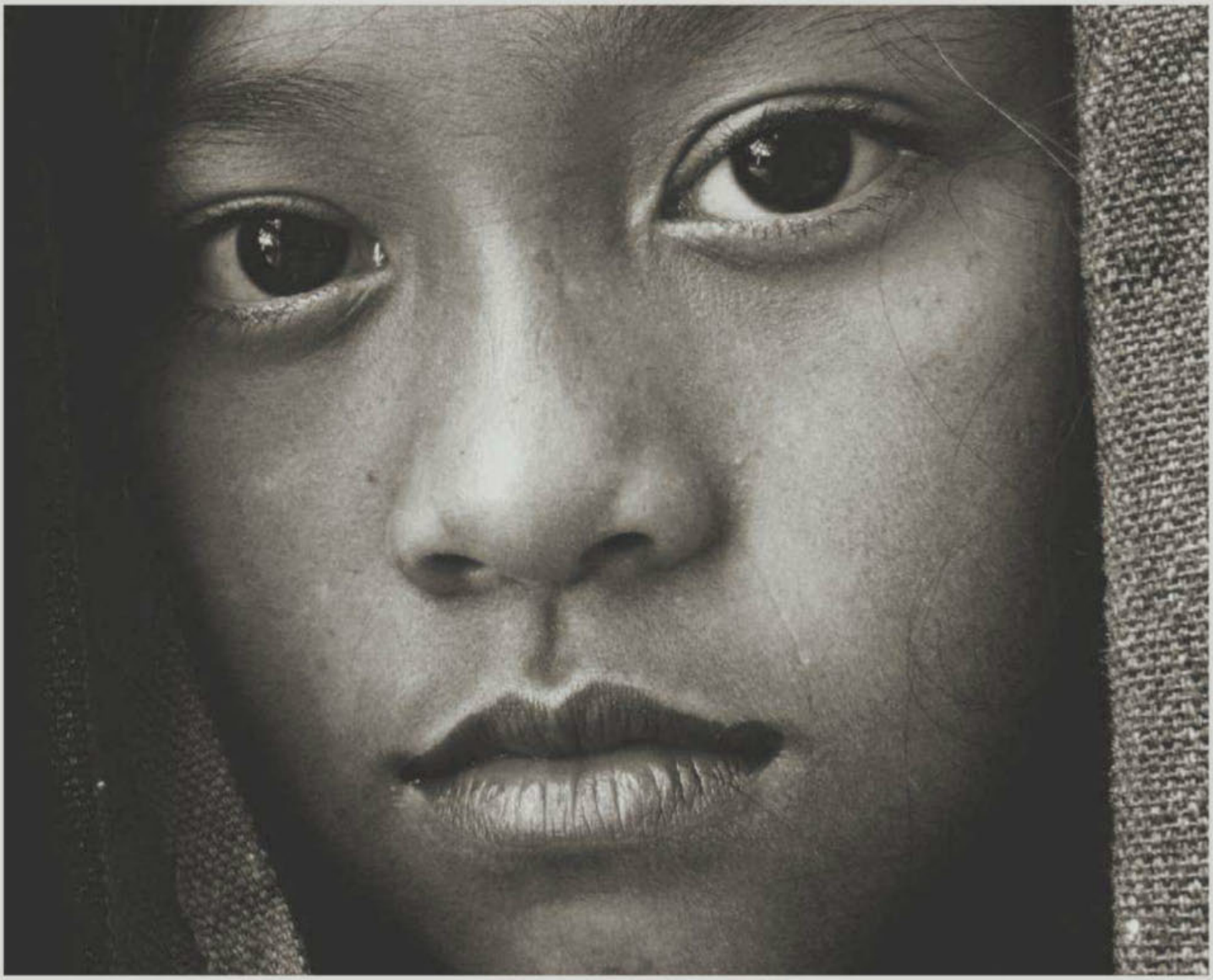
One of the main labs is the Council of Scientific and Industrial Research's National Aerospace Laboratories (NAL). Also headquartered in Bengaluru, NAL is working to establish an Indian civil aviation industry. Initially, NAL developed the Hansa, an all-composite two-seater that was commercially produced by Pune-based Taneja Aerospace and Aviation Ltd. (TAAL) for sale to India's flying clubs.

