

May 2010

AEROSPACE

A M E R I C A



NextGen

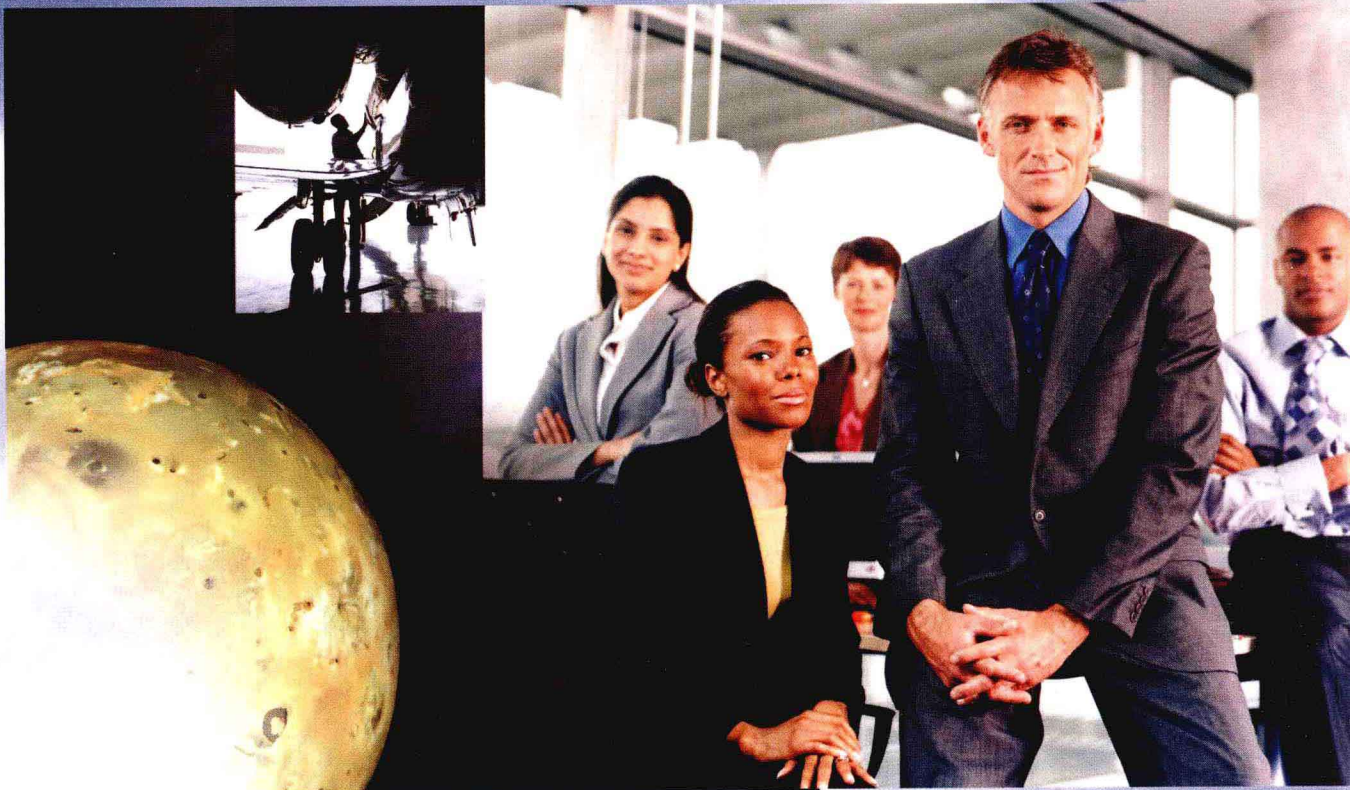
A SLOW TRANSFORMATION



**SESAR faces nontechnical hurdles
A conversation with Richard Brookes**

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New technologies and programs for the next generation of air transportation systems both in the U.S. and Europe are making progress, to greater and lesser degrees. To find out how they are faring, turn to pages 30-43.



