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AVIATION WEEK & SPACE TECHNOLOGY

2010 PERSON OF THE YEAR

Jeffery A. Smisek

CEO of United Continental Holdings Inc.

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Driving Force

In the Nov. 18, 2002, edition of *Aviation Week & Space Technology* featuring a special report on the airline industry, the cover text exclaimed, "Restructure . . . Or Die." At the time, low productivity, high costs and an onslaught of low-fare carriers grabbing market share were the bane of most large airlines' existence, especially in the U.S. and Europe.

Fact is, running a major airline successfully is akin to a crapshoot; there is always the risk stakeholders can lose big even when a carrier would seem to have everything going for it—size, longevity and hordes of loyal customers. Simply consider all the marquee names that have sought bankruptcy court protection in the last 20 years—not to mention those whose storied histories have ended in failures, like TWA and Pan Am.

Continental and United are two carriers that undertook major restructurings in the 1990s following their own turns in bankruptcy court—and more recently received regulatory approval to create United Continental. The central figure behind this bold move was Jeffery A. Smisek, Aviation Week's Person of the Year for 2010 and the individual who will lead this behemoth.

To appreciate the scope of what Smisek and his executive team accomplished—and why Aviation Week editors thought he was enough of a driving force in 2010 to become our Person of the Year—you first need to understand that this was not just another sizable merger in the tumultuous, financially perilous business of flying passengers and freight commercially.

For starters, the combined entity that will begin operating as a single airline later this year will be, by some measures, the world's largest carrier. Whether it succeeds as Smisek and his team envision remains to be seen. But we can be certain of this: Smisek's role as chief architect of United Continental will dramatically change the competitive landscape of commercial aviation forever, with repercussions that are likely to play out in ways big and small for years to come. Moreover, the product of this complex merger, for better or worse, will directly touch the lives of millions of people every year.

Think about the opportunity before Smisek and the other people who will run United Continental; their creation has the potential to establish a higher standard of service for air travelers around the globe, which almost certainly would force rivals to raise the performance bar to stay competitive. As a frequent flier, I hope the new carrier will see the long-term advantages of striving for the latter, if for no other reason than out of enlightened self-interest.

In the insightful cover story reported and written by Transport Editor Darren Shannon, you will read about the career track that took Smisek from Harvard Law School to airline CEO. You also will learn that Smisek possessed the right skill set to take on a task with the enormity of the Continental/United merger. As former Continental Chairman and CEO Gordon Bethune recalled, "It was clear he had spine." We wish Smisek well in his assignment. Above all, we hope he exercises as much courage in setting the tone and tempo for United Continental as he surely employed when he decided the merger was a seminal goal worth pursuing. The flying public deserves nothing less.

Other strong contenders for Person of the Year were David Neeleman, CEO of Sao Paulo-based Azul Airlines; and Ashton Carter, undersecretary of Defense for acquisition, technology and logistics. What all three individuals have in common is that they are catalysts of change, with the drive to upend the status quo in the pursuit of a new paradigm.

Sincerely,

Anthony L. Velocci, Jr.
Editor-in-Chief

January 3, 2011

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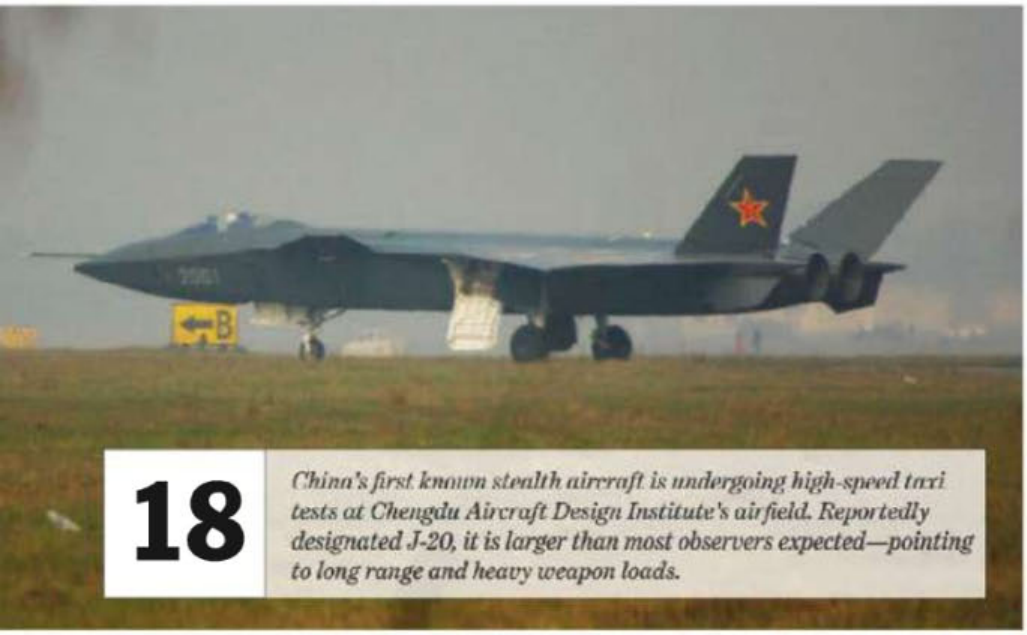
AVIATION WEEK
& SPACE TECHNOLOGY



18 *China's first known stealth aircraft is undergoing high-speed taxi tests at Chengdu Aircraft Design Institute's airfield. Reportedly designated J-20, it is larger than most observers expected—pointing to long range and heavy weapon loads.*

COVER STORY

DEPARTMENTS

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U.S. NAVY

GREAT LEAPS FORWARD

Scores of readers weighed in with comments during the holidays on Ares blog posts about China's first known stealth aircraft, the J-20 (see p. 18). Bill Sweetman, the editor-in-chief of our sister magazine *Defense Technology International*, pointed out what could be discerned in J-20 photos as they leaked into the blogosphere, while *AW&ST* Senior Military Editor David A. Fulghum explored how a hypothetical U.S.-Chinese battle in the Taiwan Strait would unfold. International Editor Robert Wall pointed out that the J-20 has overshadowed another big advance for China, the apparent achievement of initial operational capability for the DF-21D ballistic missile, which is coupled with advanced guidance to threaten U.S. aircraft carrier battle groups. All of their posts are at: **AviationWeek.com/ares**

INSIDE SOYUZ

Cosmonaut Dmitry Kondratyev sent back a rare look at life inside the cramped Soyuz vehicle during its two-day journey to the International Space Station. See his photos in Senior Space Technology Editor Frank Morring, Jr.'s Dec. 23 post.
AviationWeek.com/onspace

BIZAV OUTLOOK

The last two years have been hellish for the business aviation industry. Will 2011 be any better? In our Business Aviation Now blog, Editors Benet Wilson and Kerry Lynch examine the industry's prospects for recovery in the year ahead. And check Senior Technology Editor Graham Warwick's Dec. 23 post to view video of the first flight of the HondaJet light business jet (see p. 32). **AviationWeek.com/biz**

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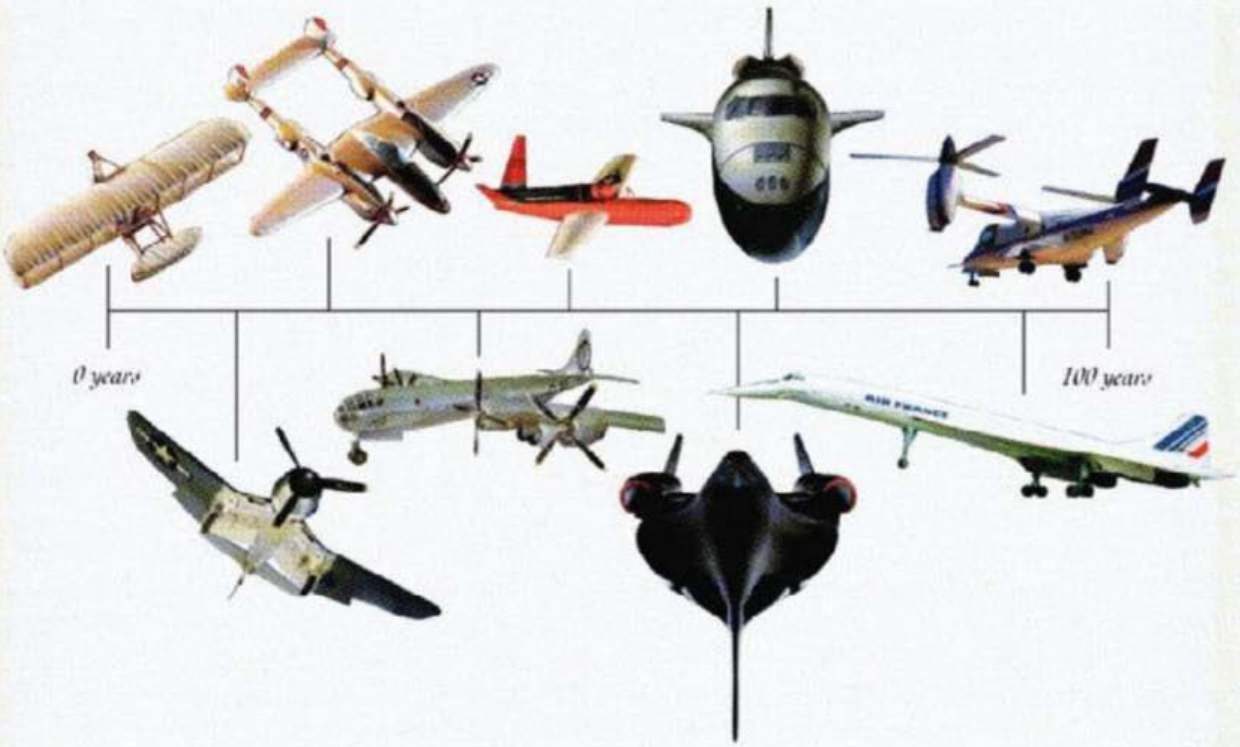

In just 100 years, flight has gone from a windswept beach at Kitty Hawk to the Sea of Tranquility and beyond. Now you can see, hear, and experience it all—at the National Air and Space Museum's Steven F. Udvar-Hazy Center in Chantilly, Va. The state's most visited museum site is home to hundreds of historic aircraft and spacecraft—many one-of-a-kind—plus an observation tower overlooking Dulles airport, an IMAX theater, interactive exhibit stations, simulators, and more.
To plan your visit, go to www.nasm.si.edu or call (202) 633-2563.

Smithsonian
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FEEDBACK

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

NTR DEFENDED

I was disappointed with reader Sam Scimemi's misunderstanding regarding the nuclear thermal rocket (*AW&ST* Nov. 1, 2010, p. 12). The NTR offers a high thrust capability and a specific impulse of over 900 and has been identified as the preferred propulsion approach for NASA's Mars Design Reference Architecture 5.0 study (NASA-SP-2009-566), which baselined using three 25,000-lb.-thrust engines.

Recent advances in fuels fabrication indicate that the NTR fuel may be able to retain all fission products in the core. Thus, the exhaust would have little or no radioactivity at start-up in Earth orbit or during ground testing.

Scimemi's claim that a nuclear electric propulsion system exists today is not accurate. The only nuclear reactor launched by the U.S.—the SNAP-10A in 1965—produced 500 watts for a few days compared to the Pewee test of a NTR in 1968 that produced 25,000 lb. of thrust with 525 megawatts of thermal power for the full required duration.

The NTR is an affordable proven technology that can safely provide high-performance propulsion for human and robotic missions.

Steven D. Howe, Director
Center for Space Nuclear Research
Idaho National Laboratory
IDAHO FALLS, IDAHO

CONCORDE VERDICT CONCORD

I have a slightly different take on your editorial "Is Safety a Victim of Justice Awry?" (*AW&ST* Dec. 13, 2010, p. 58). In March, I attended the final sessions of the Concorde crash trial because the subject interests me for many reasons: I'm a retired Boeing 747 pilot, a California attorney and a French-born (but U.S.) citizen Concorde afficionado.

I was fascinated by the way the trial was conducted. Up to that point, the pilot in me had advocated for the eradication of the criminalization of conduct relating to aviation accidents. But the judicial revelations have led me to question my conviction. I also attended the deposition, by an American attorney, of a French Dassault engineer regarding a Falcon accident. Though depositions are not trials, the word "objection" was uttered so many times during the interrogation of the witness that I was sure it would bring this procedure to a grinding halt. But one must understand that in France the role of the judge is not as an arbiter between opposing sides: prosecution and defense. The judge in this case, Dominique Andreassier, was a no-nonsense interrogator and questioned expert witnesses directly. The experts were agreed upon by the prosecution and defense who both were given opportunities to question them.

The judge was remarkably proficient. Her questioning was relentless, and the answers flowed. As an aviation safety expert, I welcomed the diligence.

Your editorial speaks of "no intent to cause harm." Although it is generally true that negligent acts are not intrinsically criminal, negligence may reach such a high degree that it


Legal Limits

becomes gross negligence. Replacing an aluminum "wear strip" intentionally made of a softer metal with a manufactured titanium strip was considered to be more than "mere negligence."

As reluctant as I am to see the criminalization of aviation accidents, I must say that as a pilot, I found nothing during this particular trial to object to, though it was comforting to know that, ultimately, no one actually went to jail.

Capt. (ret.) Jean-Claude Demirdjian
LOS ANGELES, CALIF.

VERDICT DECRIED

I was saddened by the predictable decision by the French court that Continental Airlines was the sole criminal cause of the Concorde crash in July 2000. The court decided that a metal strip that fell from a Continental DC-10 and became foreign object debris (FOD) started the whole chain that led to the accident. The court further decided that no French person or organization contributed in any way to a criminally negligent act.

I had expected that the court would not cite the government-owned airport's failure to detect and remove the FOD, a practice recommended for Concorde operations based on the aircraft's history of burst tires since 1979, including "serious incidents in 1979 and 1993" (*AW&ST* Dec. 13, 2010, p. 37). Nor was I surprised that the court did not cite the management at Aerospatiale who knew of the tire problem, yet did nothing effective to prevent it.

I do not second-guess the Concorde pilots. No one can know what they knew when that decision to takeoff was made.

But one does have to wonder why Air France continued to operate the Concorde while knowing of the aircraft's airworthiness issues.

Sanford L. Pearl
PALM BEACH GARDENS, FLA.

PERENNIAL QUESTIONS

In "Designs for Success" (*AW&ST* Nov. 1/8, 2010, p. 72) former NASA Administrator Michael Griffin says that system engineering should "minimize unintended consequences. We rarely ask 'What is this going to do that I don't want it to do?'" He believes the community's ability to predict how well the design will meet the objective is "poor and, at best, pathetic." While I agree with most of his suggestions, it surprised me that he says that nobody has posed these kinds of questions before.

So I must ask: Mr. Griffin, where were you and your people when you headed NASA?

Maybe you were not aware of, or did not communicate with, the people doing this type of work. In the 1990s, I worked on the advanced space program at Rocketdyne where I asked these questions and many more, only to be told that it was not our task to develop such tools nor was there a budget to do so.

NASA and the Defense Advanced Research Projects Agency should initiate immediately the type of program that Mr. Griffin recommends.

Zvi Friedman
SYLMAR, CALIF.

WHO'S WHERE

Christine Williams

Michael Bloomfield

Simon Henley

Meredith Siegfried

Basil Barimo

Steve Pack

Hastings Siegfried

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.*

Christine Manka Williams (see photo) has been promoted to senior operations manager-refurbishment at *Gulfstream Aerospace Corp.* She was assistant program manager for the company's Military and Special Missions unit, where she led a team that designed and outfitted the interior of a Gulfstream G550 atmospheric research aircraft for the German Aerospace Center.

Peter Muylaert has been named commercial director of *The Brussels Airport Co.*, effective Feb. 16. Muylaert, who will replace interim Director Doug Benham, is vice president-business development and real estate at Delhaize Belgium.

Peter Lynas has been appointed group finance director at *BAE Systems,* succeeding George Rose, who plans to retire on March 31 but continue as an executive director. Lynas is group director-financial control, reporting and treasury. He was group finance director of GEC's Marconi Electronic Systems when BAE Systems was formed.

Former astronaut **Michael J. Bloomfield** (see photo) has joined *Oceaneering International* as vice president/general manager of Oceaneering Space Systems. While at NASA, he was chief of safety and chief instructor of astronauts, as well as director of shuttle operations and chief of the Shuttle Branch. He also served as deputy director of the Flight Crew Operations Directorate before leaving NASA in 2007 to join ATK as vice president-Houston operations.

Andrew Jazwick has been named senior vice president-aviation security for *Science Applications International Corp.'s* (SAIC) Security and Transportation Technology Business unit. Since joining SAIC in 1999, he been liaison to the executive and legislative branches of the U.S. government.

Simon Henley (see photo) has become president of *EPI Europrop International GmbH.* with full responsibility to manage the TP400 engine program. He was director of new product introduction and helicopters at Rolls-Royce Defense, where he was responsible for the development, testing and demonstration of a wide range of new engine products. Before joining Rolls, he had a 32-year career in the Royal Navy as an aircraft engineer officer, retiring as a rear admiral.

Gregory D. Blaney has been named director of *NASA's* Independent Verification and Validation program, which provides software verification and validation services, as well as software safety assurance for the agency's most critical missions. Blaney has been acting director since December 2009 and will continue to lead the facility's day-to-day operations.

Neel Shah has been promoted to senior vice president and chief cargo officer and **Chris Collette** to senior vice president-supply chain management for *Delta Air Lines.* Shah joined Delta from United Airlines Cargo, where he was vice president-sales and marketing. Collette came from Northwest Airlines.

Cynthia Marcondes Ferreira Benedetto has been appointed *Embraer's* new chief financial officer, succeeding **Luiz Carlos Aguiar**, who will become president and CEO of the recently created Embraer Defense and Security unit. Benedetto has been with the company since 1986, most recently at the helm of Embraer's Finance Department.

Meredith Siegfried (see photos) has been promoted to president of *Nordam*. She was chief operating officer of the company's Repair Group. She was vice president of the Global Engineering and Quality, Repair Group. **Basil Barimo** is now vice president/general manager of the Repair Division and Global Technical Operations. **Steve Pack** is responsible for all of Nordam's manufacturing operations as chief operating officer of the Manufacturing Group. **Hastings Siegfried**, who was chief operating officer of the Transparency Group, is now vice chairman of Nordam and chairman of its Governance Committee.

USMC Gen. (ret.) **Peter Pace** has been named to the board of directors of the *AAR Corp.* He was chairman of the Joint Chiefs of Staff from 2005-07 and is now a member of the Secretary of Defense's Defense Policy Board.

Ronald A. Williams, chairman of Aetna and its former CEO, has been appointed to the *Boeing* board of directors.

USAF Brig. Gen. **Otis G. Mannon** has been nominated for promotion to major general. He is special assistant to the commander of Air Force Special Operations Command, Hurlburt Field, Fla.

HONORS AND ELECTIONS

Michael T. Strianese, L-3 chairman, president and CEO, has been received the John W. Dixon Award from the *Association of the U.S. Army*. Strianese received the award for his company's ongoing contributions to the U.S. armed forces and the defense industry.

William F. Marrison has received the *American Association of Airport Executives'* Distinguished Service Award for his "numerous and significant contributions to the airport community at the local and national levels." Marrison is a 28-year veteran of the Metropolitan Knoxville (Tenn.) Airport Authority.

Rep. Ralph Hall (R-Texas) has been named the next chairman of the *U.S. House of Representatives* Science and Technology Committee.

Charles O'Dell, director of operations of Sun Air Jets, has been named to the board of governors of the *Air Charter Safety Foundation*. O'Dell joined Sun Air Jets in 2002, is an active flight instructor and airline transport pilot with more than 12,300 hr.

BY JOSEPH C. ANSELMO

Senior Business Editor
Joseph C. Anselmo blogs at:
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Joe_Anselmo@aviationweek.com

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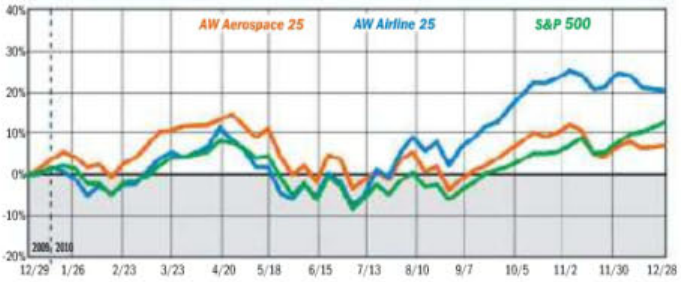
AW Airline 25	1067.9	-0.4% ▼	21.5% ▲	20.1% ▲
S&P 500	1258.5	1.9% ▲	12.9% ▲	12.3% ▲



Weekly Market Performance

Closing Prices as of Dec. 29, 2010

Company Name	Current Week	Previous Week	Fwd. P/E	Tot. Ret. % 3 Yr.	Tot. Ret. % 1 Yr.	
AIR TRANSPORT						
AAR Corp.	27.95	28.31	14.9	-26.0	17.5	▲
ACE Aviation Holdings	12.88	12.78	5.2	-55.3	128.4	▲
AerCap Holdings N.V.	13.60	13.29	7.4	-30.0	53.9	▲
Air Berlin	4.89	5.08	....	-72.9	-9.9	▼
Air Canada	3.55	3.55	18.2	-71.2	196.1	▲
Air France - KLM	17.75	18.24	14.4	-47.1	10.1	▲
AirTran Holdings	7.40	7.42	13.5	2.2	42.3	▲
Alaska Air Group	57.04	59.06	8.7	127.3	62.6	▲
All Nippon Airways Co Ltd.	3.71	3.64	31.6	3.4	34.9	▲
AMR Corp.	7.72	8.05	....	-45.0	-0.4	▼
Asiana Airlines Inc.	8.14	8.65	23.7	-10.1	144.1	▲
Atlas Air Worldwide Holdings	56.50	57.30	12.1	5.4	49.2	▲
BBA Aviation plc	3.38	3.31	12.7	3.5	39.0	▲
B/E Aerospace Inc.	36.82	37.08	20.4	-30.4	53.7	▲
British Airways	21.00	20.67	70.5	-29.2	34.2	▲
CAE Inc.	11.44	11.42	16.6	-11.4	38.8	▲
Cathay Pacific Airways	2.72	2.82	7.2	15.2	50.3	▲
China Southern Airlines	28.85	28.79	....	-31.5	76.6	▲
Copa Holdings SA	58.17	58.74	10.8	65.0	7.9	▲
Delta Air Lines Inc.	12.48	12.65	5.8	-14.5	10.5	▲
Deutsche Lufthansa AG	21.70	21.89	12.3	-5.9	26.9	▲
easyJet plc	6.53	6.64	9.7	-46.4	15.1	▲
FedEx Corp.	93.02	93.69	16.3	4.6	12.7	▲
GOL SA	14.73	15.06	16.1	-39.5	1.2	▲
Hawaiian Holdings Inc.	7.97	8.18	8.5	56.3	9.3	▲
Heico Corp.	52.14	53.03	27.9	16.9	44.1	▲
Jet Airways (India) Ltd.	15.89	16.30	18.1	-36.8	32.9	▲
JetBlue Airways	6.62	6.68	13.1	10.3	19.7	▲
Korean Air Lines Co. Ltd.	59.61	62.44	7.3	-26.3	33.4	▲
Lan Airlines SA	30.45	31.46	28.6	137.2	85.4	▲
Qantas Airways Ltd.	2.56	2.58	9.9	-39.5	-4.1	▼
Republic Airways Holdings Inc.	7.40	7.43	7.4	-62.4	4.8	▲
Ryanair Holdings ADS	30.48	29.91	66.5	-17.8	16.9	▲
Singapore Airlines Ltd.	11.84	11.67	11.5	28.8	18.8	▲
Skywest Inc.	16.32	16.63	10.7	-37.8	-6.1	▼
SpiceJet Ltd.	1.74	1.80	12.1	-22.0	42.9	▲
Southwest Airlines	13.08	13.10	15.1	7.5	14.4	▲
TAM SA	23.71	24.87	21.7	4.3	11.2	▲
United Continental Holdings Inc.	23.27	24.31	4.7	-27.9	84.1	▲
United Parcel Service Inc.	72.81	72.88	18.4	11.7	29.3	▲
US Airways Group	9.89	10.52	4.4	-32.8	97.0	▲
WestJet Airlines Ltd.	13.78	13.53	12.6	-39.0	15.9	▲

COMMENTARY

New Congress, Same Old Washington

As the New Year begins, I offer an apology of sorts to former President George W. Bush. During his tenure, Bush was criticized in this column for the "fiscal recklessness" of putting the Afghanistan and Iraq wars on a credit card. Considering that it took nearly nine years for the cumulative costs of those two conflicts to reach $1 trillion, it is breathtaking how quickly President Barack Obama and Republican leaders in Congress struck a "compromise" that will add another trillion dollars to the national debt. Tax cuts? Extend them for all and throw in some new ones. Spending? More, more and more. The deficit? We'll worry about it later.