Subsequently, NAL designed the Saras, a 14-seat twin-turboprop aimed at the utility market. The first prototype was overweight and the second crashed, but a third is expected to fly this year with increased use of composites to reduce weight, more powerful Pratt & Whitney Canada PT6A-67A engines and more advanced avionics. TAAL produced parts for the prototypes. The Indian air force has ordered an initial 15.

In its first public-private partnership, NAL teamed with Mahindra Aerospace to develop the C-NM5, an all-composite five-seat light aircraft. Acknowledging the delays endemic in Indian programs, prototype certification work was moved to Gippsland Aeronautics in Australia—a general-aviation manufacturer acquired by Mahindra in 2010. The prototype C-NM5 began flight tests in Australia in September 2011.

NAL and HAL have been working since 2007 on plans to develop the 70-seat Regional Transport Aircraft

View a history of Indian aviation from its beginnings in the 1950s to the latest all-composite aircraft in the *AW&ST* digital edition on leading tablets, or at **AviationWeek.com/indianaviation**



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*Figures from the International Committee of the Red Cross.

(RTA). Satagopan sees the yet-to-be-launched program, along with plans to develop indigenously the stealthy Advanced Medium Combat Aircraft (AMCA), as keys to taking the industry's capability to the next level.

"They are still mulling the regional transport. It will happen, but when is the question," he says. Satagopan sees an opportunity for the federal government "to get into a public-private partnership role . . . to make it happen." New programs such as RTA and AMCA are needed to build out the Indian aerospace ecosystem, he says. "What is missing today is we have no big Tier 1 suppliers apart from HAL. So how do we create Tier 1s like GKN [Aerospace] and Spirit [AeroSystems]?"

Manufacturing is spreading beyond HAL, boosted by offset work. Tata Lockheed Martin Aerostructures, a joint venture with the U.S. manufacturer, delivered its first C-130 center wingbox in August 2012. Tata Sikorsky Aerostructures is another joint venture, which began delivering S-92 cabins to the U.S. helicopter maker in 2010. Both ventures were established in Hyderabad by Tata Advanced Systems, with green-field facilities designed and constructed by Tata HAL Technologies, another joint venture.

Tata HAL Technologies was formed in 2008 to combine Tata Technologies' engineering-services experience with HAL's design and manufacturing expertise. "We took domain skills and leadership capability from HAL, plus capital, and Tata was responsible for scaling that," says Warren Harris, global chief operating officer for Tata Technologies.

The joint venture sells engineering services for aerostructures to markets outside HAL, using designers in Tata's "delivery centers" in Bengaluru, Europe and the U.S. "Business development is by Tata and delivery responsibility is through Tata and the joint venture," he says. Tata HAL delivers a complete design package, says Srivastava, including stress analysis, certification reports and engineering support through the first article produced.

Although to date much of the work placed with Indian industry by foreign OEMs has involved manufacturing, "increasingly we are seeing requests for proposals and work packages for engineering services," Harris says. The MMRCA procurement will accelerate the trend, he says, as Dassault's legacy data is migrated to the platform that will be used to develop and produce an India-specific variant of the Rafale.

Tata HAL is working on a major aerostructures design package for a European airframer, while Mahindra Satyam recently completed the structural design of "high-end primary fuselage structure" for another European airframer, says Satagopan. The scale of the work required Mahindra to develop the capability to manage large programs. "We are one of the few companies that could have done such a large work package successfully," he says. "Now we are getting similar work packages from other OEMs."

Harris says India's aerospace engineering-services business is forecast to grow from $850 million in 2011 to $5 billion by 2022. "We are working with most of the large aerospace OEMs," he says. "The driver to tap into India increasingly is the need for resources and talent, because the graying of the workforce in Europe and the U.S. means there are not enough engineers."

While its engineering capability has grown to equal that of Europe and the U.S., Harris argues, India's industry offers some unique capabilities. "India has grown out of scarce resources and its people are frugal-minded. Their engineering solutions are predicated on low cost. That can't be replicated in Europe or the U.S."

And as the industry looks set to grow while the Indian government moves ahead with massive procurements in defense and other sectors, it is expected to do so in partnership with foreign OEMs. "We are seeing a lot of opportunities in related areas such as battle management and homeland security," says Satagopan. "It is not clear that there is a single solution provider in India. Large and long-term partnerships are required."