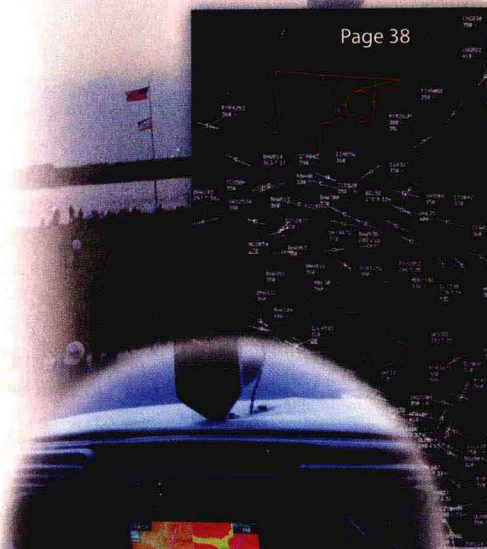
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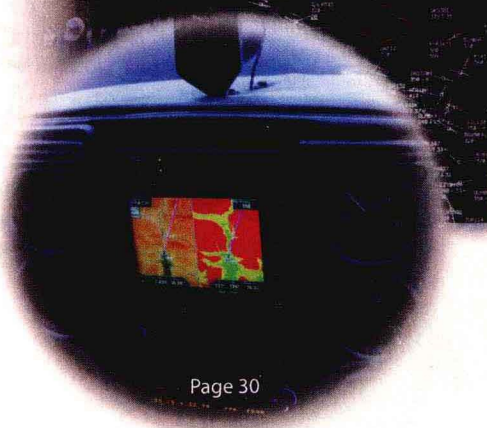
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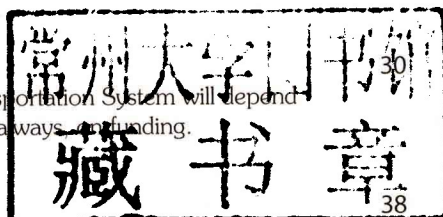
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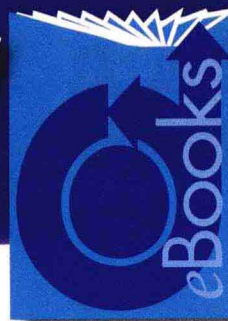
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May 2010, Vol. 48, No. 5



American Institute of
Aeronautics and Astronautics

Editorial

As the tanker turns

In late 2001, the USAF proposes leasing 100 air-refueling tankers from Boeing to replace its aging fleet of KC-135 Stratotankers, which had begun service in 1957. The replacements are to be based on the Boeing 767 and are to come in at a cost of about \$20 billion or so on a sole-source contract.

This proposal, however, is met with a hailstorm of criticism, led by Sen. John McCain, who believes the company is being given a sweetheart deal, and that there are alternative plans that should be examined before any contracts are let. This eventually leads to investigations, a CFO dismissal, a CEO forced into retirement and, by November 2003, a jail term.

By early 2004, the leasing deal is effectively scrapped.

After the dust settles, the Air Force introduces the KC-X replacement program, and on January 30, 2007, the Dept. of Defense posts a request for proposals.

Boeing again proposes a 767 derivative, and a joint venture between Northrop Grumman and EADS offers the Multi-Role Tanker Transport, based on the Airbus A330-200 and called the KC-45. Both competitors file before the deadline; both promise that manufacture of the aircraft would take place in the U.S.

In February 2008, the Pentagon announces that the contract, now worth \$35 billion to \$40 billion, will be awarded to the Northrop Grumman/EADS joint venture.

But it doesn't end there.

Boeing immediately files a protest, which is upheld by the Government Accountability Office. In July 2008, Secretary of Defense Robert Gates calls for an "expedited recompetition" and issues a new RFP. Boeing then asks for more time, which it eventually receives, as the RFP is cancelled, leaving the issue to be handled by the next administration.

Those Stratotankers are now seven years older.

Among the ideas floated in Congress is a split award, offering contracts to both companies, making some states, and their representatives—and the maintenance and overhaul folks—happy. Gates turns this suggestion down.