To be sure, a case can be made that it is bad policy to raise taxes and cut spending during a wobbly economic recovery. Similar moves in the early 1930s prolonged the Great Depression. But in taking the easy way out, Obama and the Congress did nothing to address how to reduce the deficit once the U.S. economy is on a sounder footing. They merely agreed to postpone the debate on extending Bush-era tax cuts to 2012—a presidential election year. That is not exactly an ideal time to ask politicians to vote on raising taxes or cutting Social Security benefits.

So why should investors in aerospace and defense be concerned? By kicking the "can" down the road, our so-called leaders are only deepening the pain that will be felt when the day of reckoning arrives. Today, the U.S. government borrows 40 cents of every dollar it spends. Net interest on the national debt will cost about $250 billion in Fiscal 2011—25% more than the Pentagon will spend on procurement and research. And if the deficit is left unchecked, those interest payments will grow to $1 trillion a year by 2020.

If that happens, both military and civil projects that are vital to aerospace contractors will face the ax. Development of the FAA's NextGen air traffic management system, for example, is a no brainer that would more than pay for itself by clearing gridlock from the skies and lowering fuel consumption. But if the cost of servicing the debt keeps rising, we might have to kiss NextGen goodbye, stifling the U.S. airline industry's ability to grow. Funding for NASA and other scientific endeavors also would be put at risk.

There are glimmers of hope. A bipartisan National Commission on Fiscal Responsibility and Reform created by Obama has shown a surprising degree of bipartisan support for tough budget choices. Whether the new Congress has the courage to act on those recommendations, however, is another matter. Shortly after Republicans won control of the House in the November elections, Senate Minority Leader Mitch McConnell (R-Ky.) stated that his party's top priority should be to deny Obama a second term in the White House. Barely a month later, he and the president found common ground in their budget-busting tax deal. Reaching a compromise on how to begin reducing all of that debt will be a much more onerous task.

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

Russian Air Force Increases Helo Activity

ULAN-UDE AVIATION PLANT

The Russian air force is beginning to field the Kamov Ka-52 attack helicopter and also augmenting other elements of its rotorcraft fleet.

On Dec. 28, the air force's 334th Tactical Deployment Center in Torzhok received three Ka-52s, the first from the pre-production batch of 12 helicopters being produced at the Arseniev-based Progress facility. The twin-seat Ka-52 is a variant of the single-seat Ka-50 Black Shark coaxial rotor assault helicopter and will be a special-mission rotorcraft.

Additionally, the air force has expanded its arsenal with 10 Mil Mi-8AMTSh transport helicopters (see photo) from the Ulan-Ude Aviation Plant. They are deployed to the Korenovsk air base in southern Russia. This is the air force's second batch of Mi-8AMTSh helos; the initial one was delivered in 2009. Ulan-Ude-parent, Russian Helicopters, says talks are underway on the Mi-8 order for this year.

The Mi-8AMTSh has a maximum payload of 4,000 kg. (8,800 lb.) and can accommodate up to 37 personnel or 12 litters for casualty evacuation. Despite its primary role as a transport aircraft, the AMTSh version has the same set of weapons as the Mi-24 attack helicopter, including the Shturm-V (AT-6) radio-guided anti-tank missiles, unguided rockets, gun pods and machine guns. According to Russian Helicopters, the air force rotorcraft are equipped with additional armor and new avionics to permit day and night operations in bad weather.

The Mi-8s have been accompanied by training equipment. At the end of December, Zhukovsky-based Dinamika delivered two Mi-8MTV-5 flight simulators. One has already been passed on to the Syzran air force academy, while the other is due to be accepted by the 7th aerospace defense brigade air base in Budennovsk on Jan. 7.

DEFENSE

Milestone Missed

Airbus Military missed its target of handing the first A330-derivative KC-30A tanker to its launch customer, the Royal Australian Air Force, in 2010. The aircraft maker did not provide a new delivery target date, saying only that "final handover will take place once the lengthy review of all related documentation and activities is complete." The U.K. and Saudi Arabia also should receive their first tankers this year, with the United Arab Emirates to follow in 2012.

Grizzly Growth

Airbus Military has added a fourth A400M Grizzly to its flight test program. Despite a slow start, Airbus Military is running slightly ahead of the flight test schedule, with more than 1,000 hr. and 300 flights.

Helo Carrier Deal Sealed

Russia has agreed to acquire a pair of 20,000-metric-ton-class helicopter carrier/assault ships from France, with an option to build another two locally. Russian President Dmitry Medvedev informed his French counterpart, Nicolas Sarkozy, on Dec. 24 that France's DCNS-STX and St. Petersburg-based OSK had been selected to meet Russia's requirement for the vessels. Russia issued an international tender in October for the ships for which Navantia of Spain and South Korea's Daewoo also competed. The first two ships, worth about €1 billion ($1.32 billion) will be built by DCNS-STX, with 80% French content. If the option is exercised, the second two will be assembled by OSK.

New Exocet Qualified

French armaments agency DGA has qualified the MM40 Block 3 Exocet antiship missile, which is intended for France's Horizon and Fremm frigates, for active service. The first four of an initial batch of 45 Block 3s, which will double the range of the Exocet and give it a land-strike capability, were delivered in mid-December; the remainder are due by mid-2013.

SPACE

Ariane Launched

An Ariane 5 carrying the Hispasat-1E and Koreasat 6 satellites was launched Dec. 29 from the European space center at Kourou, French Guiana. The Space Systems Loral-built, 5,320-kg. (11,700-lb.) Hispasat-1E was placed in an orbital slot at 30 deg. West. The Thales Alenia Space

Harrison Ford Wins 2010 Wright Brothers Trophy

ED HAZELWOOD/AWST

Movie audiences may identify him with characters he has played—Han Solo, Indiana Jones, Jack Ryan—but Harrison Ford's most recent award has nothing to do with Hollywood. The actor last month received the 2010 Wright Brothers Memorial Trophy for his advocacy of aviation, particularly among young people. The award, established by the National Aeronautic Association in 1948 to honor the memory of Orville and Wilbur Wright, was presented on Dec. 17 in Washington. Ford, a pilot of both fixed-wing aircraft and helicopters, chaired the Experimental Aircraft Association's "Young Eagles" program from 2004-09, leading an effort to give 500,000 children between 8 and 17 an opportunity to experience flight in a general aviation aircraft and educating them about aviation. In 2010, he flew his Cessna Caravan to Haiti to deliver relief supplies to earthquake victims and transported athletes to the Special Olympics games in Lincoln, Neb. Ford did not begin flying until age 52, but since then aviation has been a leading passion for him. Past trophy winners include Charles Lindbergh, Igor Sikorsky, Juan Trippe, John Glenn and Neil Armstrong.

OBITUARY


GENERAL ELECTRIC

Ed Woll, a propulsion pioneer whose career spanned the first decades of the jet age, died on Dec. 17 at home in Westwood, Mass. He was 96.

Woll (center in the photo, with a model of the T64) directly led or played a key role in the development of General Electric gas turbine engines that powered generations of new-technology helicopters as well as fixed-wing aircraft. Woll's involvement ranged from turboshafts like the T58, T64 and T700, to military engines such as the F404, F101 and F110. He was also a driving force behind the Energy Efficient Engine and GE27 demonstrators that spawned the GE90 and CFE738. Woll also played a main role in developing the CFM56—the world's best-selling commercial turbofan.

With degrees from Massachusetts Institute of Technology and Rensselaer Polytechnic Institute, Woll began his career with the Army Air Force in World War II at the Power Plant Laboratory at Wright-Patterson Field, in Dayton, Ohio, and at Edwards AFB, Calif.

After joining General Electric in 1946, Woll first designed an afterburner for the GE/Allison J35, the U.S. Air Force's first axial-flow turbojet. Dubbed the TG-180 by GE, the development later formed the basis for an electronically controlled variable afterburner for GE's J47 and the forerunner of most afterburner systems in model use today. Woll went on to lead the conception and design and development of GE's T58 and T64 turboshaft/turboprop engines, helping to revolutionize helicopter propulsion in the 1950s and '60s.

According to Woll, the free-turbine T64, "had its beginnings in the fall of 1953 when Jack S. Parker, my boss at that time, and I did some brainstorming to define the product line that would be the basis for establishing the Small Aircraft Engine Department. After laying down the definition and plans for the T58 and J85 engines, we established a goal of developing a 2,500-hp . turboshaft engine to supersede the 2,600- and 2,800-cu.-in.-displacement piston engines of that time."

Characterized by a high-pressure ratio, and low specific fuel consumption, the T64 was one of the earliest engines with technical innovations such as corrosion-resistant and high-temperature coatings. Woll also had a pivotal role in the conception, design and development of the J85 turbojet engine family and its derivatives, the CJ610 and CF700, which went on to power more than 30 types of military and business jets. The J85 enabled the first modern "lightweight fighter"—the Northrop F-5, cementing an almost unbroken string of GE-powered Northrop combat aircraft.

In the late 1960s, Woll directed a team—many members were J85 veterans—to develop the afterburning GE15. This 14,300-lb.-thrust engine incorporated a low bypass ratio fan, a simple concept that developed through the YJ101 into the F404 for the F/A-18. Woll was also largely responsible for the initial development of the F101X engine, which matured into the F110 that powered the F-14, and continues in service on the F-15 and F-16.

On the commercial side, Woll made major contributions to the development of the CF6 and CFM56, and was a major player in the start of the joint development program with Snecma. He retired in 1979 as vice president-engineering, responsible for all military and commercial product engineering. Woll was also recognized as the driving force behind the engine business's Zero Defects program.

Koreasat 6, with a weight of 2,850 kg., was placed at 116 deg. East. Both spacecraft are designed for 15 years in orbit.

Chapter 11 Exit Near

U.S. Bankruptcy Court in New York has reportedly approved sending a reorganization plan for TerreStar Networks to creditors for approval, and set a March 4 hearing to confirm the plan. The Reston, Va.-based operator wants to start a terrestrial/satellite phone and data service using an existing spacecraft. TerreStar filed for Chapter 11 bankruptcy protection in October.

Exim OKs Inmarsat Loans

The U.S. Import-Export Bank has approved a $666-million loan package for the design and construction of Inmarsat's Global Xpress K_a-band satellite system. The three-spacecraft system was ordered from Boeing last summer.

Galileo Control Center Opens

The European Commission and European Space Agency have opened a center in Fucino, Italy, that will be responsible for mission control of the Galileo satellite navigation system. A center in Oberpfaffenhofen, Germany, is responsible for satellite control.

AIR TRANSPORT

Tupolev Takes Off

Aviastar-SP completed the first flight of the Tupolev Tu-204SM on Dec. 29. The SM is aimed at giving the Tu-204, in production since 1989, another lease on life. It features a slightly lighter airframe, more modern avionics, a two-pilot cockpit, a new auxiliary power unit and improved Perm PS-90A2 engines designed by Russian Aviadvigatel with Pratt & Whitney. Next year, Aviastar-SP plans to produce another prototype of the SM, with an aim to complete type certification tests by 2012. However, the future of the upgrade remains unclear. So far, only Russian charter operator Red Wings has discussed the possibility of buying up to 44 units.

Confirmed Commitment

LAN Airlines has finalized discussions with Airbus over the purchase of 50 A320-family aircraft. The deal puts Airbus within reach of breaking the 500 gross-order threshold for 2010, almost matching the number of aircraft delivered in 2009.

AEROSPACE BUSINESS

Acquisition Action

BAE Systems has agreed to pay 1.2 billion Danish kronor ($216 million) to acquire ETI, a Danish cyber and intelligence company. It is the latest in a series of deals by BAE to bolster its security services activities. BAE expects the deal to close before April.

Correction

The photo of a Mojave Desert scene, on the lower half of page 52 of the Dec. 20/27, 2010, issue, should have been credited to Dr. Charles Dusenbury of Monterey, Calif.

BY GUY NORRIS

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COMMENTARY

Legendary Lessons

Celebrating its 75th anniversary, the DC-3 could enlighten today's industry

As manufacturers struggle to keep sophisticated new airliner developments on track, is it possible to still learn from epic success stories as old as the Douglas DC-3?

Given the delays and schedule slides now facing new airliner projects from the Boeing 787 to the Sukhoi Superjet 100, this is an interesting time for comparisons. The pioneering piston-engine aircraft revolutionized the air transport industry and outlived generations of "DC-3 replacements." Yet, compared with today's more complex transport aircraft programs, the first-generation Douglas Commercial (DC) family emerged in just three years. With hundreds still active, the 75th anniversary of the DC-3's first flight on Dec. 17, 1935, is particularly poignant for Boeing, which is battling to right the 787 after its seventh major hold-up.

KEITH GASKELL

Like the 787, the DC-3 was designed as a game-changer, packed with innovative features and based around the efficiency of two engines. Its genesis was a letter from Transcontinental and Western Air's (TWA) Jack Frye seeking bids to build "10 or more trimotor transport airplanes."

Donald Douglas received Frye's letter in August 1932, and 11 months later had designed the DC-1. The Douglas team reads like a who's who of aviation greats. Chief engineer was James "Dutch" Kindelberger, assisted by Arthur Raymond, while stress analysis was led by J. Lee Atwood. Other team members included Jack Northrop, Stephen Zand and California Institute of Technology luminaries such as Clark B. Millikan and Arthur Klein.

TWA's requirement called for a trimotor, but Douglas thought it could beat the spec with two 690-hp. Wright radial engines and variable-pitch propellers. The stressed-skin design incorporated retractable landing gear, large flaps and a tapered multi-spar wing design, led by Northrop. The structure ushered in the modern era of multiple load paths and fail-safe designs with extended airframe fatigue life. Before this, few aircraft flew more than 6,000 hr. over their lifetime, whereas DC-3s would demonstrate an indefinite fatigue life.

Produced for TWA as the slightly larger DC-2, it was American Airlines' interest in a wider variant, able to accommodate 14 sleeper berths, that cemented the design's place in history. The resulting DC-3, engineered by a team led by Raymond, had a wider, rounder fuselage cross-section and strengthened wings with great span and fuel capacity.

Entering service in 1936, it was immediately a profit-maker, and by 1939 it is estimated 90% of the world's air traffic was carried by the DC-3.

So what can this tell us about today's development stories? According to U.S. diplomat Henry Kissinger, "history is not, of course, a cookbook offering pretested recipes. It teaches by analogy, not by maxims." Although the DC-3 was arguably the 787 of its day, the 787 is not the DC-3 and its development difficulties reflect this. The DC-3 was the third derivative of an advanced, efficient design that packaged leading-edge technologies and materials together for the first time. Chronologically, the 787 is arguably more analogous to the DC-1 at this early stage. From a technology perspective, the 787's composite primary structure and more-electric architecture make it a larger leap than Douglas's adoption of advanced, but relatively mature features.

Rather than comparing relative leaps in 1930s versus 2000-era technology, the most relevant lessons apply to systems engineering, and the manner in which the two designs were brought together and built. The DC-1 emerged from a rapid-prototyping environment of the sort that later made Lockheed's original Skunk Works so effective. A closely knit design, engineering and manufacturing team was able to evolve swiftly, going from first flight of the DC-1 to service entry of the DC-3 in less than three years.

Contrast that with the story at Boeing, which—eager to pursue the global manufacturing model pioneered by McDonnell Douglas—has suffered as a consequence. It has endured so many delays caused mainly by supply-chain issues that four years will likely pass between rollout of the 787 and its long-awaited entry into service. Combined with the challenges of introducing new technologies, the logistics problems posed almost insurmountable issues that almost certainly will be faced by other ambitious projects such as the Airbus A350. Given the prolonged development of the A380, the longer-than-expected evolution of the 747-8, the stretched schedule for the A350 and 787, it now seems longer development cycles of 9-10 years are the new norm compared with the 5-7 years for prior generations.

BY ADRIAN SCHOFIELD
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COMMENTARY

STANDING DOWN

The major global and U.S. airline groups face a transition in 2011, with the exit of high-profile leaders who have played a key role in shaping aviation policy debates in recent years.

Giovanni Bisignani is retiring as director general of the International Air Transport Association (IATA), to be replaced by Cathay Pacific Airways CEO Tony Tyler. Meanwhile, James May is leaving the U.S. Air Transport Association (ATA) as veteran lobbyist Nicholas Calio takes over. While the issues may be all too familiar this year, the industry could see a different approach from its new figureheads.

Outgoing Lufthansa CEO Wolfgang Mayrhuber describes Bisignani as being like espresso: "small, very strong and beloved all over the world."

The former Alitalia CEO took over as head of IATA in 2002, and has gained a reputation for outspoken advocacy and a grueling travel schedule. He has not been afraid to ruffle feathers worldwide by criticizing government policies, airports and air traffic control organizations.

One of IATA's major achievements under Bisignani was forging industry consensus on an emissions reduction approach. Liberalization has been another policy thrust, headlined by IATA's Agenda for Freedom effort. Bisignani oversaw the establishment of the IATA Operational Safety Audit, which is now an industry-wide standard.

However, Tyler will inherit some big challenges. The environmental issue has certainly not gone away, and IATA and other groups will have to work hard to ensure the industry approach prevails. Airlines will want IATA to continue the momentum on liberalization, and to hold the line on ATC and airport charges despite expensive new programs.

In the U.S., the success of the ATA during May's eight-year tenure is defined to a large extent by the damage averted. True to its "do no harm" message, ATA has fought off a slew of proposed government mandates and fees. The ones that alarmed airlines most arose during the FAA reauthorization process, but will likely not be in the final bill.

ATA helped drive new legislation targeting oil price speculation, and May has kept the FAA's focus on producing near-term benefits from its NextGen modernization program. He has also garnered broad acceptance of the fact that the government must help airlines equip for NextGen.

While Calio is a relative newcomer to the aviation industry, he is well connected with the Republican establishment thanks to his senior roles in both Bush administrations. He is also well regarded by leading Democrats. The ability to work with both parties will be crucial with a divided Congress.

European Union emissions allowance (EUA) prices drifted further in December to end the year on a weak note as buy-side support dried up.

EUAs for delivery in December 2011 took up the front-year position on the forward price curve after December 2010 over-the-counter contracts went to expiry on Dec. 1.

December 2011 EUAs closed at €15.10 ($20) per metric ton on Dec. 1, and drifted lower through the month to close at €14.05 on Dec. 24, which was the lowest price since July 27.

Traders said buyers were still present in the market but were not buying in sufficient volume to drive prices higher. The thin trading conditions also exaggerated the effects of a lack of buy-side support.

Some traders said companies with a natural shortage of EUAs such as utilities would be expected to re-enter the market in the first quarter of 2011 as they seek to hedge forward sales of power.

The weakness seen on carbon prices during November and December was also underpinned by rising coal prices, which make the emissions-intensive fuel less profitable for power generators, prompting those that can to burn cleaner natural gas.

Coal for delivery into Northwest Europe climbed from $104.40/metric ton on Nov. 1 to $117.75/metric ton on Dec. 24—the highest price for more than two years.

As expected, the United Nations climate change talks in Cancun, Mexico, did not see much progress on a possible extension of the Kyoto Protocol's binding emissions reductions for industrialized countries, which expire in 2012.

However, the gathering did lead to agreements that aim to further reduce global emissions, and helped to rebuild some of the trust lost between nations at the 2009 talks in Copenhagen.

Daily Emissions Price Assessments
September - December 2010 EUA, CER Prices

PD = Price Differential, euros per metric ton
EUA = European Union Emissions Allowances for December 2011 delivery
CER = U.N. Certified Emission Reductions for December 2011 delivery
Source: Platts Emissions Daily

The Cancun package includes an agreement in which both industrialized country emissions reduction targets and developing country voluntary actions are officially recognized under the multilateral process. Countries formally recognized the role of market mechanisms to achieve emissions reductions, and agreed to report their emissions on an annual basis.

It was also agreed to boost Kyoto's Clean Development Mechanism to increase investment in emissions reduction projects in developing countries, and to design a Green Climate Fund under the U.N. to deliver climate finance to developing countries.

Frank Watson/Platts/London

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

BY FRANK MORRING, JR.

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COMMENTARY

March Target

Mercury raises questions as Messenger nears

This image of the planet Mercury is a day-long time exposure designed to reveal its comet-like tail of gas streaming away from the Sun. NASA's Stereo-A solar probe captured the image, which shows a feature much brighter than would be expected from the sodium gas tail that can be seen from Earth. The U.S. space agency's Messenger probe is set to reach Mercury on March 18, becoming the first spacecraft to orbit the innermost planet. But scientists already are using the Stereo data to determine what other gases may be flowing away from the planet's surface into the tail under the pressure of solar radiation. The tail was spotted first in the Stereo mission's online database by Ian Musgrave, an Australian medical researcher and amateur astronomer. He alerted astronomers at Boston University. "A joint study was started and now we have found several cases, with detections by both Stereo satellites," says Jeffrey Baumgardner, the senior Boston researcher who designed the optical instruments that found the tail.

BOSTON UNIVERSITY-CENTER FOR SPACE PHYSICS

BILLION-BUCK BIRDS

Boeing will provide a satellite system to the Mexican government that will serve secure military and civil communications needs throughout the country and its surrounding waters under a new prime contract worth $1.03 billion. The Mexsat system will comprise three satellites, two ground stations and other equipment. Boeing will build the Mexsat-1 and 2 mobilesat services spacecraft based on the company's 702HP bus. Each will supply 14 kw. of payload power and carry a 22-meter L-band reflector, complemented by a 2-meter K_u-band antenna. Mexsat-3, which will provide fixed satellite services, will be manufactured by Orbital Sciences Corp., based on its Star-2 bus. It will generate about 3.5 kw. of power and carry 12 active extended K_u-band and 12 active extended C-band transponders. The Mexsat system will provide Internet and voice-over-Internet protocol services in remote regions of the country and adjacent waters. Boeing beat a proposal from Space Systems/Loral for the job. In addition to Orbital, Boeing's supplier team includes ViaSat, Harris Corp. and Hughes Network Systems.