Growing Pains

The Indian airline market has great potential but is beset by myriad problems

Jay Menon New Delhi

India is a veritable catalog of airline industry woes. Persistent operating losses, strikes, grounded airplanes, inadequate air and surface infrastructure, high-cost fuel, multiple taxation issues—all have been the bane of the country's aviation sector.

While India is the ninth-largest national airline market in the world, it ought to be much larger, and both industry executives and aviation officials know it.

"Aviation [is] a vital tool that could be used to fuel economic growth," a Civil Aviation Ministry official acknowledges. He says the ministry is seeking to increase outlays in the federal budget to develop the aviation infrastructure in smaller cities and stabilize the debt-ridden national carrier, Air India.

It is one sign that India is making a concerted effort to remove at least some of the obstacles to growth of its airline industry. Estimates suggest that domestic traffic in India will reach 160-180 million passengers annually in the next 10 years and international traffic will exceed 80 million passengers per year, up from the current 60 million domestic and 40 million international passengers.

According to the International Air Transport Association's (IATA) forecast for 2012-16, India's domestic air travel market should be among the top five globally, experiencing the second-highest growth rate over that period. But it will not happen automatically.

"Building the future for a successful aviation sector must begin with solving the well-cataloged problems of airlines in India today," says Tony Tyler, director general and CEO of IATA.

"The sector is growing, but not profitably. Airline losses approached $2 billion in the year ended March 2012, after losing $3.5 billion over the previous three years," Tyler says. "With

some relief in oil prices and capacity rationalization, the red ink may recede slightly. But the crisis continues. All the network carriers are struggling financially." State-run Air India is on life support and private carrier Kingfisher Airlines is on the brink of death.

A lot has changed in the past decade, mainly with the rise of low-cost carriers (LCC). From almost nothing in 2003-04, the domestic market share of LCCs, including the low-cost arms of full-service carriers, today exceeds 70%. And the LCCs believe they have just begun to develop a huge potential market.

But first, there is need for airports that will complement the no-frills model. As one airline official says, "There is great scope for a new dimension for India civil aviation in connecting to Tier 2 and Tier 3 cities [because of] rapid urbanization of the country and the emergence of several smaller towns as industry and business centers."

The government agrees that the future of Indian aviation is in smaller cities. Ajit Singh, the minister of civil aviation, says the development of low-cost airports is the most important component of ministry's effort to provide air connectivity to different parts of India.

The government has engaged Deloitte as a consultant to identify the factors inhibiting the growth of domestic connectivity and suggest steps to change that. That will likely also include enhancement of helicopter operations and construction of heliports to serve less populated areas, including religious and tourist sites.

The Civil Aviation Ministry's Vision 2020 plan emphasizes development of the country's infrastructure and aims for user-friendly airports to handle as many as 280 million passengers per year by 2020.

"One of the key challenges will be to ensure that Indian airports function with the same efficiency as international hubs," says one airline official.

Buoyed by the success of the public-private partnership (PPP) model in airport development, the government plans to invest $30 billion in the next 10 years with more existing airports being opened up for modernization.

Airports in New Delhi, Mumbai, Bengaluru (formerly Bangalore), Hyderabad and Cochin are being placed in PPPs now. A new terminal is under construction at Mumbai airport, with international operations set to begin by August and a second phase, for domestic operations, to be ready by August 2014. The existing greenfield airport at Bengaluru is undergoing expansion to meet the growing capacity demand.

The Airports Authority of India has undertaken expansion and upgrading of airports at Kolkata and Chennai. And the government has approved 15 more airports under the Greenfield Airports Policy, most of which are being developed in PPPs, the ministry official details.

However, skeptics question the authority's abilities to manage infrastructure growth. They say that of the 115 airports run by the authority, only 71 are commercially operational. The rest are closed, mainly because they have proved to be economically unviable.

The ministry official cites examples of companies such as Regional Airport-Holdings International Ltd. (RAHI), which had revealed plans to develop India's regional aviation market, starting with two airport projects. Over the next five years, RAHI has plans to invest $700 million in over 15 aviation infrastructure and services projects.

In addition to the model agreement to develop greenfield airports under the PPP mode, the government has also allowed 100% foreign direct investment, under the automatic route.

"The PPP model for developing greenfield airports as well as upgrading existing airports has provided the opportunity to develop integrated airport cities on the lines of Dubai and Hong Kong," says Promananda Elangbam, marketing manager at Bangalore International Airport Ltd.