In September 2009, the Pentagon formally releases a new RFP. Boeing offers two proposals, one again based on its 767 and another based on the 777. Northrop Grumman threatens to withdraw, believing the new RFP offers advantages to Boeing and its smaller offering, and follows through on that threat in March 2010. EADS announces that it will not compete on its own.

But no one, except Boeing, is happy about awarding an uncompleted contract. Rumors pop up and are quickly debunked. The Russians are going to bid. No they're not. EADS is going to protest. No it's not. Then, in April, EADS North America announces that the company intends to submit a proposal in July and "is progressing in discussions with potential U.S. partners...."

In the end, the decision may come down to a choice between two fine aircraft, either of which could fill the Air Force's needs. But political pressures, both domestic and international, may make a difficult call even harder, overshadowing an evaluation of the merits of the proposals.

And the Stratotankers keep getting older. Tune in tomorrow.

Elaine Camhi
Editor-in-Chief

Euro Hawk sparks UAS integration plans

BY THE END OF 2010 THE GERMAN defense ministry is due to take delivery of its first Euro Hawk unmanned air system. In January 2007 the ministry awarded a \$559-million contract to Euro Hawk GmbH, a 50-50 joint venture between Northrop Grumman and EADS, for the development, test and support of the Euro Hawk unmanned SIGINT (signals intelligence) surveillance and reconnaissance system. It will replace Germany's aging fleet of Breguet Atlantic aircraft, in service since 1972.

After the first demonstrator vehicle, four further Euro Hawk platforms, with an operational capability, are scheduled for delivery between 2015 and 2016.

For Europe's aviation safety regulators and air traffic management (ATM) officials, the arrival of Euro Hawk within Europe is a timely reminder that there is a great deal of work still to be done to develop regulations on the three areas



that will allow UAS platforms to share airspace safely with civil aircraft: vehicle airworthiness, remote command and control systems, and ATM—especially sense-and-avoid technologies.

But Euro Hawk is in many ways an atypical UAS. It operates above 50,000 ft—higher than the main traffic lanes—and is large enough to accommodate many of the sense-and-avoid systems found on airliners. The platform is U.S. based, a derivative of the Northrop Grumman Block 20 Global Hawk, but the on-board systems are European. The SIGINT mission system that detects elec-

tronic intelligence radar and communications intelligence emitters is under development by EADS Defence & Security, as are the ground stations that will receive and analyze the data from Euro Hawk.

2012 target for regulations

The various European regulatory bodies are working toward development of certification regulations for the key technologies by 2012 to integrate all shapes and sizes of UAS platforms within Europe's airspace, with their implementation from 2015.

EUROCAE, the European Organization for Civil Aviation Equipment, has been undertaking much of the work within Europe to develop the necessary standards for operating UAS vehicles in civil airspace and proposing regulations to the European Aviation Safety Agency, which will be ultimately responsible for

EUROCAE Working Group 73: Developing UAS draft standards and requirements

EUROCAE's Working Group 73 has been formed to develop a requirements framework that will enable UAS platforms to operate within the current system without segregation from other airspace users. It held its first meeting in the Eurocontrol Brussels headquarters in April 2006. It works through four subgroups: UAS operations—sense and avoid; airworthiness and continued airworthiness; command and control, communications and spectrum security; and light UAS (under 150 kg) and operations with visual management and separation.

EUROCAE's work program has six main elements:

- Drawing up an "operational concept" to highlight airworthiness certification and operational approval items that need to be addressed—completed January 2007.
- Drawing up a plan of programs and timescales—ongoing.
- Developing a concept for UAS airworthiness certification and operational approval in the context of nonsegregated airspace. The object is to develop a report of recommendations—and a requirements framework for civil UAS—that could be adopted as a basis for regulatory policy by national administrations. The scope covers general regulatory issues, security, radio spectrum requirements, operational approval, airworthiness certification and maintenance. A specific volume focuses on UAS, typically less than 150 kg mass, limited to visual line-of-sight operations—final version of the document to appear in 2010.
- Developing a document to define the requirements for command, control and communication systems including autonomous operation—document to appear in the second quarter of 2010.
- Developing a document to define the requirements for UAS associated with separation assurance and collision avoidance—document to appear in the fourth quarter of 2012.
- Developing a document to identify those aspects of UAS normal and abnormal operations that would require special ATM consideration—ongoing.