SCIENTIFIC SPACEFLIGHTS

Researchers who need microgravity to test new technologies may be matched with potential commercial suborbital-flight providers through a new solicitation by NASA's Office of the Chief Technologist. Under the arrangement, bidders will be able to propose technology payloads for parabolic atmospheric flight and suborbital spaceflight to help the U.S. space agency reduce risk as it expands its commercial spaceflight program. "During these flights, researchers will be able to test their technologies in a range of microgravity environments and share their data with NASA [for] planning future missions," says Chief Technologist Bobby Braun. Based at Dryden Flight Research Center at Edwards AFB, Calif., the Flight Opportunities Program will hold open its solicitation for suborbital flights until the end of 2014. Deadline to apply for the first round of flights is Jan. 31, and potential commercial suborbital-flight providers will have until Jan. 20 to respond to the agency's request for information. A number of companies developing reusable suborbital human-rated vehicles for space tourism have also offered their seats and cargo space for research as a way to broaden the market for their services.

MOON DATA

Three companies will receive $500,000 data-delivery orders from NASA for work on a commercial risk-reduction initiative for the development of robotic lander technologies suitable for missions to the Moon, near-Earth objects and other Solar System destinations. Astrobotic Technology Inc. of Pittsburgh; Dynetics Inc. of Huntsville, Ala.; and Moon Express Inc. of San Francisco are among six companies selected by NASA in October to participate in the Innovative Lunar Demonstrations Data (ILDD) project led by the Exploration Missions and Systems Office at Johnson Space Center. All three companies also are participating in the Google Lunar X-Prize, an international competition to reach the Moon with rovers capable of traversing at least 500 meters (1,640 ft.). NASA's $30-million, five-year ILDD project is intended to identify and address technical risks associated with launch, in-space maneuvering, braking and landing systems. In November, NASA asked the six companies to submit strategies for addressing their top risks as well as capturing the test data. The data purchases could form the basis for hardware developed by NASA for future human and robotic missions.

BY JAMES R. ASKER

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COMMENTARY

Gathering Storms

More fights loom on defense spending

With the New Start treaty with Russia overwhelmingly ratified by the Senate, the "don't ask, don't tell" policy repealed, and streamlined defense authorization language ready for presidential signature, the end of 2010 saw significant defense-related achievements for the Obama administration on Capitol Hill. But the victories are overshadowed by a slew of unfinished business, and 2011 is shaping up to be an even harder year for getting just the basics accomplished. Increasingly at risk are appropriations for the last seven months of Fiscal 2011, as well as the administration's entire Fiscal 2012 budget request. The latest stumbling block emerged last week with reports that an unidentified White House official is saying the 2012 request will not be unveiled until at least mid-February—a week or more after it is normally delivered to Congress—due to turnover at the top of the White House Office of Management and Budget. The current continuing-resolution funding for the government runs out March 4, and the upcoming debates mean lawmakers will spend longer than a year—they started in February 2010—to finalize spending for the current fiscal year, which started Oct. 1, 2010. Besides funds for continuing the General Electric-Rolls Royce F136 alternative engine for the Lockheed Martin-led Joint Strike Fighter and implementing the administration's vision for space exploration (*AW&ST* Dec. 13, 2010, p. 20), the political fights could hold up new appropriations for the Defense Department and every other federal agency as congressional Republicans look to restrain federal spending—and block the full implementation of the administration's 2010 health care reforms. If there is a silver lining for most of the industry, it is that House Republicans, who will control their chamber, will target personnel, military benefits and the broader costs the U.S. bears to provide global and regional security instead of going after savings from weapon systems spending. Capital Alpha Partners, an investment group that talked with some Republican officials, avers, "While there will be more focus on reining in federal spending, we did not hear of any single major weapons program that was a direct target for cuts, nor did we get the sense that there is any sort of move to focus on industry profitability."

NASA/BILL INGALLS FILE PHOTO

'I will take every action available to me to support the deployment of all four phases.'

PRESIDENT OBAMA

GIVING CREDIT

A new pact that streamlines how government-backed export credit agencies should support sales by aircraft manufacturers is expected to win approval soon. The draft agreement reached Dec. 22 by the intra-government Organization for Economic Cooperation and Development (OECD) would eliminate differences in financing support for large and regional aircraft and tighten lending terms to minimize the gap between export banks and commercial lenders. The deal has been presented to Brazil, Canada, the European Union, Japan and the U.S. for final approval, which could come as soon as Jan. 20 and take effect on Feb. 1. The Air Transport Association, the U.S. airline industry's lobbying arm in Washington, says the changes are "an improvement" over the current OECD agreement but do not go far enough to eliminate the competitive advantage that foreign airlines get from their access to export credit.

RESTARTING THE DEBATE

One unexpected beneficiary of last month's Senate ratification of the New Start nuclear arms reduction treaty was missile defense programs, with Republicans squeezing an explicit commitment out of President Barack Obama himself while sowing new seeds of doubt over his sincerity. New Start opponents, including Sen. James Inhofe (R-Okla.) and George W. Bush administration U.N. Ambassador John Bolton, openly doubt Obama's commitment to developing U.S. missile defenses. The president, in turn, sent letters to lawmakers underscoring his administration's devotion to a defense system once loathed by Democrats. "Regardless of Russia's actions in this regard, as long as I am president, and as long as the Congress provides the necessary funding, the United States will continue to develop and deploy effective missile defenses to protect the United States, our deployed forces, and our allies and our partners," Obama wrote Dec. 18. He further promised that Russia does not have veto power over the European Phased Adaptive Approach (EPAA), the Lockheed Aegis-based system favored by his administration in place of the Bush administration's so-called Third Site of the Boeing Ground-based Midcourse Defense system, and that the entire EPAA plan will be deployed. "I will take every action available to me to support the deployment of all four phases," Obama declared.

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OUT OF THE M

Beijing rolls out a holiday surprise—a heavyweight, long-range combat aircraft bigger than the F-22

BILL SWEETMAN/WASHINGTON

China's first known stealth aircraft just emerged from a secret development program and was undergoing high-speed taxi tests late last week at Chengdu Aircraft Design Institute's airfield. Said to be designated J-20, it is larger than most observers expected—pointing to long range and heavy weapon loads.

Its timing, Chengdu's development record and official statements cast doubt on U.S. Defense Secretary Robert Gates's 2009 prediction (in support of his decision to stop production of the Lockheed Martin F-22) that China would not have an operational stealth aircraft before 2020.

The debut of the J-20 was announced in a November 2009 interview on Chinese TV by Gen. He Weirong, deputy commander of the People's Liberation Army Air Force. The general said a "fourth-generation" fighter (Chinese terminology for a stealth fighter) would be flown in 2010-11 and be operational in 2017-19.

The J-20 is a single-seat, twin-engine aircraft, bigger and

New Chengdu J-20 fighter has a canard delta configuration with all-moving vertical tails and fixed ventral fins. Taxi tests at Chengdu airfield started Dec. 22.

Forward fuselage of the J-20 resembles the Lockheed Martin F-22 Raptor, but the J-20 is much longer and is comparable in size to the General Dynamics F-111 strike aircraft of the 1960s.

MIST

PHOTOS VIA CHINESE INTERNET

heavier than the Sukhoi T-50 and the F-22. Comparison with ground-service vehicles points to an overall length of 75 ft. and a wingspan of 45 ft. or more, which would suggest a takeoff weight in the 75,000-80,000-lb. class with no external load. That in turn implies a generous internal fuel capacity. The overall length is close to that of the 1960s General Dynamics F-111, which carries 34,000 lb. of fuel.

The J-20 has a canard delta layout (like Chengdu's J-10) with two canted, all-moving vertical stabilizers (like the T-50) and smaller canted ventral fins. The stealth body shaping is similar to that of the F-22. The flat body sides are aligned with the canted tails, the wing-body junction is clean, and there is a sharp chine line around the forward fuselage. The cant angles are greater than they are on the Lockheed Martin F-35, and the frameless canopy is similar to that of the F-22.

The engines are most likely members of the Russian Saturn AL-31F family, also used on the J-10. The production version will require yet-to-mature indigenous engines. The inlets use diverterless supersonic inlet (DSI) technology, first adopted for the F-35 but also used by Chengdu on the J-10B—the newest version of the J-10—and the Sino-Pakistani JF-17 Thunder.

The main landing gears retract into body-side bays, indicating the likely presence of F-22-style side weapon bays ahead of them. The ground clearance is higher than on the F-22, which would facilitate loading larger weapons including air-to-surface munitions. Chinese engineers at the Zhuhai air show in November disclosed that newly developed air-to-ground weapons are now required to be compatible with the J-20.

Swept and canted "caret" inlet shape is combined with diverterless supersonic inlet technology, with a blended bulge at the top inner corner to push boundary-layer airflow away from the inlet without ramps, slots or perforations.

Features at the rear of the aircraft—including underwing actuator fairings, axisymmetrical engine exhausts and the

The delta wing has marked conical camber. Single-wheel main-landing-gear units retract forward into body sides, suggesting the presence of side weapon bays. The doors seen here close when the aircraft is taxiing.

ventral fins—appear less compatible with stealth, so the J-20 may not match the all-aspect stealth of the F-22. There are two possible explanations for this: Either the aircraft seen here is the first step toward an operational design, or China's requirements do not place as much stress on rear-aspect signatures.

The major open question at this point is whether the J-20 is a true prototype, like the T-50, or a technology demonstrator, with a status similar to the YF-22 flown in 1990. That question will be answered by whether, and how many, further J-20s enter flight testing in the next 12-24 months.

Developing an effective multi-mission stealthy aircraft presents challenges beyond the airframe, because it requires a sensor suite that uses automated data fusion, emission control and low-probability-of-intercept data links to build an operational picture for the pilot without giving away the aircraft's own location.

Ventral fins may be part of a prototype configuration, to be reduced in size or eliminated after further development of the flight control systems.

A rapid development program would be a challenge for China's combat aircraft industry, which is currently busy: The J-10B, FC-17 and Shenyang's J-11B and carrier-based J-15 are all under development. However, the progress of China's military aviation technology has been rapid since the first flight of the J-10 in 1996, owing to the nation's growing economy and the push by the People's Liberation Army for a modernized military force in all domains. Before the J-10, China's only indigenous production combat aircraft were the Shenyang J-8 and Xian JH-7, reflecting early-1960s technology from Russia and Europe.

J-20 prototype is most likely powered by Russian's Saturn engines, either AL-31Fs or the new 117S. China has an intensive program to develop indigenous high-performance engines. Orange object above the tail is a brake parachute housing.

Engine development has lagged airframe development, with reports that the Shenyang WS-10 engine, slated to replace Russian engines in the J-11B, has been slow to reach acceptable reliability and durability levels. That may not be surprising, given that high-performance engine technology is founded on specialized alloys and processes that often have no other uses. (The existence of the J-11B, essentially a "bootleg" version of the Su-27, has been a strain on relationships between the Russian and Chinese industries.)

Progress with avionics may be indicated by the advent of the J-10B, with new features that include a canted radar bulkhead (normally associated with an active, electronically scanned array antenna), an infrared search-and-track system, and housings for new electronic warfare antennas.

One question that may go unanswered for a long time concerns the degree to which cyberespionage has aided the development of the J-20. U.S. defense industry cybersecurity experts have cited 2006—close to the date when the J-20 program would have started—as the point at which they became aware of what was later named the advanced persistent threat (APT), a campaign of cyberintrusion aimed primarily at military and defense industries and characterized by sophisticated infiltration and exfiltration techniques.

Dale Meyerrose, information security vice president for the Harris Corp. and former chief information officer for the director of national intelligence, told an Aviation Week cybersecurity conference in April 2010 that the APT had been little discussed outside the classified realm, up to that point, because "the vast majority of APT attacks are believed to come from a single country."

Between 2009 and early 2010, Lockheed Martin found that "six to eight companies" among its subcontractors "had been totally compromised—e-mails, their networks, everything," according to Chief Information Security Officer Anne Mullins.

The way in which the J-20 was unveiled also reflects China's use and control of information technology to support national interests. The test airfield is located in the city of Chengdu and is not secure, with many public viewing points. Photography is technically forbidden, but reports suggest that patrols have been permitting the use of cell phone cameras. From Dec. 25-29, these images were placed on Chinese Internet discussion boards, and after an early intervention by censors—which served to draw attention to the activity—they appeared with steadily increasing quality. Substantial international attention was thereby achieved without any official disclosures.

Numbers Matter

China's huge air force, advanced missiles call for new U.S. air combat capabilities

DAVID A. FULGHUM/CANBERRA, AUSTRALIA

Australian analysts are starting to examine how combat between the U.S. and China over the Taiwan Strait might play out and what's needed to produce a win for small, high-tech forces.

Wargaming, including an extensive simulation by Rand, has shown that the U.S. would generate a 6-1 kill ratio over Chinese aircraft, but the Americans would lose. Even if every U.S. missile destroyed an opponent, there would still be enough surviving attackers to shred U.S. tankers, command and control and intelligence-gathering aircraft, says Andrew Davies, program director for operations and capabilities, Australian Strategic Policy Institute (ASPI) in an interview with Aviation Week.

"The reason [the U.S.] lost was because the Chinese sortie rates and persistence carried the day," Davies says. "Any American aircraft was operating out of Guam or Okinawa because the airfields in Taiwan were taken out in the first half hour [of the conflict]. So [U.S.] time on station over the Strait is quite limited."

Another issue is where U.S. Navy aircraft would be based. "The issue that the U.S. has is, can the aircraft carrier get close enough to the fight?" Davies says. "The Chinese have been working since the [Taiwan] Strait crises of 1995-6 to deny the approaches to China to a carrier battle group. That's why basing becomes an issue. A study that Rand did not formally publish has a scenario in which the attacking Chinese forces take as many losses as there are American missiles, but there were enough left for them to get among the [airborne] tankers and P-3s [reconnaissance] and [RC-135W] Rivet Joints [intelligence-gathering aircraft].

In fact, China now appears to have an operational anti-ship ballistic missile to threaten aircraft carrier groups at sea. Last week (Dec. 28) Adm. Robert Willard, commander of U.S. Pacific Command said he believes the ASBM "aircraft carrier killer" has achieved initial operational capability even through it will continue undergoing testing for several more years. In the past, U.S. Navy officials have told Aviation Week that the chances of hitting a moving aircraft carrier with a ballistic missile are miniscule, but even the threat of such a missile would cause the carriers to be moved farther away from any Asian battle site.

"I would say that the military balance is undoubtedly shifting as China's military expands faster than other regional nations," Willard told a reporter for Japan's *Asahi Shimbun* newspaper. "We have not seen an over-water test of the entire [ASBM] system. "The anti-access/area-denial capabilities, fully employed, will present a challenge to military operations in the region. That will have to be overcome."

U.S. NAVY

The USS Harry S. Truman, like most aircraft carriers, is packed with short-range fighters. Enemy standoff weapons can increase the distance they have to fly and limit their time over targets.

Such analyses prompted Davies to begin to analyze what really matters in terms of airpower for the U.S. and Australia in a potential confrontation with China. "Global air power [will require] long-range, stealthy, high-altitude aircraft that can stick around forever," he contends. "They are basically an area-denial asset. They have powerful sensors so that if anything moves in their [sensor suite's] footprint, it does so at great peril."

That's why Davies thoughts turned to high-persistence drones. These unmanned aircraft do not need to be B-2-sized, but perhaps a bit bigger than an F-15, is his early estimate. Unmanned aircraft will offer high persistence, particularly if the weapon load is not too big—something like the high precision Small Diameter Bomb.

Directed-energy weapons using high power microwaves, radio frequency pulses or lasers will become a part of the aircraft's suite to attack sensors and communications.

Boosters of modern airpower hold up operations in Kosovo and Iraq as examples of how successful advanced technology is. But Davies questions whether pitting a handful of modern aircraft against minor military powers is a fair test.

"That's an awful lot of money being spent to be able to kick around third-rate countries," he says. "The silver-bullet platforms are fantastic . . . where a small number of them can completely overwhelm a relatively small power. "

But when up against China, a small, high-tech force suddenly does not look as great.

"China has got thousands of redundant MiG-21s," Davies points out. "Why not make them into drones? What if each one absorbs one of the four missiles that an F-35 can carry. A MiG-21 drone is not a significant threat, but if you [face] a thousand of them and only [have] 200 missiles, you can be overwhelmed."

Testing Progress

Aircraft are flying more frequently, but F-35 testing enters 2011 with some key objectives hanging

Stovl test aircraft BF-4 carried the burden of mission-systems testing in 2010 due to delays in flying other avionics-equipped aircraft.

LOCKHEED MARTIN

GRAHAM WARWICK/WASHINGTON

Flight testing of Lockheed Martin's F-35 Joint Strike Fighter enters 2011 at a stepped-up pace, but with many key 2010 objectives still unmet and significant program changes looming.

While the program exceeded its year-end target of 394 flights, the objectives of clearing the conventional-takeoff-and-landing (CTOL) variant to begin pilot training, and the short-takeoff-and-vertical-landing (Stovl) version for training and initial ship trials, were not accomplished as planned in 2010.

Testing required to obtain "ready for training" (RFT) flight clearance for the CTOL F-35A is expected to be completed in January, says J.D. McFarlan, vice president of F-35 test and verification. RFT is required to fly the first production F-35s, which are not covered by a development flight-test clearance.

The first low-rate initial production (LRIP) batch of F-35As, aircraft AF-6 and -7, are slated to be delivered to Edwards AFB, Calif., by May to help with development testing, while the LRIP 2 batch, beginning with AF-8, will be delivered to the Eglin AFB, Fla., training center.

RFT clearance for LRIP 1 and 2 involves a limited flight envelope of 350 kt., Mach 0.8 and 4g, plus initial mission-system functionality, says McFarlan. Additional testing planned for 2011 will expand the flight envelope for LRIP 3 aircraft to 550 kt., Mach 0.95 and 7g, and add mission-system capability. Aircraft have already been flown to 580 kt., Mach 1.3 and 7g during risk-mitigation tests, he says.

For the Stovl F-35B, RFT clearance involves both conventional-flight and powered-lift modes, including initial ship clearance, and has been pushed into 2011 by delays caused by mechanical-reliability issues with the test aircraft. These are being overcome, says McFarlan, with the monthly flying rate increasing over the second half of 2010.

While the F-35As at Edwards have each been averaging 10 flights a month since June, the F-35Bs at NAS Patuxent River, Md., have struggled to match their productivity. "But the last few months have shown Stovl is capable of that rate," he says, with three aircraft each flying nine times in November.

"Stovl has not caught up, but the pace is quickening," says McFarlan. Failure-prone cooling fans have been replaced and a unreliable upper lift-fan door actuator redesigned, and no problems were experienced in the last quarter, he says.

Vertical landings, halted since September after the discovery of wear on auxiliary inlet-door hinges, are set to resume this month. McFarlan says some hinge components have been redesigned and operation of the lift-fan door rescheduled to reduce airloads on the auxiliary doors during semi-jet-borne flight.

The lift-fan door was programmed to open to 65 deg. below 120 kt., and to 35 deg. above that airspeed. But with the large door fully open, loads on the auxiliary-inlet doors behind it are reduced, so the schedule has been changed to keep the lift-fan door open 65 deg. up to 165 kt. during a short takeoff, he says.

The program has logged only 10 vertical landings since March 2010, seven of which count toward the 40 required for initial ship clearance. Originally set for March, ship trials are now slated between August and November. This window is based on when the LHD-class amphibious assault carrier can be modified with instrumentation to measure the ship environment during Stovl operations.

Flight testing so far shows the up-and-away handling qualities for all three variants are good, including during aerial refueling and crosswind landings, McFarlan says. Mission-system software stability has been good "and we are pleased with the sensor performance. There is tremendous capability in the radar and electronic warfare system."

Nose wander in transonic maneuvers has been tackled with changes to control-surface scheduling and air-data calibration, and updated flight-control software was released at the end of the year. This is expected to also correct discrepancies between predicted and measured sideslip angles and control-surface loads. Engines with design changes to reduce screech and allow use of full augmentor are being installed.

Wing roll off has been experienced during transonic maneuvering in the CTOL F-35A, but was expected and planned solutions have worked so far, McFarlan says, including scheduling of leading- and trailing-edge flap positions and rates. Roll off occurs when the shockwaves on the wing do not move symmetrically as angle of attack changes.

The same solutions will be tested on the Stovl F-35B and F-35C carrier variant (CV), which because of its larger wing has been fitted with pop-up spoilers as a precaution. "We will try the aerodynamic techniques first," McFarlan says. F-35C test objectives for 2011 include RFT clearance and land-based catapult and arrestor testing at NAS Lakehurst, N.J.

Overall, F-35 flight testing ended 2010 close to its goal of more than 3,700 test points, but while the CTOL F-35A and F-35C CV were well ahead of plan, Stovl and mission-system testing fell short. More than half the test points required for Stovl RFT and ship clearance remain to be accomplished in 2011.

A major replan of the F-35 program is to be announced by early February.

Industrial Agenda

U.K. grapples with new defense industry policy

ROBERT WALL/LONDON

The British government plans to unveil a new defense and security industrial and technology policy this year that will spell out the national industrial capabilities deemed essential to meet national security needs, even in an age of austerity.

If the discussion in 2010 in U.K. defense circles was all about the Strategic Defense and Security Review (SDSR) that saw a range of high-profile defense programs cut—from the Nimrod MRA4 maritime patrol aircraft to the early retirement of the Harrier GR.9 fleet—then 2011 is shaping up to be the year in which the government aims to tackle long-standing policy and defense management issues that have similarly profound implications for the country's defense industrial base.

A central element is the three-month comment period kicking off Jan. 5 (to be concluded by April 1) that is part of a green paper released on Dec. 20 entitled: "Equipment, Support, and Technology for U.K. Defense and Security: A Consultation Paper." It is the building block on which a policy white paper will be based.

Last month, the government also named Bernard Gray as the procurement czar for the Defense Ministry. Gray was the author of a hard-hitting critique of the U.K. military procurement process highlighting many of the shortcomings in the system that led to overruns. Starting on Jan. 4, Gray now has a four-year mandate as chief of defense materiel to fix many of the problems he lamented.

In making the appointment, Defense Secretary Liam Fox says that "unlike many others who talk about the problems facing defense procurement, he talks about solutions. He will provide clear direction and leadership to [the Defense Equipment and Support organization] during the very challenging time ahead and will be a huge asset to the Defense Board and the civilian leadership team in defense."

In July, a defense reform panel is due to make its recommendation on changes for the Defense Ministry, including in the realm of acquisition.

The planned acquisition reform efforts and defense industrial and technology policy review will be closely watched by industry. Several senior industry officials have indicated they are concerned the Conservative-Liberal Democrat coalition government that took power in May has been more indifferent to industry's concerns than the previous Labour government. While there was a recognition that during the conduct of the SDSR such distance was required, recent months have seen growing concern the government is not as willing to listen to the views voiced

by the aerospace and defense sector.

In reaction to the formal launch of the green paper on Dec. 20, Ian Godden, president of the Aerospace, Defense and Security lobbying group says that "this will help industry—from large multinationals to small and medium-sized businesses—engage fully with the [Defense Ministry], the Home Office and government more widely in order to identify what the government requires of industry to support our armed forces and as a major contributor to wealth creation in this country."

One area some industry officials have expressed concern over is support for exports, which the government vowed to strengthen. The green paper reiterates the government's commitment to across-ministerial support for such sales.