Meanwhile, although there is an unprecedented increase in traffic and demand, almost all Indian carriers are in the red. Operating costs are daunting, propelled by high fuel costs and taxes, and debts are soaring.

The government, for its part, opened up foreign direct investment (FDI) in Indian carriers to airlines abroad and is allowing direct importation of aviation fuel.

"Permitting FDI by foreign airlines was a right step for Indian aviation, as it requires resources for expansion to connect Tier 2 and 3 cities with metros and foreign destinations," says R. Neelakantan, chief financial officer of no-frills airline SpiceJet.

Clearly, the air travel market in India has room for expansion. India is estimated to have one aircraft for every 2.89 million people, which is miniscule in comparison to one for every 1.14 million in China, 0.96 million in Indonesia, 0.89 million in the Philippines and 0.63 million in Brazil. Boeing estimates that Indian carriers will require 1,450 new aircraft worth $175 billion to cope with increasing passenger traffic over the next 20 years.

Despite such forecasts and India's attempts to foster its aviation sector, some policies threaten to nip growth in the bud.

Fuel constitutes 40-50% of Indian airlines' operating expenses. A major contributor to the high fuel prices is the 4-30% value-added tax levied by various state governments. Efforts are underway to persuade Indian state governments to reduce their taxes. Carriers also complain about India's service taxes on air tickets and landing and navigation fees.

BOEING

Like other Boeing 787 operators, Air India must wait as its six next-generation aircraft sit idle, grounded by regulators.

IATA's Tyler says the fundamental problem is that India has a fragmentary approach to aviation policy that does not connect the dots in the value chain. "A coordinated 'India Inc.' approach that addresses the central challenges of infrastructure, costs, and taxes is urgently required," Tyler says.

If India can establish a coherent aviation policy, the sector's advocates point out, the economic and social benefits that derive from improved competitiveness and air connectivity would be enormous. The aviation industry accounts for close to 0.5% of Indian gross domestic product and 1.7 million high-productivity jobs. IATA estimates that the value added by each employee in air transport services in India is approximately 10 times higher than the Indian average.

Wounded Warriors

As shaky airlines launch a fare war, regulators worry and foreign investors hesitate

Jay Menon New Delhi

As if Indian airlines did not have enough problems already, now they seem to have organized themselves into a circular firing squad. Bleeding red ink, India's private carriers are engaged with debt-ridden Air India in a fierce price war.

The fare war was triggered after state-run Air India dropped prices under its special "Jaldi! Jaldi!" ("Hurry! Hurry!") promotional program late last year, undercutting rival Jet Airways and budget carriers on some domestic routes. Many in the airline industry here believe support from the government makes the flag carrier far less disciplined in its business approach. Air India's latest moves come as it fears losing market share with the grounding of its six new Boeing 787 aircraft.

AIRBUS

Low-fare IndiGo, India's largest carrier, took delivery of its first Airbus A320 with "Sharklets" last week.

Low-cost operators have responded. SpiceJet, for example, slashed fares as much as 60%, selling one-way tickets to any destination in the country for as little as 2,013 rupees ($37), including all taxes.

SpiceJet CEO Neil Mills says, "Our plan is to increase the revenue share from international operations, expand our regional routes and improve passenger load factor and revenue in the lean season by our limited low-fare offer." In one three-day sale, SpiceJet sold 700,000 tickets.

Because India's passenger traffic had been steadily declining in recent months, most other carriers have followed suit, despite a warning from the national regulator, the Director General of Civil Aviation (DGCA), not to slash rates.

"It seems the steady decline in passenger traffic is currently a bigger concern than the jet-fuel cost," says a DGCA official. "This move is definitely going to stimulate the domestic Indian aviation market, . . . but it will also test the sustainability of the recent turnaround in the sector."

Though Air India and Jet Airways say they do not plan further ticket price reductions, they appear to be cutting fares discreetly to spur sales during the winter doldrums.

High airfares reigned throughout 2012, as carriers reacted to the grounding of full-fare Kingfisher Airlines and a month-long strike at Air India. That caused passengers to opt out of air travel and led to a decline in traffic for the first time since 2009, bottoming out at 15.7% less in October 2012 than in October 2011.