The MIDCAS consortium

The MIDCAS consortium comprises 13 aerospace industries from five countries, with Sweden's Saab leading the project. Flight tests will be carried out at the CEV flight testing center in Istres, France. Thales and Sagem will research the "sense" technologies. Thales will coordinate work on cooperative sensors—such as radar, transponders and TCAS—with Sagem coordinating work on noncooperative sensors (infrared imagers, video, radar). Full consortium members are:

Saab

Alenia Aeronautica S.p.A.

Diehl BGT Defence GmbH & Co. KG

Deutsches Zentrum für Luft- und Raumfahrt e. V. in der Helmholtz-Gemeinschaft

EADS Deutschland GmbH

ESG Elektroniksystem- und Logistik-GmbH

Galileo Avionica S.p.A.

INDRA SISTEMAS S.A.

Italian Aerospace Research Center

CIRA S.c.p.A.

Sagem (Safran Group)

Selex Communications S.p.A.

SELEX Sistemi Integrati S.p.A.

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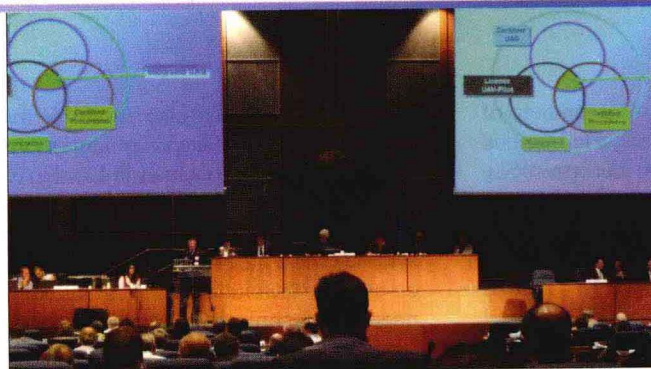


certifying and regulating these operations. This year, two important documents are due to be published outlining draft regulations on airworthiness and command, control and communications.

Working group 73 of EUROCAE, an organization of European companies, is drawing up the regulatory proposals in consultation with the International Civil Aviation Organization, the U.S. Federal Aviation Administration, Eurocontrol and RTCA, among many others. Work on accelerating the regulatory and operational frameworks to allow UAS platforms to fly within European airspace has taken place in the past 12 months.

Eurocontrol published the first ATM specifications in December 2007 to set out how UAVs should fly in European airspace. The organization's UAV Operational Air Traffic Task Force concluded that if UAS platforms are to operate in nonsegregated airspace—that is, in the same airspace occupied by airliners and general aviation aircraft operators—UAS platforms would have to meet the same requirements as manned aircraft to interact with air traffic controllers and carry out sense-and-avoid maneuvers to maintain separation. This means developing new sense-and-avoid technologies and new procedures for certifying airworthiness, security operations and operator training.

The European Defence Agency (EDA) has set a target date of 2015 for UAS platforms to become integrated within the current civil airspace structure on a "file and fly" basis. The EDA produced its



A forum on aviation cooperation was held in October in Montreal.

study on sense-and-avoid technologies for long-endurance unmanned air vehicles in 2007 (<http://www.edaeuropa.eu/genericitem.aspx?area=31&id=305>), covering the mapping of applicable regulations, definition of requirements and definition of potential technical solutions. It also covered testing of the proposed technical solutions through simulations and assessment of how implementing the solutions will affect the future use of long-endurance UAVs, ATM procedures and safety considerations.

Integration approaches

In May 2007 EDA was given the job of addressing this challenge on the basis of a stepped approach toward integration. According to Carlo Magrassi, EDA deputy chief executive (strategy), speaking in Montreal at a forum on civil/military cooperation in October 2009, "A major strategic technology development...is the so-called MIDCAS project [Midair Collision Avoidance System]. The objective of this €50-million technology demonstrator is to support the development of the critical sense-and-avoid technology and hereby, complementary with other activities, enable the operation of

UAVs in nonsegregated airspace."