MBDA

The Fire Shadow concept emerged from the U.K. Team Complex Weapons initiative sparked by the last defense industrial review.

Another area to be addressed in the pending policy is how the government plans to deal with equipment competitions or strategic purchasing to sustain national capabilities. In its green paper, the government echos the tenets of the previous Defense Industrial Strategy. The DIS, spelled out in December 2005, aimed to balance the need for maintaining key skills with buying off-the-shelf, and created several funding initiatives, such as Team Complex Weapons, to preserve capacities deemed essential.

The green paper states that "our default position is to use open competition in the global market, to buy off-the-shelf where we can, and to promote open markets in defense and security capabilities. We will take action to protect our operational advantages and freedom of action, but only where essential for national security." The policy is designed to inform spending decisions for the next few years, at least until the next SDSR which is planned for 2015.

"A key priority, therefore, is identifying the handful of critical areas where the U.K. has or needs an operational advantage and freedom of action for a particular capability, where we may have to take action to sustain the underpinning technologies and skills in order to protect our national security. To achieve this, especially at a time of financial challenge, may involve encouraging innovative approaches to and opening up wider markets for important capabilities."

The effort to devise a new industrial strategy is more complex this time around than five years ago, not just because of greater fiscal austerity, but also because the U.K. already has committed to increasing cooperation with French defense industry on a range of projects, some of which remain to be defined. That is already reflected in the green paper, which states that "acceptance of greater mutual dependence on some of our key allies" may be required.

The green paper, for the first time, combines defense and security in its review, and also addresses cybersecurity, which the government has singled out in the SDSR as a major area of focus and one of the few spending areas projected to see growth. The government has yet to spell out how it will spend the additional £650 million ($1 billion) earmarked for cybersecurity in the next few years. It is also a domain in which government plans to work particularly closely with the private sector, with details due to emerge this year when the "Cyber Security Strategy" is unveiled.

The green paper provides little guidance on what defense industrial skills the government plans to protect, although it notes that defensive measures against chemical and biological weapons are one area in which the country wants to have independence.

In addition, the green paper highlights several science and technology areas in which it believes a more effective, cross-government strategy is required, including activities in the realms of space, autonomous systems, nanotechnology, neuroscience, sensor systems, cyberspace and energy.

One segment of industry that will be monitoring the outcome of the industrial policy review particularly closely is small and medium-sized enterprises. While Britain's top-tier aerospace and defense companies have long become less dependent on their small domestic market—BAE Systems derives the bulk of its revenue from the U.S.—for lower-tier companies the revenue picture is often different.

The government signals it is eager to sustain a healthy cadre of subcontractors and is eying policies aimed at sustaining smaller firms. "We will consider whether [Defense Ministry] guidance should encourage procurement teams in certain cases specifically to welcome bids from consortia [of SMEs]," the green paper states. The government may also make the use of British SMEs a requirement when awarding sole-source contracts and, when programs are competed, bidding prime contractors may be required to furnish lists of likely subcontractors, including small businesses.

Another area to be scrutinized is support services. The U.K. has been increasingly looking to contractor logistics support in key areas. The green paper notes that the government is "currently looking into ways of developing our support activities with industry. This could include new employment models, looking at regular military, reserves, civil servants and contractors working alongside each other to deliver seamless assured support to our military commanders. We would need to be aligned in processes, procedures and information flows so that we can reduce costs, risks and administrative friction."

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End of an Odyssey

Engineers review options, operators relieved as Intelsat regains control of Zombie Sat

MICHAEL A. TAVERNA/PARIS

Intelsat is hopeful it can recover use of a wayward communications satellite that had wreaked havoc with operators around the world until it was finally shut down just prior to Christmas.

Dubbed Zombie Sat, Galaxy 15 went out of control on April 5, sending operators scrambling to protect their spacecraft from interference. During the next six months, the spacecraft flew by a dozen satellites, in some cases coming to within a tenth of the distance normally maintained between geostationary satcoms (*AW&ST* May 24, 2010, p. 23).

However, thanks to complex maneuvers—many of them invented from scratch—serious interference and service interruption were avoided. A U.S. National Weather Service outage on Dec. 4-5 that some bloggers imputed to Galaxy 15 was caused by local mechanical damage to cables on the ground and was unrelated to interference issues, according to executives from Intelsat and SES, another operator affected by Zombie Sat.

Intelsat officials say Galaxy 15 lost Earth lock on Dec. 17, causing it to lose enough power to shut down its primary C- and L-band payload, which constituted the most serious threat to neighboring spacecraft. On Dec. 23, the battery completely drained, shutting off the radio beacons and removing the remaining interference risk.

Engineers had initially expected Galaxy 15 to power down over the summer; but in the absence of telemetry data, the estimate had to be based on experience with other orbiting spacecraft, which proved unreliable.

The power-down caused the baseband equipment command unit to reset automatically, allowing Galaxy 15 to once again begin accepting commands and sending telemetry—permitting Intelsat to regain control of the spacecraft and place it in safe mode.

The next step will be to run comprehensive diagnostic tests and upload new command software patches that should make it possible to immobilize the satellite, which has been drifting steadily along an eastward track, and keep it from going astray again. Engineers will then try to move the satellite to one of Intelsat's orbital locations so the viability of the payload and the functionalities of the spacecraft can be determined.

In the second quarter of 2010, Intelsat took a $104-million impairment because of Galaxy 15, which was originally designed to operate through 2020. In the third quarter, the company said it might write down the residual value of the spacecraft, $34.2 million as of Sept. 30, if it is determined that it cannot be recovered.

ORBITAL SCIENCES CORP.

Although it approached a dozen spacecraft, Galaxy 15 did not seriously impact any, thanks to some clever engineering.

Regardless of the outcome, operators say the six-month ordeal has given the industry a rich toolbox to protect against future spacecraft loss-of-control events. Intelsat says it pioneered the maneuvers used in the first two fly-bys and other operators—SES, Telesat and SatMex—then injected their own expertise. This joint effort minimized the potential negative impact of each subsequent event.

SES Chief Technical Officer Alan Young says a three-pronged strategy developed for its AMC-11—a C-band satellite located at 131 deg. W. Long. that was the first affected by Galaxy 15—served as a basis in dealing with the Zombie Sat threat. Engineers first temporarily uplinked AMC-11 customers from a very large antenna in Clarksburg, Md. The antenna's narrow beam minimized the off-axis transmission to Galaxy 15 as it moved closer than the 2-deg. spacing normally allowed, limiting the interference that would otherwise occur. Engineers also changed the sensitivity setting on AMC-11 to minimize the amount of energy available to Galaxy 15 and so further reduce the interference risk.

In the final stages of the fly-by, when Galaxy 15 approached to within a dangerously low 0.3 deg. of AMC-11, engineers performed a "leap-frog" maneuver that permitted the two spacecraft to stay in sync and maintain a minimum spacing of at least 0.2 deg. until Galaxy 15 began moving away again. As an extra backup, engineers temporarily stopped another spacecraft, SES-1—which was passing through the 131 deg. W. Long. slot on the way to its 101 deg. W. position after an April 24 launch—to afford customers an alternate transmission path in the event the Clarksburg uplink failed.

The AMC-11 strategy proved useful in protecting other spacecraft from the Zombie Sat, including three heavily used "center of the arc" satellites that were approached by Galaxy 15 over a 21-day span in November-December, Young says. The "leapfrog" maneuver was carbon-copied on Nov. 24 for AMC-18, a C-band spacecraft at 105 deg. W., although this time no backup satellite was deemed necessary. Parts of the strategy were employed again on Dec. 4 and 15 for AMC-1, situated at 103 deg. W., and SES-1, but with a variation required because of their C-/K_u-band payloads.

For these satellites, engineers set up temporary uplinks at SES's Sunset Beach Earth station facility in Hawaii. At that point, Galaxy 15 had no coverage of Hawaii and thus could not interfere with signals uplinked from there. However, the antenna did not have sufficient power to handle all the traffic for AMC-1, so some customers had to be linked to Clarksburg, where there was still coverage. Because the separation during the AMC-1 flyby was particularly low—0.1-0.2 deg.—engineers decided to move that spacecraft slightly outside its normal station-keeping box. Young says this provided enough separation for engineers at Clarksburg to off-point the antenna so that Galaxy 15 could pass through its "null."

Back to Square One

Russia scrambling to put Glonass back on track after December launch flop

MAXIM PYADUSHKIN/MOSCOW and MICHAEL A. TAVERNA/PARIS

The Russian government is struggling to compensate for a Proton launch failure that dashed hopes of having a full 24-unit Glonass navigation satellite constellation in service by the end of 2010.

The mishap, which occurred on Dec. 5, destroyed three Glonass M spacecraft that would have ensured a full operating capability (see p. 29). As of Dec. 28, Glonass included 22 operational satellites, plus four in maintenance and two spares, sufficient for 99-100% global availability. A 24-spacecraft fleet is needed for full global coverage, including equatorial areas.

An interim inquiry report issued on Dec. 22 attributed the failure to a miscalculation that led to an oversupply of liquid oxygen to the Block DM upper stage, which is made by Energia. The report says company management also did not follow all pre-launch safety procedures, and subsequently failed to spot the miscalculation. Last week, Russian President Dmitry Medvedev dismissed Vyacheslav Filin, Energia's chief rocket and space system designer, and Viktor Remishnevsky, deputy head of Russian space agency Roscosmos, and issued an official reprimand to Roscosmos head Anatoly Perminov.

The impact of the failure was magnified by an unrelated matter that delayed the launch of the first of a new generation of Glonass K satellites, which had been set for Dec. 28 aboard a Soyuz 2.1.b booster from Plesetsk in northern Russia. Russian defense officials said the delay was related to completion of the ground control system.

To offset these setbacks, Perminov ordered engineers to put the two spare satellites into operation—one has already been positioned—and indicated the 2011 schedule will be readjusted to allow the launch of more Glonass spacecraft. Last week, he said a new attempt will be made in February to launch Glonass K. In the meantime, the spacecraft will remain in Plesetsk for further ground testing.

Although Glonass K will need to undergo extensive in-orbit trials after launch before it can be brought into operation, Russian space officials insist that the constellation will be able to reach its full operating capability this year. According to industry sources, all four of the spacecraft in maintenance are relatively new—the oldest was launched in late 2006 and entered operation in early 2007; the newest was orbited in December 2008 and incorporated into the system in January 2009.

Another two Glonass Ms are available as ground spares. Perminov said these can be lofted by midyear. More Glonass Ms are to be placed in production this year, industry officials say.

Both Medvedev and Prime Minister Vladimir Putin have given strong backing to modernizing and expanding Glonass. To show its commitment, the government is also moving ahead with efforts aimed at developing the user segment of the satellite navigation system. Yuri Borisov, deputy minister of industry and trade, said in December that production of Glonass receivers will grow to 500,000 units in 2011, up from 100,000 in 2010. At least 300,000 will go to government organizations for transport and other applications. To boost consumer sales, the government plans to increase the import tax on single-system GPS receivers to 25% from 5% while maintaining the tax on dual-system GPS/Glonass receivers at 5%.

ISS RESHETNEV

A new attempt will be made early next year to launch the first next-generation Glonass K, which was delivered in early December by ISS Reshetnev.

The measures parallel moves being taken to expand Glonass use in markets outside Russia, notably in India (*AW&ST* Nov. 1/8, 2010, p. 38).

Glonass K uses an unpressurized three-axis stabilized platform and has an operational lifetime of 10 years, versus seven for Glonass M and three for first-generation spacecraft. It will feature a code division multiple access signal format, as GPS does, in addition to the frequency division multiple access format used on Glonass M. The payload will be capable of beaming five different navigation signals, including a new civil L3 band signal.

Spatial Resolution

Italian space plan calls for broadband satellite program, shift in spending basis for ISS

ANDY NATIVI/GENOA and MICHAEL A. TAVERNA/PARIS

Liquid fuel rocket engines, high-speed Internet communications and hyperspectral imaging technologies are among the highlights of a new 10-year space spending plan drawn up by the Italian government.

The plan, unveiled last week by Italian Space Agency ASI, will also seek to shift more spending to domestic programs and spread the spending burden for the International Space Station (ISS) extension, currently awaiting approval by the European Space Agency member states, by making ISS utilization a mandatory ESA program.

As indicated at last year's Farnborough air show, the plan will include €7.2 billion ($9.5 billion) in space program outlays over the next 10 years, about level with the €750 million/year spending rate in the current three-year plan, despite severe pressure on the overall national budget (*AW&ST* July 26, 2010, p. 44). The plan does not include funding for Europe's Galileo satellite navigation program, which is funded separately.

However, the education and research ministry, which supervises ASI, says it will provide only €600 million/year, requiring the agency to look elsewhere for additional funding. A good portion of this is expected to come from the ministry of defense, which has pledged to continue covering its portion of costs for two major dual-use undertakings—the Cosmo-SkyMed Next Generation radar observation satellite system and the Franco-Italian Athena-Fidus telecommunication satellite network. Indeed, in its 2011 budget request, the defense ministry requested additional money for space programs (*AW&ST* Dec. 13, 2010, p. 54).

Continued financial support from the economic development ministry is also anticipated. In addition, ASI intends to rely increasingly on private industry through public-private financing schemes, which Chairman Enrico Saggese strongly supports.

A major aim of the new 10-year plan will be to balance spending between ESA projects and domestic programs. Italy currently contributes €400 million each year for ESA missions. ASI managers want to decrease this to €350 million within five years to free up more money for national projects.

Of €6.4 billion currently expected to be spent through 2019—allowing for funding contingencies—€2.65 billion has so far been earmarked for ESA programs and €1.1 billion for national missions. Under the new plan, an additional €1.3 billion will be made available for new ESA projects, leaving €1.3 billion available for new domestic undertakings.

Some of this will be used to expand bilateral science cooperation with France and Germany, the two main European space powers, and NASA, with which Italy has a long-standing relationship. But Rome also wants to boost cooperation with Russia and emerging space powers such as Argentina, Brazil, Kenya, Israel and India.

The ASI plan will also aim to refocus spending so it is concentrated on specific areas of technological excellence built up over the years under previous plans, Saggese says, echoing the thinking behind a new strategic plan unveiled recently by Germany. "We have to avoid re-inventing the wheel." Education and Research Minister Mariastella Gelmini says the goal will be to demand appropriate strategic, technological and industrial returns for every euro spent on space missions—including on ESA programs.

One priority of the ASI plan will be extending use of the International Space Station—for which Italy has supplied a large amount of hardware, including the Columbus orbital facility and Automated Transfer Vehicle (ATV)—to 2020 and beyond. However, the agency wants outlays for the ISS extension to be shared among more European nations so expenditures do not fall disproportionately on the countries, such as Italy, that bore the brunt of development costs (*AW&ST* Nov. 29, 2010, p. 30). The option favored by Italy would be to change ESA's rules for funding ISS utilization so the station is financed through the ESA mandatory budget, instead of via the optional program, as is currently the case.

The plan provides for at least four astronauts, including two recently qualified, for both short (10-day) and long (6-7-month) missions.

A second priority of the 10-year plan will be to build on the ongoing Athena-Fidus project to deploy a domestic high-speed broadband satellite system, using a K_u-band orbital slot at 9 deg. E. Long. Like a similar initiative in France, the project will be implemented by a private operator through a public-private financing arrangement.

Another objective of the plan will be to expand remote sensing capability into the hyperspectral optical domain. Italy recently inked a framework agreement with Israel to build a twin-satellite hyperspec-

Liquid fuel engines developed under Italy's plan could improve the capability of the Vega launch vehicle, set to enter service this year.

ESA

tral system, Shalom, drawing on experience from Italy's Prisma demonstrator, currently in development (*AW&ST* Dec. 13, 2010, p. 14). Radar imaging technology will be sustained, with at least two new-generation Cosmo-SkyMed satellites launched every seven years, and operational life of these low-Earth-orbit satellites will be increased if possible.

ASI also wants to expand space launcher know-how beyond solid rocket motors and boosters, which Italy supplies for the Ariane 5 heavy-lift rocket and Vega light launcher programs. The agency has asked national aerospace research center CIRA, which it took over last year, to begin work on oxygen/methane liquid fuel and hybrid engine technologies that Italy intends to earmark for an upgraded version of Vega as well as the New Generation Launcher that will follow Ariane 5. ASI will also remain a major funder of undertakings within ESA's Future Launcher Preparatory Program, in particular the Intermediate Experimental Vehicle, which is to be launched by Vega in 2013.

Proton's Back

Speedy return permits timely liftoff of Eutelsat high-throughput K_a-band satellite

MICHAEL A. TAVERNA/PARIS

International Launch Services's Proton M booster is back in business, following launch last week of Eutelsat's KA-SAT.

The rocket's return to service, only three weeks after a Proton Block DM failure that grounded the entire rocket line, was made possible by the nature of the Dec. 5 mishap, which allowed investigators to quickly rule out factors linked to Proton M. But it also doubtless reflects the improved quality assurance, reporting and inquiry procedures introduced by the Russian Space Agency, ILS and Proton prime contractor Khrunichev after a pair of Proton M shutdowns in 2007-8.

Both ILS and archrival Arianespace insist that the ability to quickly rebound from a failure has sharply reduced launch risk.

The 6,150-kg. (13,560-lb.) KA-SAT lifted off from the Baikonur Cosmodrome in Kazakhstan at 3:50 a.m. local time on Dec. 27 and was released into geostationary transfer orbit 9 hr. and 12 min. later.

The launch had initially been set for Dec. 20 but was scrubbed pending an inquiry into the Proton DM incident, which destroyed three Glonass spacecraft (see p. 27). Although a preliminary report on Dec. 10 exonerated the Proton M, mission managers decided to give engineers further time to review the findings before resuming the launch campaign.

A subsequent interim report on Dec. 22 imputed the failure to a liquid oxygen overload on the Block DM upper stage, clearing the Proton M, which uses a Breeze M upper stage, for a return to operation. A final report is due out shortly.

The mission was the eighth of the year for ILS, which is responsible for commercial Proton flights, and the 12th overall for the Proton vehicle. ILS also recorded its seventh order of the year last week, for Satmex 8, to be orbited in the third quarter of 2012.

KA-SAT is the second in Europe designed for broadband—after Avanti Communications's Hylas-1, launched Nov. 26 atop an Ariane 5—and the first of a new generation of high-throughput spacecraft that are expected to dramatically improve the competitiveness of satellite communications compared to terrestrial cable networks. Capable of providing 70 Gbps. of K_a-band capacity, the Astrium-built spacecraft will serve more than 1 million households and businesses in Europe and the Mediterranean Basin from a perch at 9 deg. E. Long. The satellite is equipped with 82 spot beams and 10 gateways connected to the Internet.

A second high-throughput satellite, ViaSat-1, is due to be orbited early next year by ILS. Hughes Network Systems and Inmarsat have also ordered 100-Gbps.-class K_a-band satellites, which are expected to increase bandwidth by a factor of 10 and to offer costs comparable with terrestrial fiber.

INTERNATIONAL LAUNCH SERVICES

With a capacity of more than 70 Gbps., KA-SAT will reach more than 1 million homes and businesses across Europe and the Mediterranean Basin.

MICHAEL MECHAM/AW&ST

Sikorsky's use of composites for the CH-53K fuselage prompted it to turn to outside specialists, including Spirit.

Composite Entry

Sikorsky turns to composite specialists to help triple lift of Marines' CH-53

MICHAEL MECHAM/WICHITA, KAN.

Spirit AeroSystems was in the early days of designing the most intricate of Boeing's single-wind composite sections for the 787 when Sikorsky sought it out to make the main fuselage for the CH-53K for the U.S. Marine Corps.

Sikorsky had used composite fuselage assemblies in its helicopters for years, but they were not major structures. To reach that manufacturing level, the Stratford, Conn., company knew it needed outside expertise if it was to satisfy the Marines' expectations for a complete remake of its 1982-vintage CH-53E Super Stallion, says Sikorsky Military Systems President Mick Maurer. The Marines have 152 CH-53Es in service, not enough to support the nine heavy-lift squadrons they are allocated. The full CH-53K purchase of 200 rotorcraft would give them that ability, says Deputy Assistant Navy Secretary Thomas Laux. If implemented, that contract will be worth $20-30 billion to Sikorsky and its suppliers.

Among the requirements for the Marine Air-Ground Task Force (MAG) is a helicopter that can take standard U.S. Air Force 88 X 108-in. 463L pallets directly from a C-17 without the tedious task of breaking down their loads to fit 48 X 48-in. wooden pallets, as must be done on CH-53Es. The MAG also is looking for a helicopter that can lift 27,000-lb. payloads at sea level in 100F conditions and fly them 110 nm. to 3,000-ft.-high dropoff points. The -53E's limit under those circumstances is 7,600 lb.

Additionally, the Marines want the new helicopter, which has an 88,000-lb. gross takeoff weight, to have sufficient armament to allow it to routinely operate behind enemy lines, says Marine Col. Robert Tobin, 3rd. The -53E is not rated for such assignments. The MAG wants "forward basing with increased reliability and increased survivability" but with the same shipboard footprint as the CH-53E, he says.

The new rotorcraft is to carry 37 troops (55 with center-line seating), have a 170-kt. maximum speed and a basic range of 620 mi. Its armament includes a .50-caliber tail gun—not found on the CH-53E—besides two side guns. It also carries defenses for man-portable air defense systems.

"The CH-53K is the only major helicopter development project underway in the world," says Laux, a former CH-53 program manager. He asserts that it meets the "do more without costing more" mandate advocated by Pentagon acquisition chief Ashton Carter. As to the $1.1 billion in added costs and any other effects of a three-year development delay, Laux says he's confident that Sikorsky and its suppliers are now on track.

Spirit's contract is for seven aircraft: the first ground-test prototype rolled

MICHAEL MECHAM/AW&ST

GKN produces the composite aft transition (see "Marines" symbol), which Spirit integrates into the fuselage before shipping to Sikorsky for final assembly.

out here Dec. 16, static and fatigue articles, and four flight-test aircraft. The company expects to receive its first low-rate-production contract in 2014. CH-53K service entry is set for 2018.

Sikorsky's initial talks with Spirit in 2006 came only a year after Boeing spun off its division here to Canada's Onyx Corp. Those talks were before the new company, Spirit AeroSystems, produced its most spectacular composite component—the Section 41 nose for the 787. But the factory had experience in composite assemblies and a major profile as builder of the 737-800 fuselage on which Boeing was developing the P-8A Poseidon anti-submarine patrol aircraft for the U.S. Navy. "That's one reason they were so interested in us," says Spirit's chief operating officer, Buck Buchanan.

A CH-53K production order will bring Spirit its first pure military contact and further enlarge its manufacturing presence. Besides working on every Boeing program, Spirit has gained major new commercial contracts from Airbus, Gulfstream and Mitsubishi since its spinoff. Of the CH-53K work, Buchanan says, "it's less than 5% [of revenues] but it gets us going."

The cabin Spirit builds is 15% larger than the CH-53E's and a complete redesign, although the rotorcraft's total length of 99 ft. requires no more deck space than the -53E's. The cabin is 30 ft. long, 8.5 ft. high and 10 ft. wide. The cockpit is 8 ft. long.

The fuselage is basically four large pieces—12-ft.-wide, full-length left- and right-side skins; and a 10-ft.-wide, 30-ft.-long top and bottom. Unlike the 787 nose, which Spirit delivers with wiring, tubing and systems installed, the CH-53K's fuselage is a basic composite shell, although it has some embedded tubes, Buchanan says. It will be built in an International Traffic in Arms Regulations-compliant facility on the opposite side of the Spirit campus from the 787 factory.