Air India had the second-largest market share in November at 20.7%, following IndiGo at 27.3%. The most significant market share decline was seen at Jet Airways, which went from being the largest airline at the beginning of 2012 to third place by year-end.

Meanwhile, the government worries about the long-term impact carriers' health. As one DGCA official warns, "Indulging in low-cost fares may damage the balance sheets of already debt-ridden carriers."

But the scramble for market share is taking place as almost all the domestic carriers scout for foreign partners to infuse funds to help them survive, and that is no coincidence, most aviation insiders believe.

Jet Airways is in discussions with Abu Dhabi-based Etihad Airways to sell a minority stake. SpiceJet is holding similar talks with Malaysia's AirAsia Ltd., the region's largest budget carrier.

Even desperately ailing Kingfisher might be rescued by an angel investor outside of India. Deep in debt and grounded since Oct. 1 following labor unrest, the airline is talking with various investors, including Etihad. While some industry sources have been saying the Persian Gulf carrier is close to buying a 48% stake in cash-strapped Kingfisher for about 30 billion rupees ($553 million), last week others were predicting an imminent hookup between Etihad and Jet Airways.

Though it would hardly fix all that ails Indian aviation (see page 50), a major carrier's alignment with a foreign airline should have a major impact on the domestic market, insiders believe.

Foreign airlines, however, are not rushing to invest in Indian carriers. With exquisite insensitivity for timing, the aviation ministry is saying it will constitute another fare-monitoring unit to ensure greater transparency. Predictably, that has scared foreign investors.

Meanwhile, the fare war among Indian carriers continues. And passengers are certainly not complaining.

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Orbital Recycling

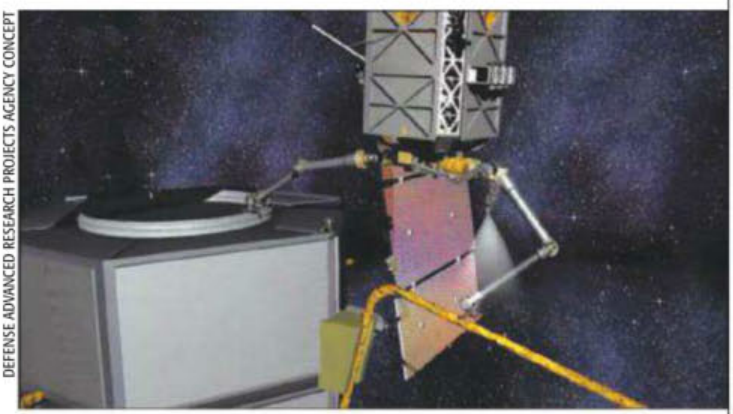
Savvy repurposing of communications-satellite antennas could yield substantial savings

Graham Warwick Washington

Reusing hardware already in orbit, rather than launching a new spacecraft, could dramatically cut the cost of providing military satellite communications, but requires a technology leap to enable robotic servicing in geosynchronous orbit and beyond.

Under the Phoenix demonstration planned for 2016, the U.S. Defense Advanced Research Projects Agency (Darpa) plans to show that a robotic vehicle can remove the antenna from a retired spacecraft in graveyard orbit and attach systems to it to rebuild a functioning communications satellite in geostationary orbit (GEO).

Phoenix aims to "increase the return on investment for Defense Department space missions by really lowering the cost," says David Barnhart, Darpa program manager. The program centers on developing "a different way of building spacecraft, with some level on on-orbit assembly to add hardware and use what is already up there."



DEFENSE ADVANCED RESEARCH PROJECTS AGENCY CONCEPT

Although antennas average only 2-3% of a communications satellite's mass, the cost of the spacecraft increases proportionally with aperture size, in turn driving the size of booster and cost of launch into GEO. "The dollars per specific mass is not that high for an antenna, but if you have to send up a large satellite on a large booster the cost is very high," he says.

An example is the $350 million sticker price on NASA's TRDS-K data-relay satellite, with its two 4.9-meter-dia. (16-ft.) unfolding parabolic antennas, and the likely $200 million price tag for its launch in January by Atlas V. "The cost depends on the size of the antenna. With a large commercial aperture, say 18 meters, this architecture could provide a potential 10 times reduction," he says.