MIDCAS team members met for the first time on February 16 at Eurocontrol headquarters in Brussels, with around 70 representatives from

various European aviation authorities, air traffic control (ATC) organizations, aviation industries and research organizations. The work on developing standards and systems for sense-and-avoid equipment—with standardization work taking place under EUROCAE—will culminate in flight trials with the new equipment on board an Italian Alenia Sky-Y UAS by the end of 2012.

A need for improved ATC datalinks was also highlighted by the European Commission (EC)-funded Innovative Operational UAV Integration (INOUI), a 24-month, €4.3-million research study completed in October 2009 and led by German air navigation service provider DFS Deutschflugsicherung, which investigated how current data-link technologies could be developed to fulfill the ATC role, perhaps through mandating satellite communications, given the requirement for UAV platforms to operate beyond line of sight. The report also highlighted the potential for low-cost general aviation collision avoidance technologies, such as those developed by Flarm Technology (<http://www.flarm.com>).

Another emerging technology that could provide the basis for sense-and-avoid systems on board smaller UAVs is automatic dependent surveillance broadcast (ADS-B) services that would require a simple transponder with a backup data-link transmission system. Such a technology has been investigated recently under the NASA Aeronautics Research Mission Directorate *Integration of Advanced Concepts and Vehicles into the Next Generation Air Transportation System (NextGen)* study.

In planning for integration of UAS platforms into European airspace, Eurocontrol is implementing a two-phase strategy: a near-term objective of enabling UAS integration into the ATM system based on current technologies and

Air4All and ASTRAEA

There have been two other significant European programs to develop strategies to integrate UAS platforms into civil airspace.

The EDA commissioned the **Air4All** consortium to develop a detailed action plan to demonstrate how UAVs are to be able to fly in civil airspace by 2015. The plan was released in 2008 and included a roadmap for an implementation plan with technological, regulatory and cost estimates. Participants included Alenia Aeronautica (Italy), BAE Systems (U.K., Sweden), Dassault Aviation (France), Diehl BGT Defence (Germany), EADS CASA (Spain), EADS Defense & Security Germany, Selex Galileo (Italy), QinetiQ (U.K.), Rheinmetall Defense Electronics (Germany),

SAAB AB (Sweden), Sagem Defense Systems (France) and Thales Aerospace (France, U.K.).

Meanwhile the U.K. has been developing its own UAS integration strategy in the form of the **ASTRAEA** program, a £32-million aerospace program involving a consortium of companies including BAE Systems, EADS, Cobham, QinetiQ, Rolls-Royce and Thales, working with autonomous systems specialist Agent Oriented Software. The ASTRAEA program focused on assessing the viability of enabling autonomous aircraft to operate within U.K. airspace and in October 2008 carried out a number of simulated flights with an autonomous UAS, at the **ParcAberporth** range in the U.K.

procedures and a long-term strategy of enabling UAVs to fly alongside manned aircraft within the Single European Sky concept of operations, due to be fully implemented from 2020.

INOUI also highlighted a requirement for "dynamic replanning"—when a UAS flight plan would need to be altered because of a potential conflict. It suggested that technologies developed within the EC-funded SOFIA (Safe Automatic Flight Back and Landing of Aircraft) project (<http://www.sofia.isdef.es>), which investigated the technologies and procedures to return an aircraft automatically to a safe landing following a hostile action, could be reconfigured for such a role.

"Two further important UAS work strands under the EDA umbrella are worth mentioning, both initiated from the Air4All Roadmap development," according to Magrassi. "The first [is] the so-called SIGAT activity, with the aim to support the preparation of the World Radio Conference in 2012 and subsequently in 2015. EDA participating member states, in August 2008, tasked the Air4All Frequency Group to work toward the identification of appropriate spectrum requirements to consolidate a common European position regarding regulatory and operational UAS requirements for the upcoming World Radio Conference.