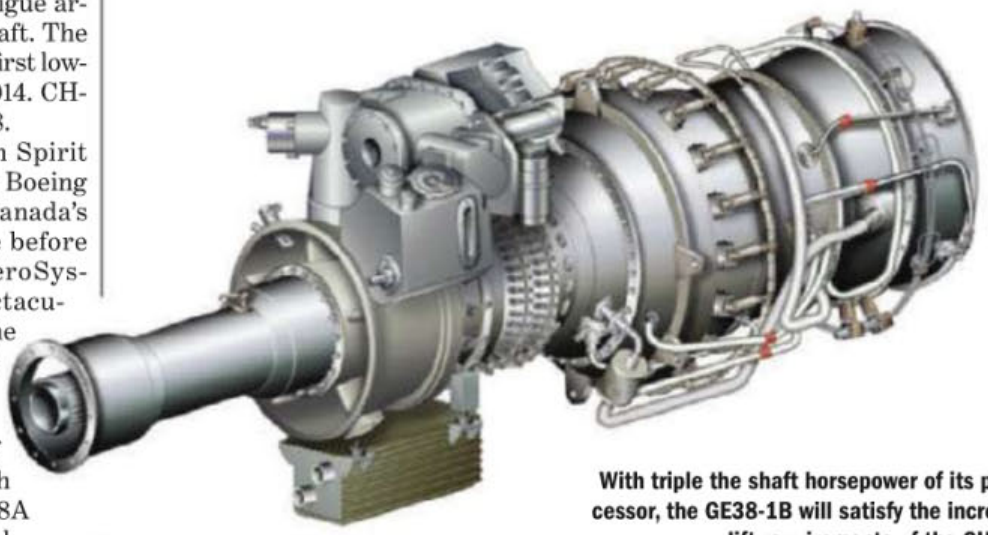
In the cockpit is a Rockwell Collins avionics management system that includes a next-generation design for a common avionics architecture. Tobin says one advantage of fly-by-wire is the redundant linkages it brings in flight controls against enemy fire over mechanical systems.

The fuselage includes sponsons from ITT Aerospace of Salt Lake City that house components such as the main landing gear, fuel, and mechanical and electrical assemblies, freeing space in the cabin. Because the sponsons are made of composites, Sikorsky says they "represent a significant technology advancement" over metal for operations in harsh environments.

The aft transition is from GKN Aerospace of St. Louis. Spirit integrates it with the main cabin before shipping the complete fuselage to Sikorsky's Assembly and Flight Operations in West Palm Beach, Fla. The first shipment was made on Dec. 23.

The new helicopter will fly with three GE Aviation GE38-1B engines developing 7,500 shp. each. They upgrade the three 4,380-shp T64-GE416/416As on the CH-53E. The first engine to test (FETT) run was last spring in Lynn, Mass. First engine deliveries are set for the second quarter. As of Dec. 10, the GE38 engines had run 305 hr. with 332 starts in test.

The aircraft uses a single 49-ft.-dia., seven-blade rotor. Hamilton Sundstrand is contributing a new auxiliary power unit that achieved FETT last July in San Diego.



GE AVIATION CONCEPT

With triple the shaft horsepower of its predecessor, the GE38-1B will satisfy the increased lift requirements of the CH-53K.

MICHAEL MECHAM/AW&ST

One Marine priority was to increase internal space so that pallets can be loaded directly from C-17s.

HondaJet Progresses

The aircraft is now in flight-testing phase with certification targeted for 2012

WILLIAM GARVEY/RIDGEFIELD, CONN.

Although two years behind its original development and delivery schedule, HondaJet certification testing is underway and the manufacturer hopes to begin deliveries of the light jet—Honda's first commercial aircraft—in late 2012.

"We'll try to keep this momentum to keep to the schedule," says Michimasa Fujino, president/CEO of Honda Aircraft Co.

The first production-conforming HondaJet launched on Dec. 20 on a 51-min. flight out of Piedmont Triad International Airport in Greensboro, N.C., where the airplane company is headquartered. Two more aircraft are to join in the flight-test program by summer, while another pair will be devoted to structural testing. Construction of the first of the latter pair is completed.

According to Fujino, the aircraft's GE Honda HF120 turbofan engines, rated at 2,095 lb. thrust, are expected to receive FAA certification this year, with the aircraft and its production facility gaining their respective authorizations next year.

The company, a wholly owned subsidiary of Honda Motor Co., reports orders in hand for "well over" 100 of the $4.5-million jets, and Fujino says plans now call for delivering 30-40 within the first six months of certification.

Some 20+ years in development including more than 500 hr. of flight tests in a proof-of-concept aircraft, the HondaJet is distinctive for mounting its engines on pylons atop the wings, a configuration its designers maintain improves aircraft performance and fuel efficiency by reducing drag. The design also allows for a more spacious, five-passenger cabin while reducing ground detected noise, they say. The natural laminar flow wings are aluminum, while the fuselage is composite construction. The cockpit features a three-screen Garmin G3000 avionics suite with touch-screen controllers.

HONDAJET PHOTOS

The first FAA-conforming HondaJet used the 10,000-ft. Rwy 5R at Piedmont Triad International Airport for its maiden flight.

Honda created the airplane subsidiary in 2006, and broke ground on a large headquarters, research and development, and manufacturing complex in Greensboro the following year. The offices and R&D center are now in place; the 266,000-sq.-ft. production facility is expected to be completed early this year.

Initially, HondaJet deliveries were to begin in 2010, but that target slid as a result, the company says, of unspecified vendor difficulties. The delay happens to coincide with one of the steepest sales declines in business jet history, with light jets suffering the most.

Fujino says that despite severe erosion in order backlogs among rival manufacturers, HondaJet orders have remained pretty much intact, with relatively few cancellations offset by new sales. "Even in this very tough market, we don't have any significant cancellations," he says. Furthermore, he expects the overall economy will have strengthened by the time HondaJet deliveries begin in earnest, boding well for further sales.

HondaJet competes most closely as an entry-level jet with the Phenom 100, which entered service in 2008, and the CJ1+, manufactured by well-established jet makers, Embraer and Cessna, respectively. At program launch, Piper Aircraft had agreed to collaborate on HondaJet sales and service. However, Piper subsequently began development of its own light jet, the $2.5-million Altaire, powered by a single Williams FJ44-3AP, and the arrangement with Honda has apparently been dissolved.

Asked if other models are planned, Fujino says, "we cannot sustain a company with one product," but declined to speculate on what might be the next aircraft. He did say that future models might not feature the engine-over-wing design, but would likely incorporate concepts that are equally innovative.

Honda Aircraft now employs about 550 people and expects to add 150-200 incrementally as it ramps up for full production.

Original plans called for the HondaJet to be powered by the HF118, a small turbofan developed by Honda. However, engine performance was considered less than ideal, prompting Honda to partner with General Electric and create GE Honda Aero Engines in 2004 with the express purpose of developing and manufacturing turbofan engines in the 1,000-3,500-lb.-thrust class. The HF120, the first product of the 50/50 partnership, will be initially manufactured at GE's Lynn, Mass., plant, but then transfer to Honda Aero Inc.'s facility in Burlington, N.C.

The HondaJet's afternoon flight took place in sunny, VFR conditions at Piedmont Triad Airport, Greensboro, N.C.

Shining Light

Alfred Kahn's legacy continues to shape industry 30 years after deregulation

DARREN SHANNON/WASHINGTON

While Alfred "Fred" Kahn's life focused on teaching economics and his love of Gilbert and Sullivan, his brief, but explosive, involvement with aviation as the champion for ending government control of route allocation and pricing will continue to reverberate across the industry.

Kahn's life was shaped by the Great Depression; so much so that he stopped studying his first love, theater, for economics, and by 1937 was leaving New York University (NYU) with bachelor's and master's degrees in the subject; by 1942 he had completed his Ph.D. From there, he helped with the war effort from Washington, but a career in academia called, and by 1947 he joined the faculty at Cornell University, where he would remain connected until he succumbed to cancer at home in Ithaca, N.Y., on Dec. 27. He was 93.

That move to academia suited Kahn, but three years after publishing his 1971 call for deregulation, "The Economics of Regulation," he was approached to head the New York Public Service Commission. At first he balked, but after talking with a close friend he grasped the opportunity to apply his theories in the real world.

Those theories espoused the freedom of market forces, and while in New York, he relaxed the state's control of public service companies supplying electricity, gas, telephone and water.

His efforts were quickly noticed, and when Jimmy Carter became president in 1977, Kahn was the only one considered to oversee the deregulation of the country's airlines, an initiative that had been brewing for several years at the Civil Aeronautics Board (CAB) before he assumed the role of chairman.

What would become his most lasting legacy almost never happened, for Kahn was more interested in heading the Federal Communications Commission. But a telephone call from Sen. Edward Kennedy (D-Mass.), a champion of airline deregulation, persuaded Kahn to take the job, even though he admitted that most government appointees "can't possibly know less than I about the airline industry."

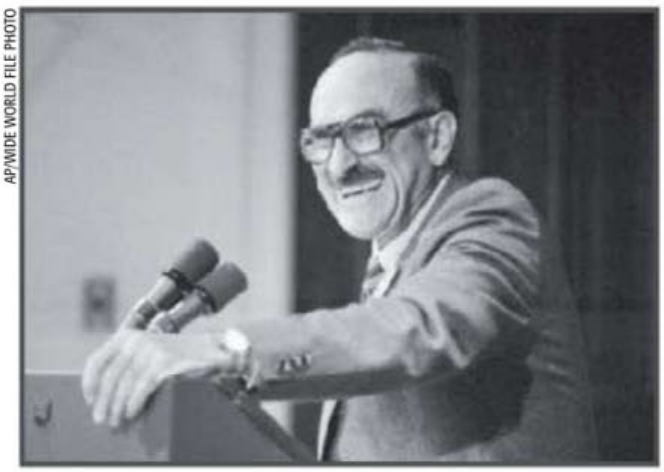
Those who worked with Kahn at CAB recall fond memories. "It was exciting, invigorating to work with Fred. You could argue with him, he wanted that, everything was up for grabs. He had none of the vanities of an insecure boss," says Michael E. Levine, one of the chief architects of the Airline Deregulation Act of 1978 and now senior lecturer at NYU School of Law. "There was a sense you were involved in something useful."

Robert Cohn, Kahn's executive assistant at CAB and currently partner at the Hogan Lovells law firm in Washington, notes that the new chairman: "Took his role seriously. And he took it as an independent adviser rather than an advocate. Fred wanted to do what was best."

What Kahn thought was best was not supported by all, especially by executives from the industry he was overhauling, who argued that his lack of industry expertise and the government's reliance on economists would produce misguided policies. Antics like Kahn's decision to reassign all dormant route authorities on a whim did not help the matter.

But even his critics respected Kahn, including Robert Crandall, who remains as vehemently opposed to deregulation as he was in the late 1970s. "I may have disagreed with Fred, but dealing with him was a pleasure," says the former American Airlines president and chairman. Crandall also recalls Kahn's humor and sharp tongue, which the economist spared from no one, not even President Carter.

AP/WIDE WORLD FILE PHOTO



Kahn at White House conference on regulatory reform in 1980.

Kahn's role was not simply to head the deregulation initiative. As Jeff Shane, a former undersecretary at the U.S. Transportation Department and now a partner at the same law firm as Cohn, recalls: "Deregulation needed someone to champion the cause, and Fred was the right person to do that."

Kahn was proud of deregulation, arguing that it saved consumers billions every year in reduced fares, and that it supported new entrants. In the years since, he acknowledged his failure to recognize the effects of overexpansion and that the law had some unintended effects on U.S. aviation. He blamed the financial disasters that followed on poor management, lax antitrust oversight and an ill-prepared FAA rather than deregulation.

His legacy permeates beyond the U.S. As consultant George Hamlin, an industry veteran, notes: "The U.S.'s ability to turn its airline industry on its head led the way for the rest of the world." Shane, meanwhile, points out that "today we talk about international liberalization. That would not have been possible without deregulation in the U.S."

Kahn left CAB in 1978. In the years since, he concentrated on topics closer to his heart, notably communications and energy policy, but always kept an eye on his creation, occasionally rising to defend his work or berate industry and government for failing to realize its potential. His influence on the industry was short in duration but long on impact, and it will be missed.

He leaves his wife, Mary, and three children.

Flying Again

Boeing resumes 787 tests and ponders revised certification target

GUY NORRIS/LOS ANGELES

Boeing is poised to issue a revised 787 program schedule following the resumption of flight tests on Dec. 23.

Initial flights will focus on an interim version of updated power distribution system software and are aimed at Boeing-specific aircraft systems evaluation rather than FAA certification, according to the company. The revised target for this milestone, as well as the planned first delivery to launch customer All Nippon Airways, is widely expected to be around mid-2011, or three to four months beyond the current mid-February schedule.

Boeing declines to comment on the extent of the potential schedule slide, but Scott Fancher, 787 vice president and general manager, says an assessment of the new timetable is expected sometime this month. "Initially, we will resume a series of Boeing tests that remain to be completed in the flight-test program. That will be followed later by a resumption of certification testing."

Flight trials resumed using ZA004, the fourth 787 test aircraft, following the completion of ground tests of an interim power distribution system software load by Boeing and Hamilton Sundstrand on Dec. 20. System verification included "laboratory testing of standalone components, integration testing with other systems, flight simulator testing and ground-based testing on a flight-test airplane," the company stated.

The new software load addresses problems uncovered with the original power system following an onboard fire on ZA002 at Laredo, Texas, on Nov. 9. Fire, caused by arcing with a loose washer or some other small foreign object, erupted behind the P100 panel, which takes the electrical power generated by the left engine and distributes it to aircraft systems. The nearly 3.5-ft.-tall panel is located below the passenger floor in the aft electronics bay just behind the wing. It contains electrical boxes, including control units, circuit breakers and relays.

Forensic evidence from the fire damage pinpointed one of two contactors in the P100 panel, CK2435505, as the

JOE WALKER

Tests of the updated power system on ZA004 included deployment of the ram air turbine (aft of wing).

Winds of Change

Greater understanding of aircraft wake turbulence may ease spacing requirements

ROBERT WALL/LONDON

In answer to a growing constraint problem at a increasing number of airports, Europe this year may introduce new rules on wake vortex separation aimed at potentially freeing up valuable capacity at the slot-constrained facilities.

The policy, still in the final stages of development, will assess several years of research to better understand the turbulence an aircraft leaves in its trail and how these disturbances are affected by such environmental conditions as crosswinds. Although specifics remain to be sorted out, Paul Wilson, head of airport operations and environment at Eurocontrol, says a 5-8% increase in capacity could result at slot-constrained airports.

While wake turbulence has been a concern of aviation safety officials for years, in Europe the issue has received increased attention recently regarding the A380 wake vortex separation standard. The initial separation characteristic was so severe, Airbus officials feared it could harm the business case for the aircraft because the additional seating capacity it offered could be undermined by the lower number of arrivals and departures related to wake separation.

Airbus pursued an extensive round of measurements to better define the actual wake vortex characteristics of the A380, which led to a gradual easing of the initial standard. Since then, Boeing 787 and 747-8 program officials have begun wrestling with large separation demands, at least during the test phases, and continue to collect data.

The National Transportation Safety Agency's stance is that a specific wake vortex of large aircraft should be determined, rather than relying on estimates used in the past. Wilson says refined wing designs and use of winglets are among the reasons that newer models are altering wake vortex patterns.

More data should emerge in the coming months. Airbus recently completed another round of A380 trials to gain a better understanding of the effect of the wake turbulence on the trailing aircraft, Wilson says, and has involved the European Aviation Safety Agency in the process. Data from the latest trials are now being analyzed. European officials suggest an A320 can fly 5 mi. behind an A380 without affecting operations.

Similar trials are underway in the U.S. At Boeing, laser radar measurements are being performed in the desert near Fresno, Calif., to compare the turbulence left in trail of a 747-400 and a 747-8. The data from those trials were recently handed to experts for analysis. The goal is to provide a more data-based

source of the ignition. The contactors are electrical control boxes that relay the power from the engine generators, and open or close circuits as power needs fluctuate. Contactor CK2435505, on top of the panel, was "melted," according to engineering reports, while the lower contactor—CK2421501—suffered "extensive fire and smoke damage to backside."

Fire from the contactor burned a 1-ft. hole in the back of the panel, and badly charred the adjacent fuselage insulation blanket material. However, while the review included the effectiveness of the insulation in preventing damage to the primary composite fuselage skin structure, the main focus was on why the system failed to automatically revert to the second power distribution system. Boeing insisted that basic standby functions kicked in as planned during the final descent into Laredo, and the crew retained positive control "at all times and had the information it needed to perform a safe landing." However the FAA is understood to have instructed Boeing to add extra time for electrical system testing and verification, including qualification testing for the planned extended twin operations (Etops) clearance for long-range single-engined operation at entry into service.

As part of the follow-on testing, Boeing plans to use the flight-deck systems' engineering development unit, ECAB-1, for a series of tests early on Jan. 3, which will evaluate revised head-down and head-up-display software. The second 787 that is expected to rejoin the flight-test effort is the initial aircraft, ZA001, which will come out of maintenance sometime after Jan. 3.

wake separation standard by the time the 747-8 enters service this year.

The A380 data analysis also proved that wind conditions could have significant effect on wake turbulence, which current standards do not reflect. Wilson notes that even when crosswinds of 30 kt. prevail, the separation standards remain. "We have data that shows that at 10 knots, [the wake vortex] is blown away." Additionally trials are planned this year to better define the situation.

Moreover, experts believe that under certain conditions, wake vortices generated on one runway do not blow across to a closely spaced parallel one. That could open up greater independent use of both.

One of the issues under scrutiny is building the safety case and ensuring that even if separation distances are relaxed, an adequate safety margin remains, even if winds change rapidly. The goal now is to devise "core procedures" that would be combined with meteorological data for specific airports so that rules could be tailor-made for facilities. Wilson hopes the first airports will be able to start operating with these rules before year-end.

WEI MENG

Big Bet

Smaller players are troubled by consolidation of China's air cargo markets

LEITHEN FRANCIS/SINGAPORE

China Eastern Airlines' planned takeover of Great Wall Airlines and Shanghai Airlines Cargo marks a major consolidation within China's air cargo market that may adversely affect a host of airlines of various sizes.

The Shanghai-based airline group told the Hong Kong stock exchange that its dedicated cargo carrier China Cargo Airlines plans to acquire the air cargo transport businesses and related assets of Great Wall and Shanghai Airlines Cargo. The assets include all aircraft, personnel, routes and contracts.

China Eastern already owns 51% of Great Wall and Shanghai Airlines Cargo, dedicated cargo carriers based at Shanghai Pudong International Airport. Great Wall's other owners are SIA Cargo with 25% and the Singapore government's investment arm Temasek Holdings with 24%. SIA Cargo, in turn, is buying a 16% stake in China Cargo. Meanwhile, Shanghai Airlines Cargo's 25% shareholder, Taiwan's EVA Air, is buying a 16% stake in China Cargo. The buy-ins are subject to regulatory approval and will result in China Eastern and China Ocean Shipping's stake in China Cargo reducing to 51% and 17% respectively, from 70% and 30%.

Great Wall and Shanghai Airlines Cargo never achieved economies of scale, but merging with China Cargo does provide critical scale. The combined entity will begin with a fleet of 20 aircraft. According to Ascend data, Great Wall has a fleet of three Pratt & Whitney-powered Boeing 747-400 freighters, Shanghai Airlines Cargo has two Boeing 757Fs and four MD-11Fs; while China Cargo has three Airbus A300-600RFs, two GE-powered 747-400Fs, four Boeing 777-200LRFs, two MD-11Fs as well as two 777-200LRFs on order. The two smaller carriers had no aircraft orders and were sourcing aircraft from their shareholders. Once the assets are combined, China Cargo will likely seek to simplify the fleet around 747-400s and 777s, say industry executives.

China Eastern's move is partly in response to increased competition from Air China, which recently sold a stake in Air China Cargo to Cathay Pacific Airways. Air China Cargo will be using the investment to expand its 747-400F fleet and to establish a hub in Shanghai, where China Cargo is based. Air China Cargo has eight 747-400Fs and one Tupolev Tu-204F with another four Tu-204Fs on order, according to Ascend.

The consolidation in China's air cargo market is in line with the general ethos of Li Jiaxiang, chief of the Civil Aviation Administration of China (CAAC). Since Li took over that post in 2008, many of China's smaller passenger airlines have either closed or been acquired by one of the country's big four carriers—Air China, China Eastern, China Southern Airlines and Hainan Airlines. Li, former chairman of Air China, believes in supporting the big four and ensuring that they are substantial enough to be significant players on the world stage.

Air China Cargo is reaching new heights, largely through hooking up with Cathay Pacific Airways.

The emergence of Air China Cargo and China Cargo puts pressure on Guangzhou-based China Southern Airlines Cargo and Shanghai-based Yangtze River Express. The latter two have no joint-venture partner. China Southern Airlines Cargo was looking to partner with Air France-KLM but that deal fell through in 2009 during the global financial crisis. Taiwan's China Airlines, meanwhile, sold its 25% stake in Yangtze in August back to Hainan Airlines Group.

Smaller cargo carriers also may find it tough to compete against China Cargo Airlines and Air China Cargo.

Lufthansa Group's joint-venture cargo airline Jade Cargo International has struggled and will probably continue to do so in the new competitive landscape. Jade, a joint-venture with Air China's Shenzhen Airlines, has seven 747-400s, according to Ascend.

Korean Air's Tianjin-based joint-venture cargo airline, Grand Star Cargo, still has only one aircraft, a 747-400F, even though it has been in operation for three years.

There are also two small Shenzhen-based cargo carriers Donghai Airlines and SF Airlines which operate 737-300Fs and 757Fs, respectively. The other small player, Tianjin-based Okay Airways, operates 737-300Fs on behalf of FedEx.

Cathay Pacific CEO Tony Tyler says Air China Cargo's main advantage is its access to the belly-hold on Air China's passenger aircraft. This provides Air China Cargo with a more comprehensive network in China—an important aspect considering that many of the country's export-oriented factories are leaving Shanghai and Guangzhou for smaller cities inland, he says.

China Cargo Airlines, too, could offer a comprehensive network by utilizing the belly-hold on China Eastern's passenger aircraft. But carriers such as Grand Star, SF, Okay and Donghai have no such opportunity. Foreign carriers that have been tapping China's booming cargo market, by flying to Guangzhou and Shanghai, may also find it hard to increase cargo traffic in the future, as these carriers lack a domestic China network.

Battle Lines

Firefly will operate leased 737-800s, but is considering A320s for future fleet

LEITHEN FRANCIS/KUALA LUMPUR

AirAsia is Southeast Asia's largest low-cost carrier, but it will face new competition from Malaysia Airlines' (MAS) Firefly, which will begin operating Boeing 737-800s this month.

MAS mainline had been vying against AirAsia by discounting excess seat inventory through "everyday low fares" promotions. "But by doing that, you run the risk of diluting your brand value," says MAS Managing Director and CEO Azmil Zahruddin. "We see that Qantas and Jetstar have been quite successful," he says, referring to that group's dual-brand strategy.

Firefly Managing Director Eddy Leong declares: "We won't be cannibalizing MAS because MAS focuses on premium travel, and we focus on value and the price-sensitive market. We took our time to learn this business, and we can operate it in a low-cost and simplified business structure."