While it can take up to 15 years for fuel reserves to be depleted and solar arrays degraded to the point where a satellite has to be retired, Darpa calculates the antenna structure could last more than a century. The agency believes the cost of providing satellite communications could be reduced dramatically by removing and repurposing an existing antenna by attaching "satlet" modules manufactured at high volume and low cost and launched cheaply and quickly as piggyback payloads on commercial satellites.

"If we cannot replace the appropriate functions and mass to control the aperture, the concept does not make sense," says Barnhart. The plan is to achieve this through aggregation, sending up satlets that each perform a function, such as attitude control, momentum management or power generation, provided by the original satellite. "We will create an aggregate set of hardware. The question is how many of these very small things do we need, and can we aggregate them at low cost?"

In the Phoenix concept, a robotic servicer/tender would be launched into GEO. The satlets, along with tools for the servicer's robot arms, would then be packed into payload orbital delivery systems (PODS) and delivered to GEO as hosted payloads on commercial satellite launches. "The tempo at which the satlets are going up becomes critical," says Barnhart. With 10-15 GEO commercial launches a year on average, "that's a one-a-month tempo on which we can take advantage of any excess mass as hosted hardware."

The PODS would be ejected on command from the GEO satellite and collected by the servicer, which would store the satlets and tools on its toolbelt before heading to graveyard orbit to rendezvous with the donor spacecraft. There the servicer would attach the satlets to the antenna, which would then be severed from its satellite and towed to GEO to take up position as a reconstituted communications satellite.

Begun last July, the four-year, $180 million Phoenix program is making progress with several prototype systems undergoing laboratory testing. These include:

- The servicer/tender's robotic-arm grappler, end-effector gripper and adhesive grasping pads to hold the satellite.

Servicer/tender grips donor satellite with one robot arm as it severs the boom-carrying antenna with another.

- A "hyperdexterous" mutli-jointed robot arm to bring lights and cameras close to the work area.
- A tool to mechanically sever the boom carrying the antenna while minimizing debris generation.
- A system to make a "stem boom" for gravity stabilization of the separated antenna from flat carbon-fiber tape.

This month, Darpa will issue a solicitation for the remaining five of 12 technologies required for the Phoenix concept. These involve elements critical to the planned demonstration, including sensors and systems for "safe and responsible" rendezvous and proximity operations by the servicer, both while picking up the drifting PODS and working on the cooperative donor satellite. Darpa will also explore with commercial satellite operators ways to launch the PODS into GEO.

The Phoenix demonstration will test key aspects of the concept, but not a complete operational system. "In the first demonstration we will attempt to bring up the functions to repurpose an antenna," says Barnhart. "For the demo, we will take the satlets up with us [on the servicer/tender launch]." The demonstration aims to repurpose a small 1-5-meter antenna and validate that radio-frequency communications can be restored via the rebuilt aperture in graveyard orbit. "For the demo, we will not bring the aperture to GEO," he says.

Darpa has yet to select a donor satellite. "Of the 500 retired spacecraft, 140 have been identified with apertures that would be useful for the demo. We are continuing to work through a number of identified candidate assets."

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Aviation Week & Space Technology
February 4, 2013 VOL. 175, NO. 4 (ISSN 0005-2175)

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Feb. 14-15—CANSO Global ATM Operations Conference. Madrid, Spain. See www.canso.org/opsconference2013
Feb. 17-21—Gulf Defense Conference and Official Conference of IDEX. Abu Dhabi, UAE. See www.idexuae.ae/page.cfm
Feb. 26-March 2—Australian International Airshow and Aerospace and Defense Exposition. Avalon Geelong Airport. See www.airshow.com.au/airshow2013
March 12-14—ATC Global Amsterdam 2013. Amsterdam RAI Exhibition & Congress Center. See www.atcglobalhub.com/events
March 18-20—11th Missile Defense Conference and Exhibition. American Institute of Aeronautics and Astronautics (AIAA), Lockheed Martin Corp. and U.S. Missile Defense Agency. Washington. See www.aiaa.org/MDA2013
March 19-21—Composites Manufacturing 2013. Long Beach (Calif.) Convention Center. See www.aerodefevent.com
March 19-21-American Astronautical Society's 51st Goddard Memorial Symposium: "Success Through Interdependence." Greenbelt Marriott Hotel, Md. See www.astronautical.org.
March 25-28—22nd AIAA Aerodynamic Decelerator Systems Technology Conference and Seminar. Daytona Beach, Fla. See www.aiaa.org/ADS2013/jhitchen@smi-online.co.uk

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Be Smart In Facing U.S. Defense Cuts

BY CHARLES F. WALD

Wald, a retired U.S. Air Force general, is the leader of Deloitte's Department of Defense practice in Arlington, Va. He commanded the 9th Air Force and U.S. Central Command Air Forces from 1999-2001 and led the development of the coalition air campaign for the war in Afghanistan following 9/11.