"Another activity being coordinated with the European Space Agency is the common approach regarding command and control of UAS and satellite services, as well as the air traffic control data link."

Satellite study contracts

In February 2010 EDA and ESA signed contracts, worth €400,000 each, with two consortia to progress the work on command and control alongside ATC data-link services. EDA has contracted EADS Astrium Services/EADS Defence & Security—Military Air Systems (France) to investigate the command and control segment. ESA signed a second contract with INDRA Espacio de Spain to investigate the ATC link segment.

The studies will examine how UAS platforms can be integrated into nonsegregated airspace using satellite communications and satellite navigation for command and control, sense and avoid,

and ATC. They will also research the added value of satellite communications for high-data-rate payload links; the viability of such a solution for future services based on UAS supported by space systems; the investments that will be necessary in the future; the next steps needed in technical and regulatory terms for establishing such a service; and the road map for civilian, security and military services.

Tackling smaller UAVs

But many in the industry believe the key challenge will be to introduce new sense-and-avoid technologies, procedures and regulations for UAVs that are not large enough to accommodate current traffic collision avoidance systems.

"Programs such as MIDCAS are aimed predominantly at the larger UAS vehicles entering the market," said Peter van Blyenburgh, president of UAS trade association UVS International, "but there is very little work to develop appropriate technologies for the smaller systems, those under 150 kg."

Much of the work to develop regulations of these smaller systems has been led by the Joint Authorities for Rule-

making on UAS group of national European civil aviation authorities. Led by the Netherlands, JARUS is working on developing a single set of airworthiness and operational airspace requirements for consideration by the relevant regulatory authorities. But with these small systems about to enter the market in growing numbers, there is increasing awareness within Europe of the need to focus regulatory attention at this level of UAS.



For Europe, the key focus now is to pull together all the work undertaken by national and international agencies and deliver a cohesive regulatory structure that meets the short-term aerospace safety requirements of national states while being able to harness the longer-term technological promises of data-fusion, miniaturization and increasing autonomy.

As ever in Europe, the issues of developing joint approaches across national and international institutions are proving as much of a challenge as developing the appropriate technologies.

Philip Butterworth-Hayes
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Correspondence

In **Environmental regulations fly high and wide** (March, page 4), Mr. Butterworth-Hayes states that the Carbon Reduction Commitment (CRC), a regulatory scheme put in place by the U.K., will attempt to reduce emissions by 60% over 2008 levels by 2050. The emission reductions demanded for aircraft by the CRC is unclear, but the International Air Transport Association is stated as proposing 50% reductions for aircraft by 2050.

Missing from the article are important numbers. Given that the rate of increase in CO₂ levels, as reported from the Mauna Loa, Hawaii, observatory and other sources was about 1.9 ppm per year, and given that aircraft contribute

about 2% of this CO₂, reducing CO₂ contributions by aircraft by 50% would reduce global CO₂ emissions by about 0.019 ppm per year. From 2050 to 2100, this would mean a reduction of only 0.95 ppm in atmospheric CO₂ concentrations, or 0.2% of the 2008 concentration of 385 ppm. Note that the percentage of CO₂ in the atmosphere is only 0.038%.

Given this minuscule difference in the percentage of CO₂ in the atmosphere caused by this reduction, how much cooler will it be in 2100 if the reduction is made than if it isn't? Also, how much revenue will be lost by the airlines, the aircraft production industry (AIAA's membership), and tourism in-

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dustry if the cuts are made (through increased taxes and thereby ticket costs)?

Joe Sheeley

Tullahoma, Tenn.

Reply by author: The huge current cost of research into new fuels, more efficient engines and air traffic management procedures will make it possible for the aerospace industry to reach IATA's target of a net reduction in carbon emissions of 50% in 2050 compared to 2005, despite trebling the number of aircraft in operation over the same period. The question is, is this investment worth it?

The industry can only respond with a technological solution to what is a political question. The results may seem, in context, minuscule. But with regulators in Europe and elsewhere contemplating caps on air traffic growth on the basis of the industry's carbon footprint, if you can demonstrate that technology will decouple growth and environmental impact there will be no justifiable reason to cap growth in the first place.