The carrier, which celebrated its third anniversary in April, has nine ATR 72-500 turboprop aircraft with one more on order and due to be delivered this month. It also plans to take delivery of its first two 737-800s this month and use them to launch services on Jan. 15 from Kuala Lumpur International Airport (KLIA) to Kuching and Kota Kinabalu in eastern Malaysia.

Firefly's turboprop operation is based at Kuala Lumpur Subang Airport, but the 737s have to fly out of KLIA because the authorities allow passenger carriers to serve Subang only with turboprops. Leong dismisses suggestions that having two home bases will add cost and complexity to Firefly's business.

"We are already flying from different bases," Leong notes, adding that "we are flying from Subang and Penang." Penang is an island off western Malaysia. "It's really not a problem. Most of the support services at these airports are provided by MAS. The complexity is quite minimal," he adds. Firefly also has no intention of shifting its turboprop fleet to KLIA, says Leong. Subang is popular with consumers because it is closer to Kuala Lumpur's city center.

Firefly's 737-800s will be in a 189-seat all-economy configuration. AirAsia operates Airbus A320s in a 180-seat all-economy configuration. Leong says the -800s "can go up to six hours, so we can go to India and China if we want." He says Firefly will focus initially on domestic routes and then expand internationally with major cities in Southeast Asian countries high on his list.

Malaysia Airlines' turboprop operation Firefly is adding 737-800s this month.

FIREFLY CONCEPT

"Make no mistake, Firefly's fares will be extremely competitive and our service will be award-winning as well," says Leong. "Our unit cost, cost per ASK [available seat kilometer], will be the lowest in Malaysia," he says. The jet operation will make use of Firefly's existing infrastructure, in place for turboprops, and will also use MAS's resources, including engineering expertise.

Firefly plans to have six 737-800s by the end of 2011, all sourced from the leasing market, and its fleet plan calls for seven -800s to be added in 2012, seven in 2013, five in 2014 and five in 2015. Some of these will be purchased because in 2011's third or fourth quarter it plans to place an order for 30 narrowbodies, Leong says. Even though Firefly has chosen 737-800s to begin with, it will consider A320s for its purchase order, he adds.

The move to add jet services appears to have already sparked a price war. Firefly announced introductory one-way fares of 9 ringgit ($3) for flights between KLIA and Kuching and Kota Kinabalu. AirAsia responded by offering 1 million seats at zero fares.

"We have 96 aircraft and built a network of 145 destinations. We only fear ourselves," says AirAsia Group CEO Tony Fernandes. Besides Malaysia, AirAsia has affiliates in Indonesia and Thailand, and it is establishing joint-venture carriers in Vietnam and the Philippines. Fernandes says AirAsia will continue to expand in Malaysia at a faster rate than Firefly. And AirAsia has a stronger brand and a lower cost base than Firefly, he asserts. When asked if AirAsia might consider adding turboprops, Fernandes is dismissive: "Focus is why we succeed—sticking to our core business."

But there is no doubt Firefly's presence poses a challenge. Leong says his carrier aims to tap the growth in Malaysia's airline passenger market. However, it's too soon to predict whether Firefly's expansion will crimp AirAsia's growth, the same way that Jetstar capped the growth of Australian low-cost carrier Virgin Blue. Leong is diplomatic on this topic: "I don't know . . . we don't pay a lot of attention to outside people.

"We're focused on how to make the best out of the MAS group. We're not going out to outgrow the market, we're not doing it to outdo another business," but to better serve the market and add value to the MAS group, he says.

ATR

Lion's Wings Air has been moving into Indonesian domestic regional routes with ATR transports.

Boom Time

New Asian carriers aim to capitalize on the next travel boom

LEITHEN FRANCIS/SINGAPORE

A wave of new carriers will be entering the Asian market this year to fill the void created by players that exited earlier.

Economic growth in Asia is fueling demand for domestic air travel, and greater political stability is helping to attract foreign tourists.

Sumpun Pongthai, director of the flight standards bureau at Thailand's civil aviation department, says an air operator's certificate (AOC) has been issued to Jet Asia Airways. The carrier will fly an ex-SkyStar Airways Boeing 767-200 on routes between Thailand and South Korea, an important source of foreign tourists.

Moreover, in the coming weeks, the AOC for Crystal Thai Airlines may be finalized, says Sumpun. Crystal plans to operate Airbus A320s from Bangkok to Phuket, Thailand; Clark, Philippines; Cochin and Mumbai, India; Dubai, United Arab Emirates; and Seoul, South Korea.

Sumpun also says Legacy Air and Nakhon Chiangmai Air have received business licenses, signed by the transport minister, but still lack AOCs. Legacy plans to operate Saab 340s and Nakhon Chiangmai intends to fly ATR transports, say industry executives.

Thai Tiger—a new low-cost venture between Thai Airways International and Singapore's Tiger Airways—also plans to apply for an AOC and hopes to start A320 services in May.

Singapore's Tiger also recently placed two A319s with small Filipino carrier Seair, which is flying the aircraft internationally and marketing the flights through Tiger's website.

Competition in the Philippines is set to intensify further because Malaysia's AirAsia is establishing AirAsia Philippines in partnership with three Filipinos, one of whom is the cousin of the country's president. The new carrier aims to begin services during the third quarter of 2011.

In Malaysia, Heritage Air, a potential new carrier, plans to apply for an AOC and operate BAe 146s and Embraer ERJ 145s from its base in Malacca to destinations in Indonesia and Thailand. These aircraft have short-takeoff-and-landing capability, an important requirement as Malacca's runway is too short for A320s and Boeing 737s, says CEO Radzlan Abu Bakar. Heritage Air is privately owned but has the support of the Malaccan government, he adds.

Myanmar, meanwhile, had national elections in November—its first in 20 years—and the hope is that the country will now open up to the outside world and attract more visitors. Two would-be carriers are hoping to capitalize on this opportunity, and both are trying to secure ATR 72-500s, say industry executives.

The first, Air Kanbawza, derives its name from its owner, Myanmar's Kanbawza Bank, which in early 2010 bought a large stake in Myanmar Airways International. The other, Asian Wings Airways, is linked to Sun Far Travel & Tours, based in Myanmar. The two will fill the void left by Yangon Airways, which lost its AOC in December. (Myanmar's civil aviation department gave no public reason for its decision.)

Indonesia's airline industry is less dependent on foreign tourists than other Southeast Asian countries. It has a huge domestic market and big carriers: Garuda Indonesia, Batavia Air, Sriwijaya Air and Lion Air. These jet operators focus on larger domestic routes, making it harder for startups to penetrate this segment. But these carriers—with the exception of Lion's Wings Air—have ignored small regional routes, creating an opportunity for new players.

Sky Aviation is looking to enter this segment. The timing could be right because it will be filling the void left by Riau Airlines, a turboprop operator that shuttered its operations in November. Sky has been conducting air tours using four-seat Cirrus aircraft, but it plans to have scheduled flights using Fokker 50s, ATR 72s or both. It will serve Sumatra, the market that Riau Airlines exited.

Riau Airlines, meanwhile, is embroiled in a legal dispute with AeroCentury, the U.S. company from which it was leasing two of its five Fokker 50s. Riau also was leasing two BAE Avro RJ100s from BAE Systems, and industry executives say Riau owes money to BAE.

While AeroCentury and BAE have thorny relations with Riau Airlines, Indonesia remains a business interest. AeroCentury has been talking to Aviastar and TransNusa Air Service about leasing the two Fokker 50s. TransNusa recently bought an ex-Japan Air Central Fokker 50 from Nordic Aviation Capital (NAC). And BAE is busy pitching 146-200/-300s to Aviastar, which wants more of these aircraft, says an Aviastar executive. In October, Aviastar also acquired, from NAC, its first Fokker 50 and wants two more, the executive says.

Indonesia's smaller carriers are expanding rapidly to satisfy Indonesian laws that say all airlines must have at least 10 aircraft in 2012, five of which must be owned. This is a boon for aircraft vendors; but the laws will lead to market consolidation, since some carriers cannot afford to own five aircraft.

Capacity Overload

India plans new $2-billion international hub in Mumbai

NEELAM MATHEWS/NEW DELHI

India's commercial capital, Mumbai, is set to see a second international airport with a $2-billion price tag, as the city's international hub is so overcrowded that carriers are shifting flights elsewhere, especially to New Delhi.

In the past year alone, infrastructure and space constraints forced the civil aviation ministry to refuse permission to airlines from Bahrain, Dubai, Qatar, Oman, Singapore, Malaysia and Thailand to start operations in Mumbai, home to 18 million residents.

Long the nation's busiest hub, Mumbai lost that title to New Delhi in 2008. As the new year dawns, New Delhi will handle 96 more flights per day than Mumbai as major airlines, including Air India, shift to the capital city's better facility. Both Mumbai airports will offer domestic and international services, after the new one opens.

"The new Mumbai airport should have been running by now," says Civil Aviation Minister Praful Patel. As he contemplates the damage to Mumbai's tourism and business economy, he says the new facility should be running by 2015. If it isn't, he expects severe consequences for the country's financial center.

A greenfield airport has been selected in Navi (New) Mumbai, a suburb 50 km (30 mi.) southeast of the city center. The 1,405-hectare (3,471-acre) site is to have two runways and be built in four stages. It is expected to handle 10 million passengers initially, doubling to 20 million in eight years and 40 million by 2030.

Construction is slated to start in October, according to lead developer City and Industrial Development Corp. (Cidco). It will call for bids next month.

Political clearance has come after a three-year battle between the aviation and environmental ministries. Construction will require removing mangroves and a hill and diverting a river.

As with India's other private airports, Navi Mumbai will be developed through public-private partnerships. The public company will hold 74% of the shares, while the government-owned Cidco and Airports Authority of India will have 13% each.

Observers are looking for developers to learn from past mistakes. Cost control is essential to avoid inflated airport fees later, says Kapil Kaul, an India-based analyst for Sydney's Center for Asia Pacific Aviation. "Economic fitness is critical for investors to ensure returns are in tandem with cost logistics," an airport official adds.

One aviation industry analyst would like to see foreign partners play a larger role in Navi Mumbai than they have on past airport projects in India. "Unfortunately, many airport owners think they can run airports by edging their partners out," he says. "This does not help in bringing in professionalism."

Despite glitzy private airports in India, critics say they lack functionality. They point to the absence of a true fixed base operator anywhere in the country and no low-cost terminals. This is surprising, since 75% of all seats sold in India are by budget airline brands.

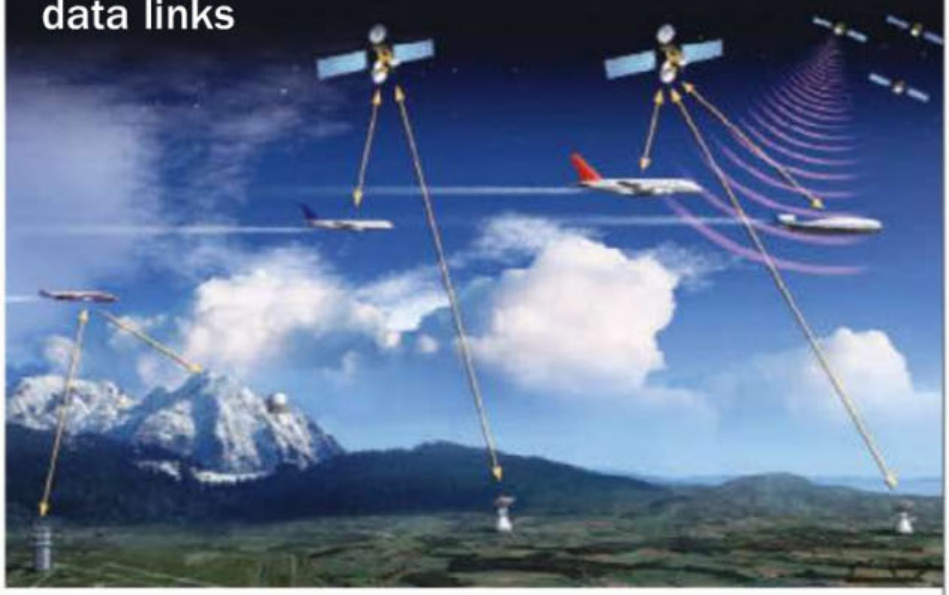
"In the next two years, Mumbai will have to look at a low-cost terminal, cargo logistics and general aviation," says Kaul. "Also, given the track record of Mumbai's [lack of infrastructure], it is essential that there is seamless road connectivity to the airport, which is currently lacking."

JOEPRIESAVIATION.NET

Overcrowding has been so severe at Mumbai International that the city is losing traffic to New Delhi. A new airport is slated to open in 2015.

Missing Link

Europe defers use of Egnos for air navigation, studies impact of sat-based data links



ESA CONCEPT

Concepts such as ESA's Iris call for using satellites to speed up pilot-controller communications.

MICHAEL A. TAVERNA/BRUSSELS

European planners hope the process to approve the use of the European GPS augmentation System (Egnos) can be put back on track, following the apparent correction of a problem with one of its monitoring stations.

Egnos was certified for air navigation in July and was expected to transition to operational use for en-route and non-precision lateral guidance approaches (LNAV) starting on Aug. 2. A formal declaration by the European Commission, which owns the system, approving the Egnos safety-of-life service was due by October or November.

However, a glitch with a monitoring station GPS receiver, which has been in service since October 2009, forced engineers to revert back to open service, delaying the start of air nav operations. Jose-Luis Fernandez, the service provision unit manager at the European Satellite Service Provider (ESSP), responsible for operating Egnos, said last week that the problem has been resolved and the fix is now being flight-tested.

Egnos was cleared for en-route and LNAV operations on Nov. 30 and a formal EC safety-of-life service declaration is now expected in mid-January, Fernandez says. France, which delivered the Egnos certificate on behalf of Eurocontrol, is expected to publish the first APV procedures. At least 30 of the 37 nations authorized to use Egnos are expected to publish operating procedures within the first year of operation, according to Eurocontrol, which together with the EC and the European Space Agency (ESA) helped fund system development.

Meanwhile, planners are looking at how other satellite-based systems can be integrated into air traffic management modernization plans without impacting their affordability. The European Union sees improved air traffic management as one of the chief beneficiaries of its new space policy, and space is a key focus of the EU's Single European Sky ATM Research (Sesar) program, the European equivalent of the U.S.'s NexGen initiative (*AW&ST* Nov. 1/8, 2010, p. 34).

So far, €120 million ($157 million) has been earmarked for satellite navigation, timing and communications activities within Sesar, says Patrick Ky, executive director of the Sesar Joint Undertaking (JU), responsible for implementing the program. The current priority is developing a controller-pilot data link communications (CPDLC) capability, that could substantially increase the traffic load handled by ATM systems.

The need for an efficient CPDLC is being driven by the evolution of ATM toward performance-based navigation (PBN) objectives like collaborative trajectory management, and the capacity limitations of the VHF channels currently used for controller-pilot communications. Bo Redeborn, Eurocontol's director for cooperative network design, notes that current CPDLC links used for Automatic Dependent Surveillance-Broadcast (ADS-B), which employs satellites to improve over-water navigation, entail latency lags that are not suitable for PBN.

In October, a Eurocontrol convergence working group began defining requirements for the CPDLC system, which could be satellite-based, terrestrial or, ideally, a combination of the two. The U.S., Japan and Russia are looking to participate.

Right now, says Ky, the idea is for a link specific to ATM, but planners are exploring broadening the concept to accomodate the exploding use of satellite communications on transport aircraft.

Ky notes, for example, that the still-unexplained loss of an Air France Airbus A330 over the South Atlantic last year is building support for integrating a capability that would permit the regular download of data from aircraft voice and data recorders, which can only be done via satellite. On Nov. 2, Sesar awarded Astrium Services a five-month study to explore the feasibility of doing this.

European planners hope a consensus on requirements can be reached by November 2012, when ICAO plans to address flight planning modifications. This would permit new CPDLC capabilities to be included by Sesar's 2020 in-service deadline.

The Sesar JU is investigating a half dozen options for CPDLC, including an ESA system known as Iris that could be proposed for full-scale development at ESA's next ministerial summit in 2012 (*AW&ST* Jan. 5, 2009, p. 43).

The JU hopes to agree on a requirement by the end of 2011 and to have a working concept within three years. However, Ky notes that final decision on whether to deploy a satellite-based system will depend on the ultimate cost, including ground and aircraft equipment, compared to other solutions, and whether airlines can be convinced the return is worth the investment. "Engineers are looking for the best technical solution for ATC, but airlines have their eyes on the business case," says Ky. "It's a big cultural change."

Engine Empowerment

Military production to benefit from worker-led commercial engine improvements

GUY NORRIS/LOS ANGELES

A wave of production efficiency changes developed on commercial engines is rolling through General Electric's military products as GE prepares to transfer F110 assembly to its production center at Lynn, Mass., from Texas.

The change gives employees responsibility for producing an engine from first module through testing, using processes developed and designed in-house. The "empowered workforce" concept is being initially introduced on the F414 line, which is currently running at a rate of roughly 100 engines per year. Early results show a 30% cut in labor hours and a 40% reduction in cycle time per unit says Maria Deacon, area executive and general manager of the Lynn facility.

Deacon led the introduction of the same process on the GE90, GP7200, CF34 and GEnx lines at GE's Durham, N.C., facility. But she says the changes are being introduced for different reasons. Whereas the move at the commercial line was to boost efficiency for upcoming production peaks, the Lynn move is aimed at improving processes, maximizing throughput and "challenging the old way of doing things."

The transformation was challenging, says Deacon, as the Lynn workforce was "traditionally very unionized and regulated." Although they were asked in the same way as the Durham employees to offer their own ideas and follow through on implementing them, the initiative "was more to do with changing the mind-set of employees, and making them think differently about how we assemble engines in the 21st century. Why would we not want to do it?"

Employees who would formerly be specialized at specific tasks such as rotor grinding or stacking rotors are now "empowered" to perform multiple tasks and work together on one engine serial number from start to finish. "We ask them to 'own' the whole engine, and they need to understand and work at each workstation. So they do a bit of everything and are truly multi-skilled," Deacon explains.

The transformation has not been without its challenges, she concedes, adding that the average age of the assembly worker is in the 50-55 range. However, following initial trials and the first shipment of F414s made under the new process six months ago, "we got the unions on board and that was one of the keys."

GE is now laying the foundations for similar changes on the T700 turboshaft and F110 lines, and plans to implement them on the upcoming GE38 turboshaft as well as the F136 Joint Strike Fighter alternate engine, which will be assembled here if it survives threatened funding cuts. The new process will also be introduced on the CF34-3 and -8C5 commercial engines, the latter having been transferred to Lynn from Durham in May to relieve pressure on the high volumes at the latter site.

The process on the F414 will be expanded to include the post-assembly test in early 2011, adds Jennifer Smith, plant leader for Lynn assembly test and overhaul. Smith, who came with Deacon from Durham to help oversee the transformation, says: "Before, they'd just see what their work assignment was for the day. But this really allowed us to do cross-training across the organization, so they weren't considering themselves as one-trick ponies anymore."

Although the CF34 and T700 are not set to move fully to the new concept until later this year, the T700 has "had a piloted build of it as a team," says Smith. Initial results were "the same sort of magnitude" as the F414, she adds. Similar initial work on the CF34 "is showing cycle reductions with the cross-training we've done. The -8C5 is showing a 25% cycle time reduction," she says.

The F110 will move to Lynn from its present assembly site at Kelly AFB, Texas. Savings are expected on this limited-production-run engine, which is currently forecast to see 12 delivered in 2011, 26 in 2012 and 43 in 2013. Improvements are also planned for the upcoming HTF120, currently in development at Lynn for the HondaJet business aircraft.

GENERAL ELECTRIC

Employee-led production improvements have cut F414 assembly cycle time 40%.

DECISION MAK

Tenacity and quick wits bring Jeff Smisek to the forefront of global aviation

DARREN SHANNON/WASHINGTON and CHICAGO

Legislators are notoriously opposed to the airline industry's current wave of consolidation, and that was clearly evident during a few weeks in June when Washington, suffering another of its blazing summers, was abuzz with fiery rhetoric and thundering diatribes against the proposed merger of two industry heavyweights. But as Continental Airlines' Chief Executive Jeffery A. Smisek sat next to his compatriot from United Airlines in the firing line of indignant lawmakers, he steadfastly refused to concede he was creating an anti-competitive behemoth, instead arguing that it would revitalize an industry "eking out an existence" while its international rivals increased market share.

Some lawmakers struggled with this concept, but importantly for Smisek his argument was accepted by the world's regulators, and in just six months—an unprecedented speed in mergers of this magnitude—they approved a deal that cements the return of U.S. operators to the top ranks of global aviation.

Those hearings were but a small part of a busy year for Smisek, who, while grappling with his own merger, also facilitated SkyWest Airlines' takeover of Continental's main feeder airline, ExpressJet—a deal that established SkyWest as the world's largest regional operator.

And the effect of the merger between Continental and United would quickly reverberate beyond the U.S. to Latin America, where executives at LAN Airlines and TAM Airlines, worried that the resurgence of regional powers like themselves would be stifled by the consolidation of their northern competitors, formed their own merger plan to create the first Latin American operation to rank among the world's powerhouses.

This was not the career 56-year-old Smisek envisioned when received his degree from Harvard Law School in 1982. Law appealed to the Air Force officer's son, and by the mid '90s he had risen to partner at Vinson & Elkins, where he specialized in corporate finance and securities law (and fortuitously for his future, mergers and acquisitions). But this changed in 1995 when Gordon Bethune convinced the lawyer that instead of trying to attract his business, he should switch careers and help pull a troubled Continental Airlines out of the doldrums.

"Back then it was clear he had a lot of spine," says Bethune.

His first task as general counsel was to relieve Continental from the financial and operational burden of a fleet of Airbus A300s. In an oft-told story, Smisek approached the carrier's lessors with a proposal that not only returned the aircraft, but also helped place them with new customers. "There were two things needed in the situation; the first was to make the decision, and then it had to be implemented. Jeff was the right man and was given charge of the negotiations," says Larry Kellner—an accountant also persuaded to join Bethune's management team—who rose to lead Continental as chairman and CEO from 2004-09.

"In these cases, where typically you would send in the

ER

LENNY GILMORE

lawyers, we did send a lawyer, but one that understood the long-term business implications of these negotiations," adds Kellner.

Both Bethune and Kellner note Smisek's intelligence and quick wit, and laud his ability "to not worry about making the hard decisions" and his honesty in negotiations. But there is also another side to the man. "I wouldn't want to be an adversary," says Bethune. "If you punch him you had better watch out."

These traits were clearly illustrated on the road to creating United Continental Holdings Inc.. For this, we need to go back several years, when Continental was being marginalized within the SkyTeam alliance, particularly by its domestic partners Delta Air Lines and Northwest Airlines, which were planning their own eventual merger in 2008.

Up to this point Continental had valued its independence, but the prospect of being the only U.S. airline without the financial and operational support of an alliance convinced management and the carrier's board of directors that it should seek some form of partnership. And just as this conclusion was made, along came United Chief Executive Glenn Tilton, a vocal advocate of consolidation who had been seeking a merger to solve his own company's fiscal woes.

The timing appeared serendipitous, and the two airlines conducted due diligence. But, as Kellner, by then Continental's top executive, recalls, there were doubters. "I was happy to have Jeff's counsel. We are not different in our goals, but we have different perspectives. Jeff was a leading voice in objecting to the merger."