Crisis is a word often applied to the proposed defense "sequestration" cuts, now set to take effect on March 1. There is no dispute that these budget reductions could send powerful tremors through the U.S. military and defense industry.

The projected loss of an additional $500 billion from the defense budget should not be taken lightly. A recent Aerospace Industry Association study found that as many as 2 million jobs could be lost if the sequestration mandate of the Budget Control Act goes into effect. The impact on the manufacturing and delivery of sophisticated weapons systems also could be quite significant.

Clearly, the U.S. is facing a dramatic turning point in the way national security is structured and financed. But I look at this crisis the way the word was originally defined—a turning point of great significance. It is a chance to finally build a more modern, responsive and focused military as dictated by the geopolitical demands of today.

> "Do we need or can we afford three separate air forces? The same scrutiny must be applied across all combat disciplines."

We live in a new world, a new reality. Our national approach to defense has been in transition since the end of the Cold War, but still relies heavily on more conventional 20th century strategies. With two wars winding down and inevitable cost-cutting coming to the Defense Department budget, challenges may now force us to rethink the capabilities that we genuinely need in a 21st century national security strategy.

Let's concentrate on how we plan and budget with these new realities in mind—not recreating what has worked in the past, but looking ahead at what might be needed the future. For starters, we should place increased emphasis on technology asymmetries such as stealth aircraft, the efficient use of unmanned vehicles and superior intelligence-gathering. They are just some of the timely and sensible alternatives to more costly and conventional systems.

These asymmetries—along with our air and sea mobility, space and missile defense technology, precision munitions and superior information management—distinguish not only the U.S. defense establishment, but also the manufacturers of such advanced weaponry. In short- and long-range planning, our budget priorities must be intelligence, surveillance and reconnaissance (ISR), special operations forces, precision engagement and nuclear deterrence. We are uniquely equipped to excel in these areas. Agility, speed and clear superiority in technology should be our global calling cards.

- First, we should prioritize U.S. superiority in ISR and in space, despite concerted efforts by China to overtake us in these areas.
- Second, we must maintain a strong global presence through our aircraft carriers.
- Third, in what is potentially an overwhelming advantage, we should further develop our unmatched stealth technology and advanced avionics.
- Finally, we should fully exploit our expertise in data management. "Big data" analytics is a critical differentiator for our country, one that will only grow steadily in importance in the decades ahead.

The programs that do not fit into these asymmetries should be examined closely for potential cuts and consolidation. For instance, we should eliminate redundancies across service lines. Do we need or can we afford three separate air forces? The same scrutiny must be applied across all combat disciplines.

The reality is we are unlikely in the near- to mid-term to become involved in a major ground conflict. Therefore, our end-state force structure should be reconsidered. Currently, it costs $1 billion for every 10,000 active-duty personnel.

We also must be thinking more globally in our 21st century assessments. One of the big issues to examine is how we enable the defense industry to be more competitive internationally. According to the Defense Security Cooperation Agency, the U.S. accounts for more than three-quarters of all global arms sales. More than $66 billion in U.S.-produced military equipment was sold overseas in 2011.

I suspect the demand for more sophisticated, state-of-the-art weaponry and technology will increase dramatically abroad. That makes perfect sense. Our allies face the same security challenges and opportunities as we do. As a result, they have the same need to deal as effectively as they can with these new and deadly threats.

If one does indeed regard crisis as opportunity, as I do, we have a great chance to rebuild and reform our defense establishment. If we do this right, we can come out of this current fiscal crisis a more focused and efficient military—and a stronger, safer nation.

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The CSeries aircraft program is currently in development phase and as such is subject to changes in family strategy, branding, capacity, performance, design and / or systems. All specifications and data are approximate, may change without notice and are subject to certain operating rules, assumptions and other conditions. The actual aircraft and configuration may differ from the image shown.

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