I have just read **Why asteroids beckon** (March page 12), and, sad to say, found Tom Jones' arguments wanting. He has attempted to intermingle manned exploration of NEOs with the need to prepare to deflect one of these should it endanger Earth, two very different objectives. The former is elective, the latter, not.

But overriding this is the question: whither human spaceflight. We are at a very uncomfortable crossroads. The "vision" program was begun by President Bush, who then chose to tacitly continue it without further verbal support, only to have it terminated by President Obama. NASA geared itself around the Constellation program, spending billions of dollars on it, only to have it dumped in the waste can.

As I have felt before, I thought returning to the Moon was a lousy goal, a "been there, done that" effort that would not attract public support. NASA appears to have counted on the continuation of the program without doing much to sell the public on it. The coup de grace to the program was the poker play by the Augustine Commission, essentially daring the president to put up or kill it. He chose the latter, probably quite startling the members of the commis-

sion. Augustine gave himself absolutely no wiggle room, such as suggesting that Constellation could continue with the current funding if one assumed that the space station's life would be extended. That has now been done, but the Constellation program is now, unless resurrected, dead.

And, if Tom Jones thought that returning to the Moon was a public yawn, manned visitations to NEOs would be a total sleepwalk. Exactly how do you build excitement? The only goal that would attract public support is a manned Mars mission and, right now, a hell of a lot of PR would be needed even for that.

If in the NASA budget there will now be money for advanced propulsion system development, success in this area could resurrect the human spaceflight program. In the interim, I am afraid that

the technical expertise will be disbanded and lost. I sincerely doubt that manned exploration of Mars can be handled by commercial spaceflight development.

May I suggest that this issue be the subject of much debate within AIAA and its sister organizations, one in which we consider the various options we might take to get us back to manned spaceflight and the exploration of Mars? I believe that we are now like Moses wandering in the wilderness, and that it will be years of soul searching until we recover the will to move on—somewhat akin to the period following the end of the manned Moon expeditions. I am dismayed by the matter-of-factness in both the editorial, **Space, safety—and risk** (March, page 3), and in Tom's article; we have been gored and are simply too acquiescent to speak out. **Richard Eiger**

Events Calendar

MAY 4-6

ASTRO 2010—15th CASI Astronautics Conference, Toronto, Ontario, Canada.

Contact: G. Languedoc, 613/591-8787; www.casi.ca

MAY 11-12

Inside Aerospace—An International Forum for Aviation and Space Leaders, Arlington, Va.

Contact: 703/264-7500

MAY 13-15

Fifth Argentine Congress on Space Technology, Mar del Plata, Argentina.

Contact: Pablo de Leon, 701/777-2369; Deleon@aate.org

MAY 31-JUNE 2

Seventeenth St. Petersburg International Conference on Integrated Navigation Systems, St. Petersburg, Russia.

Contact: Prof. V. Peshekhonov, www.elektropribor.spb.ru

JUNE 1-4

Fourth International Conference on Research in Air Transportation, Budapest, Hungary.

Contact: Andres Zellweger, dres.z@comcast.net

JUNE 7-9

Sixteenth AIAA/CEAS Aeroacoustics Conference, Stockholm, Sweden.

Contact: Hans Bodén, hansbod@kth.se

JUNE 8-10

Third International Symposium on System and Control in Aeronautics and Astronautics, Harbin, People's Republic of China.

Contact: Zhenshen Qu, ocicq@126.com

JUNE 14-18

ASME TurboExpo 2010, Glasgow, Scotland, U.K.

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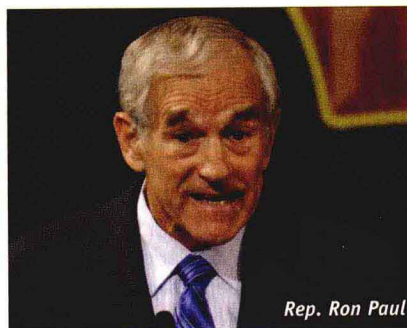
Feeling the pinch and fighting back

"THE PRESIDENT MADE A MISTAKE," SAID Sen. Bill Nelson (D-Fla.) at a public space forum in Cocoa, Fla., on March 19.