Smisek tells a similar story. "A merger with United was always the right thing for Continental, it is good for our future, and there is very little network overlap. But a merger is always risky. Simply executing one is difficult. But in 2008 the economy was going into a dive, capital markets had closed down, liquidity was strained. We were both losing money and the price of oil was surpassing $100. There was just too much headwind.

"Strategically it is the right deal, but then it was the right deal at the wrong time."

As a result, Continental walked away from the merger contemplating a future as member of the Oneworld alliance, even though all the strategic models pointed to the Star Alliance, which was co-founded by United in 1999.

But Tilton had other ideas. Despite objections from his own senior managers and board members soured by their recent experience with Continental, he again approached Kellner and his team, this time with the promise of mentoring the Houston-based airline into its own alliance. Now there was no hesitation, and Continental duly accepted the offer and started the integration process that ended with its formal entry into the Star Alliance in October 2009. In hindsight, it also afforded the two companies a continuing due diligence that would make their eventual merger negotiations a formality.

But a merger was neither intended nor guaranteed. US Airways CEO Doug Parker, a fervent proponent of consolidation, was actively seeking a merger partner, and having failed in 2006 to persuade Delta to join forces, he had turned his attention to United. That deal, while not as operationally attractive as a Continental/United link-up, still provided a serious option for Til-

ton, and by early 2010 the two companies were nearing a definitive agreement. But then someone close to the secret talks leaked details to *New York Times* journalists.

This is where Smisek rose to the challenge. Time was limited and a major decision had to be made, one that meant the end of a brand he had helped resurrect and the loss of headquarters and operations in a different part of the country.

From a market perspective, Parker had the advantage. Continental had a history of faltering at such decisions, including a notable example in the late 1990s when Bethune ripped up an agreement with Delta, vowing never to hand power of his airline to another's CEO.

According to people close to the United/US Airways negotiations, the Tempe, Ariz.-based airline "still had at least a 50/50 chance of being the only offer around."

Smisek is matter of fact about those days in April. "If US Airways had succeeded, our only merger partner would have disappeared. There was no other option," says the man who now sits at the head of the combined United Continental. This argument was pivotal to his congressional testimony. While under attack for perceived anti-competitive tactics, Smisek held that the opposite was true: that his airline had no real growth opportunity and that without this merger Continental would eventually disappear.

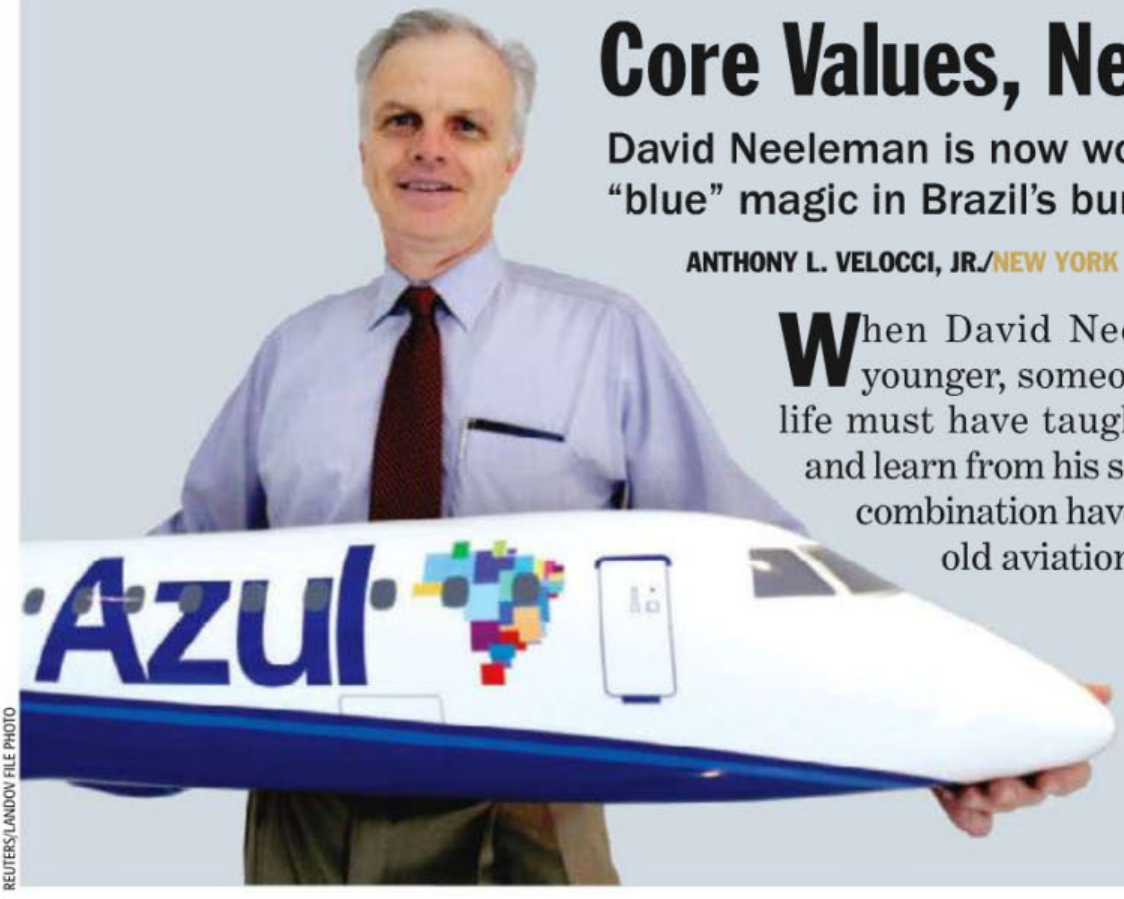
There were other elements playing in Smisek's favor that made the decision easier. Notably, his actions were defensive rather than aggressive, which allowed him to persuade critics within his own board and across Houston's business community that certain conditions—namely the lost brand and relocation—were necessary evils and that the alternative—going it alone—would eventually mean greater losses for all concerned. This freedom came with a small irony too, for Smisek had intended to approach Tilton about a possible merger in mid-2010, a move that surely would have enraged many close to the airline if Smisek had proposed the same deal he signed with Tilton.

Smisek was also granted a certain detachment. "If someone wanted to know: 'Why Chicago? Why United? Why Tilton as chairman?' All I had to say was, 'Talk to Glenn,'" he recalls. "These were his conditions and the deal was over if they were not met."

That is not to say Smisek capitulated. He agrees that a single headquarters had to be chosen and the flight operations facility had to be close to that base, and while Continental had superior brand recognition in the U.S., the United name was stronger in the international market that is fundamental to his expansion plans.

The economic environment had also improved since 2008. "The market was stable, capital was available at low interest rates, and profitability was improving. This time we had a tailwind," says Smisek. It also helped that United had restructured its debilitating debt since the failed 2008 merger attempt and had shrunk from two and half times the size of Continental to just 20% larger than its Texas partner.

Regulators agreed, and approval was obtained in an unprecedented six months with only minor concessions. "I was happy, but not unsurprised by the speed of the [U.S. Justice Department's] decision," says Smisek. "The



REUTERS/LANDOV FILE PHOTO

Core Values, New Venues

David Neeleman is now working his "blue" magic in Brazil's burgeoning market

ANTHONY L. VELOCCI, JR./NEW YORK

When David Neeleman was much younger, someone influential in his life must have taught him to think big and learn from his setbacks, because the combination have served this 51-year-old aviation entrepreneur well.

He may be most famous for starting JetBlue in 1999, which dramatically altered the competitive landscape of the U.S. airline industry. The startup caught on in no time for its innovative—and refreshing—ap-

LENNY GILMORE

Smisek sees international growth as key to United Continental's future. Aircraft like the Boeing 787 will play a major role in that expansion.

merger is a good merger. There is little network overlap, which means we keep most of our staff. And it is good for the industry as a whole."

Smisek was also a factor, according to Tilton. "Jeff's experience is beneficial in managing the complexity of realizing all of the benefits of the merger; such as capturing all of the synergies; leveraging the route network and improving customer service. Jeff is well aware of the considerable work that is needed to realize that potential and take United to a position of sustainable profitability and true global competitiveness," says the former United chief and current chairman of United Continental.

While it is still too early to predict the full ramifications of this merger, the combination of United and Continental is a pivotal event in global aviation. Not only does it solidify the U.S.'s return to an industry-leading role, it emphasizes a prudence that was lacking from U.S. aviation. Mirroring Delta Air Lines' merger with Northwest Airlines two years prior, the new United is committed to capacity control, and the creation of such heavyweights, while rankling consumer advocates, brings stability to an industry beset by years of bankruptcies and job losses.

For international carriers, it marks an end to a decade of weakened competition from North America as U.S. carriers struggled with unprecedented losses, low domestic demand and an uncompetitive product, and should enliven the battle for market share across the Pacific. It also brings new nuances to Continental Micronesia's role as an intra-Asia carrier, and should embolden a transatlantic market that is at the forefront of consolidation.

And there was an almost immediate effect in Latin

ing—approach to serving travelers sick of feeling like they were being taken for granted by large, established carriers. "We returned humanity to air service," he says. So successful was Neeleman in tailoring JetBlue to a specific market need that *Fortune* magazine listed him as one of America's most admired and innovative CEOs.

Then Neeleman took the brunt of a management shake-up eight years later. He was tossed out following a public relations disaster: The airline stranded passengers on airplanes sitting on the tarmac for hours at New York's John F. Kennedy International Airport, where JetBlue is based, during a brutal snow and ice storm that pummeled the East Coast.

Within a year, a wiser and more determined Neeleman launched Azul in Brazil. (Azul is Portuguese for blue.) One of seven children, Neeleman was born in Sao Paulo and lived in Brazil until he was five years old. A Mormon, he returned when he was 19 to perform missionary work.

In Brazil, Neeleman effectively has replicated the JetBlue model—except in the case of Azul the opportunity to advance civil aviation across a large geographic area was even riper. Brazil, Neeleman points out, has a large and rapidly growing middle class and more than 20 cities—none of which have "decent" air service—that boast populations of up to 1 million. From the outset, his plan was to connect these metropolitan areas.

So far, so good. The airline has a 75-80% market share in the routes it serves, using Embraer 195 aircraft operating about 14 hr. a day. He ordered 26 more of that model last summer. "We don't need aircraft that are any larger; we would rather do high frequency." Revenues per available seat mile are 10% higher than those of competitors even though Azul's fares are about 15% lower, Neeleman says. Revenues were about $150 million last year and could be double that for 2010.

Azul Linhas Aereas Brasilieiras Chairman and founder David Neeleman displays a model of the Embraer 195 in January 2009, the year his new "blue" venture took off.

At this juncture, Neeleman's major concern is whether Brazil's aviation infrastructure can keep up with the rate at which he thinks he can sustain Azul's remarkable growth; thus far it is outstripping JetBlue's during its early years. In its first 12 months, Azul carried 2.2 million passengers, breaking the previous record held by—JetBlue.

"The Holy Grail in the airline business is to combine the best possible service, creating preference among passengers, with the lowest cost of operation," he says. "All we need them to do is fly us once, and we will hook 'em. That's what happened with JetBlue, and that is what's happening at Azul, because we treat customers like customers."

LENNY GILMORE

Jeffery Smisek

President and
CEO United Continental Holdings

Born: 1954 in Washington; raised in California, Germany and Texas.

Education: 1976, Princeton University, A.B. summa cum laude in economics 1982; Harvard Law School, J.D. magna cum laude

> "The competition is literally entering the market at 500 miles per hour."

America, a region still developing but recognized by the International Air Transport Association as one of the most promising sectors for growth. Historically, U.S. carriers controlled most international access to Latin America, but while North American aviation focused on its recent troubles, several Latin American operators emerged to fill the void, notably Chile's LAN Airlines and Brazil's TAM Airlines, two carriers that have prospered in the past 10 years.

As recently as 2009, both LAN and TAM were content with organic growth, particularly the Brazilian operator, which constantly refuted merger rumors with potential suitors including TAP Portugal. But in August 2010, as it was becoming clear that the U.S. government would approve United's deal with Continental, the two family-owned carriers unveiled their own merger, citing the growing trend of consolidation as a catalyst.

Minding the Business

Carter is in for the long haul to transform Pentagon buying practices

AMY BUTLER/WASHINGTON

Perhaps the strongest measure of Ashton Carter's influence in changing how the Pentagon buys weapons is the desire of so many industry titans to wait out his term as procurement czar and get back to business as usual.

But, that is not likely to happen. After nearly two years in office as the undersecretary of Defense for acquisition, technology and logistics, Carter is resigning his post as a Harvard University educator. Harvard offers its tenured staff only two years as a leave of absence for public service. "I'm not going anywhere as long as the president and the secretary of Defense want me to keep doing what I'm doing," Carter tells Aviation Week. "I came here committed to the tasks that we have undertaken, and that will take time and determination. I knew that from the beginning and I intend to be here and see them through."

A top priority for Carter is his efficiency initiative, which is "looking to get more [products] without more" money and carries the full backing of Defense Secretary Robert Gates and a White House bent on stemming the national debt. The plan, which was rolled out last fall, includes reliance on more fixed-price contracting in order to more evenly share the burden of failures to reach programmatic schedule and cost targets with industry. "We want these programs, we want them to continue, we want the capabilities that they represent," Carter says. "And, we can't have that if they continue to grow in cost year by year."

Among a bevy of industry leaders cringing at the efficiency initiative was Tom Bell, a senior business strategist at Boeing Military Aircraft. He vocalized the sentiment of many in industry last year saying that under the rubric of efficiencies, the Pentagon was targeting profit. The Pentagon is in danger of losing "the capitalistic principles" that facilitated the growth of the industrial base. "We don't want to become the Soviet Union," Bell said. "We don't want to be a captive industry."

Carter objects to the notion that the Pentagon has declared a war on profit. "People who say that not only have it wrong, they have it backward. The way you incentivize productivity in defense as in the commercial world, is by sharing the benefits of increased productivity," he says. "The technological vibrancy and the financial viability of a healthy defense industry are in the national interest."

One tangible example of Carter's influence on weapons procurement is the newly signed low-rate initial-production Lot IV contract with Lockheed Martin, lead contractor on the $382-billion F-35 program. This is the first fixed-price contract for this program, although it includes a 50/50 risk-sharing agreement up to a 140% per-unit cost over-

This new carrier, which will be called Latam Airlines, creates a regional power of unprecedented size that will rank among the likes of Singapore Airlines, Cathay Pacific Airways and a merged British Airways/Iberia in terms of revenues and passengers carried.

United Continental's formation also heightens the debate on international ownership laws, which many in the airline community say have restricted the industry's growth since their enactment at the end of World War II. With United Continental joining Delta, Air France-KLM, Lufthansa Group and the newly announced International Airlines Group formed from the merger of British Airways and Iberia, regulators have shown an acceptance of regional consolidation; maybe now they will address restrictions on international ownership that no longer apply to most other industries.

Smisek also used the merger to facilitate SkyWest Airlines' takeover of ExpressJet, an Embraer ERJ operator created to provide most of Continental's regional feed that has struggled to control costs since Continental sold its majority stake in 2002. In an enlightening Securities and Exchange Commission filing, ExpressJet details how the Continental chief executive brokered a supply contract with SkyWest even as the former Continental subsidiary was rejecting a takeover from its Utah-based rival. He then voiced his concern with ExpressJet's management about the regional carrier's economic viability, and his intent to walk away from his capacity purchase agreement with ExpressJet if SkyWest's offer was not accepted.

Two months later, SkyWest was celebrating its own consolidation success, folding ExpressJet into its Atlantic Southeast Airlines operation, a division it acquired from Delta in 2005. This act gave SkyWest expanded access to the United Continental network, which relies heavily on regional operators to provide domestic feed into its hubs, and catapulted the company from an already strong position to market dominance. And while specific details of SkyWest's contract with Smisek are unknown, it is widely assumed that the cost and performance conditions will become a template for every new regional contract across the U.S.

The ExpressJet situation also reflects the tenacious side of Smisek's personality. "What happened was necessary," he notes. "There were several problems, namely one single type of equipment with one single supplier that had an unsustainable cost structure. ExpressJet was not competitive, and that was not good for Continental. For one, we lease them the aircraft. We had to rely for feed on a contractor who could not price that feed competitively and survive." Without his interven-

age. There "is no question it was a step forward," in reining in runaway cost, "but there is also no question there are many steps ahead" for the Joint Strike Fighter, Carter says. This template is likely to be applied to other programs in 2011 and beyond.

While pressuring contractors to be leaner, Carter has also been a driving force behind rebuilding the Pentagon's relationship with industry, which greatly atrophied during the previous administration. "We are opening the door here in the department to industry [in an effort to] reach out, to listen and to communicate," Carter says. "Industry is essential to our success." He plans next year to "turn that dialogue into a better approach to industrial policy than we have had," including a focus on space propulsion and satellite manufacturing.

Carter's intent to steer the Pentagon's acquisition corps toward more agile support for the wars in Iraq and Afghanistan has also greatly impacted the aerospace industry. He has influenced the funneling of billions of dollars worth of spending on quick-reaction fixed- and rotary-wing aircraft programs, sensor efforts and anti-improvised explosive device (IED) capabilities for troops abroad. Some examples include the ramped-up spending on aerostats and airships for persistent surveillance in Afghanistan and the fielding of hyperspectral sensors to find explosive components as they are being formulated by insurgents in Afghanistan and before they make it into IEDs.

"One of the things I would like to do over the next year is to make our support to the wars that are ongoing or wars that might occur in the near term less ad hoc," Carter says. "If you are looking for a frustration on war support it is that we have still not—eight years into war—institutionalized the way we provide urgent support to the warfighter."

During a visit to Afghanistan, Carter discusses persistent intelligence collecting efforts with units operating the Predator unmanned aerial vehicle.

U.S. DEFENSE DEPT.

tion, Smisek says, ExpressJet eventually would have collapsed and that would have reverberated across his own network. "It is very hard to wind down an operation and at the same time ramp up another. It is costly and time-consuming," he explains.

Critics, however, hold that his involvement with ExpressJet illustrates a worrying trait. "Jeff is competitive, arrogant, smart, then back to arrogant and competitive," says Jay Pierce, president of Continental's Air Line Pilots Association (ALPA) chapter and a former ExpressJet pilot. "When Jeff has made a decision he doesn't change. That worries me."

According to the union chief, these same traits are evident in Smisek's decision to assign 70-seat regional jets from United's fleet into markets once covered by Continental's scope clause, the country's most restrictive in terms of aircraft seat capacity in feeder markets.

"We expected this to be discussed at the negotiating table, instead we hear about it from an analyst conference call," says Pierce. "There are questions of integrity and thoughtfulness that come in to play. This is a stupid fight that could have been avoided."

While there are solid arguments for the regional jet decision, it also stokes another criticism: that Smisek, despite 15 years in the industry, is a novice as CEO. "Jeff happened to find himself at the right place at the right time, but he is an unknown quantity to us. That is a concern," says Greg Davidowitch, president of United's Association of Flight Attendants chapter. Pierce, who has worked with Smisek for several years, meanwhile acknowledges that though he has experience "we must consider this is the first time he is up for this."

UNITED CONTINENTAL HOLDINGS

Smisek's cause is not helped by some unfortunate comments, including his classification of US Airways as the "ugly girl" suitor for United, and an apparent dismissal of labor's involvement in the merger process often repeated by ALPA's Pierce. He also angered several legislators during those contentious congressional hearings into the merger, when the fatal crash of Colgan Air Flight 3407 near Buffalo, N.Y., in February 2009 was discussed, by appearing to distance his airline from the accident even though its was operating as a Continental Connection service.

And he failed to quash a simple criticism of the merger that focused on a doomsday scenario for the company's 10 hubs, during a court hearing in San Francisco that indicated an annoyance with the entire merger process despite his many years as a mergers and acquisitions lawyer and airline executive.

But these hiccups, and Smisek's failure to impress union leaders, so far, have failed to permeate through the ranks. He is more charismatic than most airline

UNITED CONTINENTAL HOLDINGS

Smisek's management style includes more interaction with employees, such as Stan Zurudzki, whom the CEO met at the airline's hub at Chicago O'Hare International Airport.

Smisek believes United Continental's new livery retains Continental's brand recognition in the U.S. while reflecting United's stronger international presence.

CEOs and has showed no issue with being approached by staff while he waits for a flight at Chicago O'Hare International Airport, be it an employee marking his 32nd year with United who just wanted to "meet the new boss" or a pilot wanting to talk shop. Now, this may merely be sociable, but in an industry that has seen one CEO openly carry a six-shooter through strike lines, another use private security to guard from death threats, and union websites calling for the instant dismissal of his own predecessor, Smisek's ability to sit alone in O'Hare is noteworthy.

Labor dissent could still be a bigger challenge for Smisek than the financial merger, and union leaders have a legitimate concern; airline management has a poor history when it comes to labor negotiations. Here Smisek has some experience, as general counsel at Continental he drafted many union contracts, and there is a momentum at United that is reminiscent of his early days in Houston when employees were invigorated by a new management. But there are other issues that muddy the waters, particularly discord between the union groups fighting for supremacy at the new United, and here Smisek's charm and tenacity will have to play second fiddle to patience, a trait that has not been needed since he assumed the top role at Continental at the start of 2010.

He appears ready. "Running a good airline is about service. If you enjoy coming to work every day, you will treat customers with dignity and respect. I am finding an enthusiasm here for what we are building, but we also need to build trust. There is a lot of work ahead, and there will be some anxiousness, but we are a family of 87,000 people intent on becoming the world's leading airline, not just its largest."

United Continental Holdings Inc.

Formed:	Oct. 1, 2010
Ticker:	UAL on the New York Stock Exchange
Single operating certificate:	Late 2011*
Aircraft:	548 narrowbody, 159 widebody and 547 regional aircraft (13 contract operators)
Destinations:	371 (223 in the U.S., 148 international)
Countries served:	59
Departures (daily):	5,811
Passengers (annual):	144 million
Capacity (2010):	253.3 billion available seat miles*
Traffic (2010):	211.6 billion revenue passenger miles*
Load factor (2010):	83.5%*
Employees:	86,852

* estimates provided by company *Source: United Continental Holdings*

And Smisek is planning to encamp at the United building in Chicago for some time. "I am here to see this through," he notes during an interview in his office on West Wacker Drive. And it seems this is not only about the merger. "This industry is fascinating. The competition is literally entering the market at 500 miles per hour. It has everything. You deal with capital markets, labor, it's global, and you deal with the consumer.

"What more could you ask for?" he adds, even if his children wish he worked in a "more exciting" part of the aerospace industry they read about each week when he brings home his copy of Aviation Week.

Podding Up

Rafale F3 recce capability to be available by early 2011, but maybe not for Afghanistan

MICHAEL A. TAVERNA/ST. DIZIER, FRANCE

French air force officials expect the first squadron of new Rafale F3 multirole fighters to be ready for reconnaissance missions by spring, allowing pilots to take advantage of the aircraft's advanced Reco NG reconnaissance pod.

The 1/7 Provence Sqdn. based here will be the first trained to use the fully digital day/night pod, which reached operational status in the air force on Nov. 8. Sqdn. commander, says the air force has taken delivery of seven of the 20 Reco NG pods ordered, but only two are based with the squadron. A third was returned to the supplier, Thales, for demonstrations. He declines to say where the others are, but at least one is known to equip the Rafale F3 contingent on the aircraft carrier Charles de Gaulle, deployed to the Arabian Sea in November in support of NATO and U.S. forces in Afghanistan; and one at Mont de Marsan in southwestern France, where the third F3 combat squadron will be based. Another is thought to be with a partial Rafale squadron standing up in Abu Dhabi, United Arab Emirates—one of the fighter's near/medium-term export prospects.

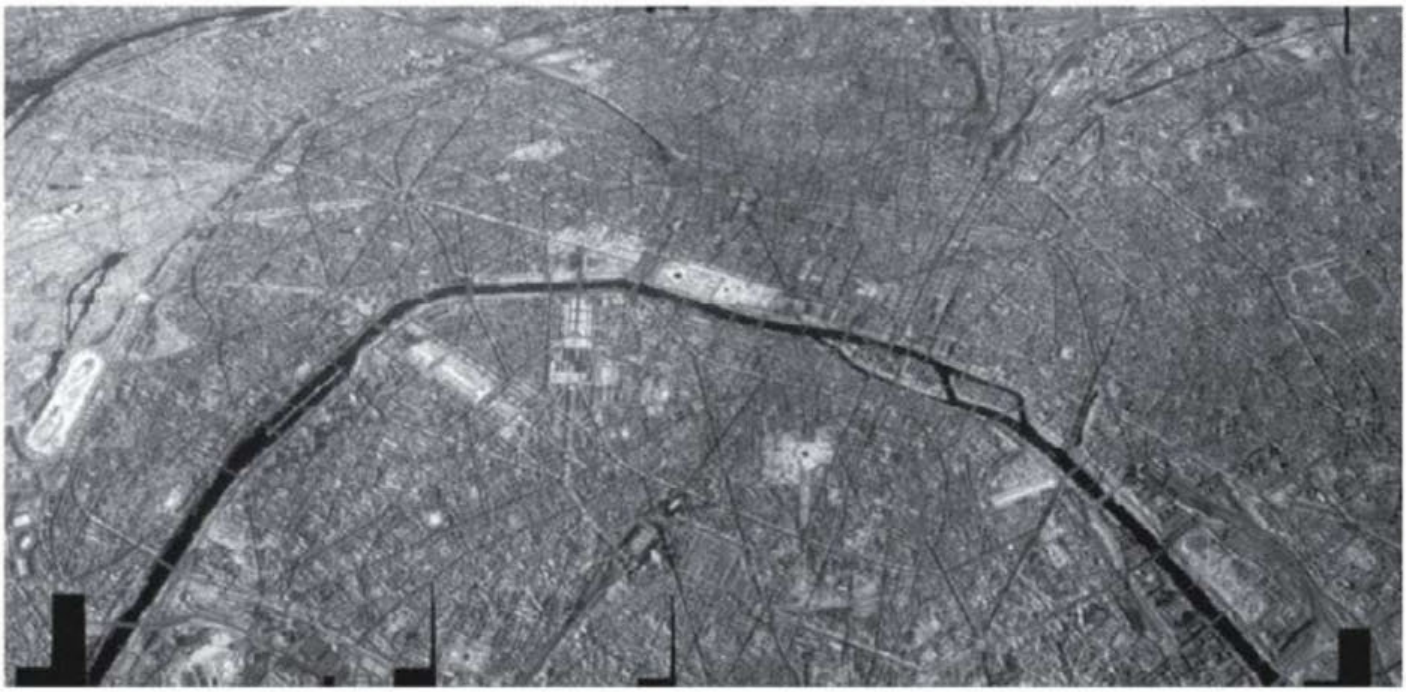
The next eight pods will be delivered to the navy, starting at year-end, and deliveries to the air force will not be completed until the end of 2012. Under France's new joint use policy, all the pods are pooled between the air force and navy, and because of limited stocks will be rotated from base to base along with other ordnance, Rulliere says, limiting the rate of the F3 training ramp-up.

A core cadre of six air force personnel was trained at Mont de Marsan in July-August, and this team will be dedicated to F3 recce training. Because of the high level of automation and high degree of integration of the Reco NG, each pilot requires only two flights to master the pod, plus 2-6 hr. of ground training, including preparation of a dummy mission. Recon officers (ROs) and image interpreters must also be trained. Each training session involves three pilots, one or two ROs and two interpreters.

Once an F3 simulator is in place next year, the training requirement will be reduced to one flight and one or two simulator sessions.

Rulliere asserts the full 1/7 Provence Sqdn. will be qualified for recce missions by the spring, when air force Rafale F3s will begin their first overseas rotation in Kandahar, Afghanistan, probably in conjunction with the Mirage 2000D. However, it has yet to be decided whether the aircraft will be assigned a recce mission, he says. The evolving threat in Afghanistan is placing the focus on endurance, rather than on tactical reconnaissance. Germany earlier this year withdrew its contingent of Tornado recce aircraft.

It is not yet known whether any of the ten naval Rafale F3s on the Charles de Gaulle have undertaken recce missions. One aircraft was lost in an as-yet-unexplained incident early in December. Naval officials say it was carrying four laser-guided bombs, two external fuel tanks and a pair of Mica missiles, but no Reco NG pod.



SIRPA AIR

This composite view of Paris, taken in a single pass at operational altitude and speed, shows the capability of the Reco-NG.

Along with the Damocles target designator, Rover data link and other equipment, the Reco NG provides the Rafale with a multirole reconnaissance, nuclear and naval strike capability to complement the conventional strike and air-to-air role.

The 1/7 Provence was the first Rafale F3 squadron to stand up, in mid-2009. The second F3 squadron, EC1/91 Gascogne, formed in July, is also located at St. Dizier, as is the ETR transformation squadron, formed in September to transition pilots from other aircraft to the F3.

Lt. Col. Loic Rulliere, the 1/7 Provence

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The McGraw Hill Companies

Rulliere says all Rafale F3 pilots will be trained in reconnaissance, although the degree of specialization remains to be determined and only a small number of aircraft—two or three—will typically be assigned to recce missions. St. Dizier air base houses 38 pilots and 24 technical support personnel.

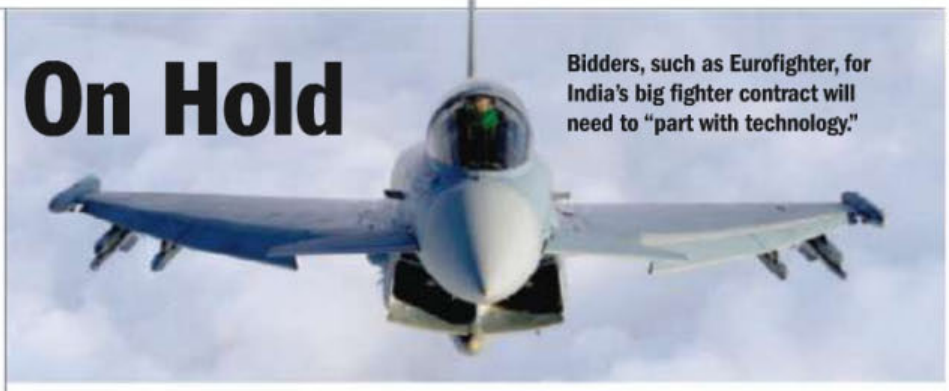
The 1-metric-ton, 5-meter (16-ft.) long Reco NG is equipped with visible and infrared sensors designed to perform high, medium and low-altitude reconnaissance from close and medium range to stand-off distances of 40 km. (25 mi.) or more—beyond the reach of medium-range air-to-air missiles. The pod can also handle very-high-altitude strategic recce missions previously performed by the Mirage IV as well as very-low-altitude high-speed recon flights, although currently the latter mainly serve for show-of-force, air force officials acknowledge.

Pods interface with an air transportable mission preparation and debriefing system and digital multisensor imaging processing and interpretation station on the ground via a data link. Imaging campaigns are preprogrammed but the pilot can switch to manual if the mission requires. The pilot triggers the imager by simply designating the object on the head-up display, map or radar or infrared search-and-track screen.

Data can be sent in real time or stored on board and transmitted as soon as the aircraft is within view of a ground station, for example when the aircraft returns to its base or is rerouted to a new mission. Transmission typically takes 15 min. Rulliere says this permits information to be available more than an hour earlier than pods on the Mirage F1CR, France's current reconnaissance aircraft, and provides a quantity of information equivalent to 6 or 7 F1CR missions.

All images are bispectral and georeferenced using an integral inertial referencing unit, simplifying utilization and archiving and enabling a host of applications. These include change and function detection; extracting size, surface area, speed and other parameters from objects on the ground; and verticalizing areas on the perimeter of images to improve their readability. The highly agile imaging head allows both line search and spot collect and permits multiple angles and views, maximizing the amount of data that can be obtained in a single pass. A frame-by-frame video function enables objects to be filmed from different angles through 360 deg.

On Hold



EADS

Bidders, such as Eurofighter, for India's big fighter contract will need to "part with technology."

Tech-transfer evaluations may delay downselect of India's multi-role fighter

NEELAM MATHEWS/NEW DELHI

India has proved once again that it cannot move too fast in acquiring a major weapon system.

Even as the evaluation of its Medium Multi-Role Combat Aircraft (MMRCA) tender comes closer to its final stages, evidence is mounting that downselect winners will not learn of their acceptance until the fourth quarter instead of the first.

The MMRCA contract promises an order for 126 aircraft and is the largest military procurement pending in India. It has drawn bids from the Mikoyan MiG-35, Dassault Rafale, Eurofighter Typhoon, Saab Gripen, Boeing F/A-18E/F and Lockheed Martin F-16.

India requires that any aircraft or weapon system introduced into service clear all tests and evaluations. All of the MMRCA candidates have completed user trials, including weapons, technical and maintainability evaluations. Currently, the bidders are being evaluated on their proposals for industrial offsets, with technology transfer to come next.

Only when this process produces a short list will their commercial offers be evaluated. The downselect is expected to eliminate two or three of the six initial candidates, but nothing is definite.

Vendors, who were supposed to have their evaluations completed last April have already been required to extend or revise their bids until next April because the initial selection process bogged down. If the defense ministry is not able to complete its downselect process by then, vendors will have to resubmit their bids and another year's delay will ensue.

That raises the prospect that volatile financial markets might cause swings in currency rates that could change the value of the range of highest to lowest bidders significantly, given that rates are determined not when bids are received but when the commercial evaluation begins.

The holdup centers on terms for technology transfer, which must be completed with the main contract, a defense official explained. India requires that licensed production of the aircraft—including engines, accessories, radars, systems and tooling—be covered by the tech-transfer proposal. The ministry holds refusal rights on any specific item, and suppliers must provide full life-cycle product support.

Vivek Lall, vice president of Boeing India, views the process positively, citing "greater opportunities for the Indian defense industry to work with partnerships, or in collaboration with foreign companies that will likely continue to supply [the industry with] defense armaments and transfer of technology."

But analyst V. Siddhartha of the Center for Air Power Studies in New Delhi has reservations. "There is no guarantee that the technology you get will not be state-controlled," he says.

Former Air Chief S.P. Tyagi says that opening up the market to foreign direct investment will be good for India. The current limit is just 26%. But that level is too small to give foreign investors a meaningful say in board decisions, he says.

India sees everything from microtechnology and materials to prototype production emerging from MMRCA's tech transfers. Air Vice Marshal M. Matheswaran, the assistant chief of the air staff, says the country can leverage MMRCA "to get what we want" and persuade vendors to "part with technology."

Additionally, India's domestic defense sector is favored by "buy local" and taxation arrangements. It also will likely require foreign firms to provide inputs into both platform and systems development, says Lall.

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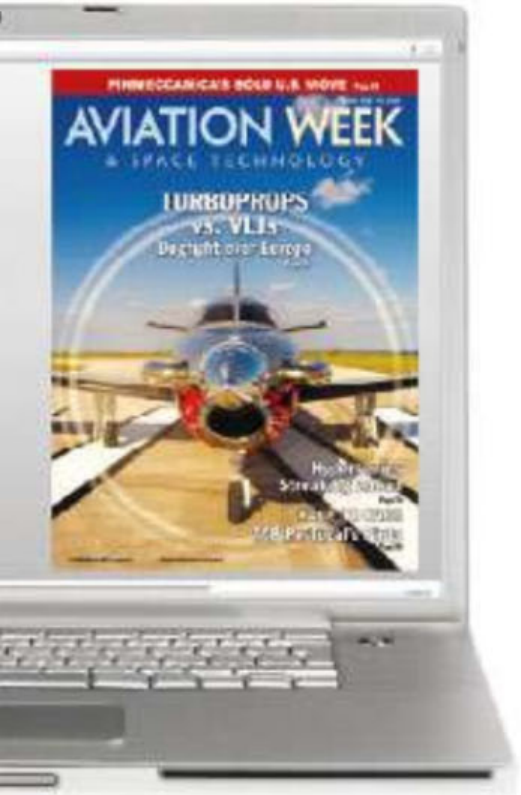

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Knockdown Factors

Updated design tools promise launch vehicle weight savings

NASA

FRANK MORRING, JR./WASHINGTON

NASA built this test rig for validating new shell-buckling knockdown factors in rockets.

New analysis of one factor that drives structural design in launch vehicles suggests that weight savings of as much as 20% can be achieved in some large components and gives designers a much better understanding of the level of robustness needed for safety.

The NASA Engineering and Safety Center (NESC) at Langley Research Center has spent $13 million since 2007 recalculating and experimentally validating shell-buckling "knockdown factors" that have been in use since the beginning of the space age. Derived from engineering testing that started in the 1920s, the original knockdown factors determine how much additional margin designers need to add to the predicted buckling load of a rocket body or other curved structure to create a safe design.

But excessive margin equals unnecessary weight, which cuts into the useful payload a vehicle can lift to orbit. In the past 30 years, engineers have developed a better understanding of just why a cylindrical structure buckles, and the NESC-led project is using that knowledge to develop and validate less restrictive, more robust knockdown factors."The original design factors, or knockdown factors, were developed in an era when we didn't have the great computing capabilities that we have now," says Mark W. Hilburger, a senior research engineer in the Structural Mechanics and Concepts Branch at Langley and the originator of the Shell Buckling Knockdown Factor project.

Since then, engineers have learned the effects of manufacturing imperfections, different materials and other factors on structural strength, allowing Hilburger and his colleagues to begin to recalculate the knockdown factors more rigorously. Rather than the extensive empirical testing that produced the factors in the Apollo-era NASA/SP-8000 design monographs, the team is conducting controlled trials in a special facility at Marshall Space Flight Center to validate their work, and these analyses will be the basis for new knockdown factors.

To date, they have tested four 8-ft.-dia. aluminum lithium, orthogrid-stiffened cylinders to failure, demonstrating that their calculations correlate with the test data to within 5% as compared with a 30-50% discrepancy historically. That improvement in correlation will enable a reduction in conservatism and can translate into weight savings in structural design, which can be significant in large pieces like the core stage of a heavy-lift launch vehicle.

"We did a full-vehicle study on the Ares V," says Hilburger. ". . . In the core stage there is a tremendous amount of weight-savings potential there because it's very heavily loaded, [it has a] very large diameter and very thin walls."

On the Ares V, with its large surface area, even a 0.1-lb. saving per square foot would add up to thousands of pounds of mass that can come out of the structure. Across the Ares V, the team found structural-mass savings of 10-20% depending on location.

In February, the shell-buckling team will test a 27.5-ft.-dia space shuttle external tank barrel at Marshall to validate the scalability of their new analysis-based design factors. In addition to the aluminum lithium cylinders NASA is fabricating for the tests, Boeing and Northrop Grumman are providing composite test articles under Space Act agreements with the agency to validate knockdown factors for composite structures, for which there are no existing design guidelines.

The commercial involvement suggests a future direction for the new knockdown factors. The original application for the recalculation was in the Constellation program's Ares vehicles—the Ares I crew launch vehicle and the Ares V heavy lifter. Those developments have been scrapped under the new NASA approach to human space access in favor of commercial crew transport and a government-built heavy lifter, but the revised design factors can be used on those launch vehicles as well.

The NESC team already has held two workshops for NASA engineers, and they have published their findings in NASA technical memorandums. The "biggest challenge," Hilburger says, is persuading engineers to accept the new figures his team is developing.

"The second-biggest challenge is to develop a technology-infusion strategy and a set of guidelines that will last another 20 or 30 years, and in a way that they're applicable to who knows what vehicles get built later on," he says.

In addition to greater accuracy in designing structures, the new knockdown factors will give engineers a better understanding of how new manufacturing techniques and build tolerances can affect the buckling of the structure. NASA spent millions on friction-stir welding tooling for the Ares vehicles, and learned how the heating associated with the process alters the geometry of the metal being welded. That knowledge has allowed much greater accuracy in predicting shell buckling, in part because the welds are so uniform compared with traditional welds and result in very repeatable quality and geometry.

"That's why you have to start including not only your designers, but the folks who are building these parts, and get an understanding of how we can tweak these tolerances," Hilburger says. "... So then you start building on your knowledge and help guide the manufacturing to make a better product."

Precision Innovation

Tianjin industrial base tackles key Long March 5 manufacturing challenge

BRADLEY PERRETT/BEIJING

The plant building the CALT Long March 5 has proved its technology for precise assembly of large-diameter sections with friction-stir welding, a key achievement as the program moves toward a 2014 first flight.

The 211th Factory at the Tianjin industrial base used that and other advanced manufacturing technologies in building an engineering sample of a short section of the Long March 5's second stage, a liquid-hydrogen tank, says national space contractor CASC.

CASC

The Tianjin space industry base has shown it can weld this 5-meter-dia. Long March 5 section with precision.

"The welding equipment used for this section was all developed by the 211th Factory," CASC says. "The manufacturing process achieved precision assembly of the storage tank, using advanced automated welding technology, including friction-stir welding."

This section was the first Long March 5 engineering sample with a width of 5 meters (16.4 ft.), the standard diameter of the core stages of the launcher.

CASC's statement indicates a significant step forward in the program, since CALT Vice President Hao Zhaoping has said that precision manufacturing of large-diameter sections is one of the key technical challenges of the program. The core stages of CALT's earlier launchers have 3.35-meter diameters.

A friction-stir weld is made by a rapidly rotating dowel that heats, softens, forges and consolidates the metal.

CALT (the China Academy of Launch Vehicle Technology) is China's main builder of launcher rockets and is part of CASC (China Space and Technology Corp.).

The Tianjin base has been set up to build the Long March 5 and would also make the Moon rocket that China would build for its proposed manned lunar missions.

Beijing is considering plans to land people on the Moon in 2020, 2025 or 2030, the chief scientist of the lunar program, Ouyang Ziyuan, has said. The Hainan launch center, being built for Long March 5s, will also handle any Moon rocket.

For the moment, China is concentrating on a series of unmanned lunar probes, of which the second, Chang'e 2, is now orbiting the Moon.

Yu Dengyun, the deputy chief designer of the lunar exploration program, says five possible landing places for the next mission, Chang'e 3, have been chosen. That spacecraft's landing gear and lunar rover are in the prototype stage, he adds.

The rover, being developed by CASC and the China Academy of Sciences, will weigh about 100 kg. (220 lb.). Another CASC unit, the Shanghai Academy of Spaceflight Technology, has built an engineering model of the rover.

In deciding Chang'e 2's fate at the end of its mission, program managers have three choices: crashing it into the Moon, sending it into deep space or bringing it back to Earth, either to burn up in the atmosphere or to be left in Earth orbit. The option of bringing Chang'e 2 back is a reminder that a spacecraft returning from the Moon could conceivably be placed surreptitiously near an important Earth-orbiting satellite of another country.

There is no suggestion that Chang'e 2 would enter such an orbital position, nor that it is carrying any kind of jammer. Chinese engineers surely had enough challenges in designing it as a purely scientific instrument. But a senior U.S. space scientist suggests that foreign governments will be interested in seeing whether China does undertake the exercise of bringing the probe back, because a little spacecraft could not be detected and tracked by Earth-based radar as it maneuvered away from the vast radio reflector that is the Moon.

The chief designer of the Chang'e 2 probe, Huang Jiangchuan, says bringing the spacecraft back would be easier than sending it to lunar orbit.

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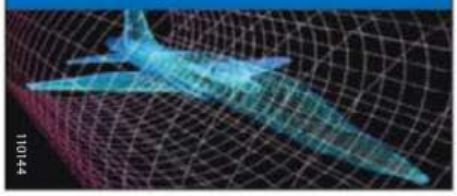

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Air Travel Growth? Not So Fast

BY KEVIN MICHAELS

Kevin Michaels is a co-founder and partner in AeroStrategy, a management consulting firm specializing in the aerospace and aviation industries. He is based in Ann Arbor, Mich.

Many industry observers (including this author) are surprised by the resilience of air transport production rates following the Great Recession. How can Boeing and Airbus possibly increase production rates while most capital goods industries—including business aviation—experience production rate declines of 20% or more?

One factor underpinning the confidence of original equipment manufacturers is robust long-term air travel growth projections; most forecasts call for 4.5-5.5% annual growth over the next 20 years. This is nearly double the anticipated annual global GDP growth over the same period and is indicative of an industry in a growth phase. Moreover, these growth projections are higher than the 4.2% annual growth rate since 2002, and the 4.6% rate from 1990-2002. According to these forecasts, air travel demand could actually accelerate.

> "The growth rate of revenue passenger miles in the U.S. is less than that of GDP, and Europe appears to be following this pattern. To achieve the global growth many predict, the rest of the world would have to execute perfectly."

However, AeroStrategy believes that air travel—at least in North America and Europe—is in fact a mature market and that these forecasts are likely overstated. The first and obvious reason is the higher cost of fuel. This expense has increased 400% over the last decade and now comprises 30% or more of an airline's cost structure. Add to this the twin prospects of carbon emissions taxes and additional increases in fuel costs and there is a significant probability that, in the long run, airlines must increase fares and thereby reduce air travel demand—particularly in comparison with past decades that saw lower relative fuel expenses.

A second factor is the maturing of the U.S. and European air travel markets. The U.S. market has been deregulated for more than 30 years, growth in revenue passenger miles is less than GDP growth and—as noted by the Air Transport Association—air travel accounts for a shrinking share of the U.S. economy. This is a stunning fact for an area that accounts for nearly one-third of the global market. What if other regions follow the U.S. pattern? This is exactly what appears to be happening in Europe, where the stimulation of liberalization and growth of low-cost carriers appears to be waning.

Add to this the difficulty of adding new infrastructure, the socio-cultural attitudes of "green" consumers and bleak near-term economic growth forecasts, and it is highly likely that air travel growth will slow considerably. With more than half of the global market in a mature state, the rest of the world must execute perfectly (growing at twice GDP) if the 4.5-5.5% growth rates are to be realized.

A third factor is the growing threat of alternative modes of transportation, especially high-speed rail in Europe and China. Europe is in the midst of a significant high-speed rail expansion; already some lucrative routes are affected such as Madrid-Barcelona where air travel has lost 50% share in one year. Even more dramatic is the massive high-speed rail buildout in China, where the government will invest $300 billion to create a national grid by 2012—several years earlier than originally planned. China Southern Airways is already losing traffic on some routes. While rail will not compete with air travel for routes of longer than 800 mi., it is worth noting that the aviation industry is counting on domestic China and European markets to produce approximately one-fifth of its absolute growth over the next 20 years. Some will surely be lost to rail.

With headwinds blowing in the face of airline industry growth, perhaps is it time to think in terms of an industry with mature rates of growth—perhaps in the 3-4% range. This is not necessarily bad news if it facilitates airline consolidation and improved profitability.

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