Nelson, Congress's most visible advocate for human spaceflight, was referring to President Barack Obama's decision to delete the Constellation human spaceflight program from the administration's FY11 NASA budget request. Nelson spoke of the "perception" that Obama "killed the space program," but he also called Obama "a vigorous supporter of the manned space program."

In objecting to Constellation's absence from the funding proposal, Nelson has plenty of company on Capitol Hill and in industry. Twenty-seven members of Congress (two-thirds of them from Alabama and Texas) initially wrote to NASA Administrator Charles Bolden saying, "The termination of the Constellation programs is a proposal by the president, but it is Congress that will accept or reject that proposal. In the meantime, FY10 funds for the Constellation programs are to be spent as if the program will continue." Among signatories to the letter is Rep. Ron Paul (R-Texas), who is usually a voice for smaller government and a foe of federal spending. Since that initial letter was written, other lawmakers have joined in.

With the nation's capital and especially Congress focused on the economy, health care and immigration, it is unclear how much of their own personal clout lawmakers are willing to expend to try to



Rep. Ron Paul

reverse the proposal. However, the administration is listening, and there are preliminary signs that the White House and NASA are taking another look.

The Constellation project, one goal of which is to return astronauts to the Moon by 2020, grew out of the far-sighted 2004 "vision" of a replacement for the space shuttle to deliver astronauts to LEO and eventually take them farther into space. But the public seems to have little interest. While Constellation remains in the current (FY10) budget, the idea of restoring it to FY11 funding appears to enjoy limited support outside Alabama, Florida, Maryland and Texas, states where key NASA facilities are situated.

If left unchanged, the administration's new policy will be especially difficult at Florida's Kennedy Space Center, which will have no manned space activity to support, and at Alabama's George C. Marshall Space Flight Center, which has developed rockets from the Apollo-era Saturn to the present-day Ares.

Under the administration's plan, NASA will scuttle the shuttle successor Orion and the lunar lander Altair. The agency will also abandon both Ares I, the launch vehicle for Orion, and Ares V, the heavy-lift launch vehicle designed to send Orion and Altair to the Moon. The revelation that the administration is abandoning government-funded human space exploration was handled poorly. In a telecast to NASA field centers soon after the February 1 release of the budget

proposal, NASA's Bolden apologized for the abruptness with which the policy shift was announced.

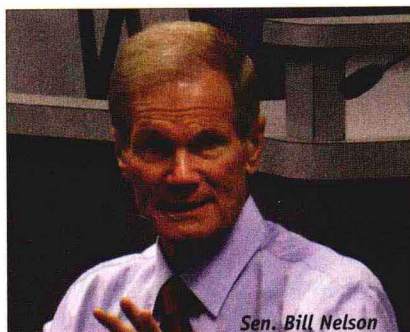
Ironically, at a time when federal deficits and the national debt are issues, a decision to drop Constellation will not result in NASA returning any funds to the treasury. The FY11 budget plan is actually slightly larger than FY10 spending, with funds going to private rocket and space companies, atmospheric physics research and climate science, as well as robotic exploration of the solar system.

When we went to press, the president had called for a "space summit" on April 15, at which, among others, officials in Florida—heavily impacted by the coming retirement of the shuttle and the cancellation of its replacement, Constellation—were scheduled to attend. *Florida Today* reported that rally organizers were seeking to assemble 5,000 spaceflight supporters to tell the president, as Brevard County Commissioner Robin Fisher put it, "This current [NASA] budget, the way it is structured, is not acceptable to this community."

In Florida and elsewhere around the country, supporters of a robust space program believe that even if the White House does not change policy, Congress will force a change. Many in Washington view the agency and its administrator, Bolden, as performing a difficult balancing act in order to satisfy both Capitol Hill and the White House as well as the conflicting requirements of FY10 and proposed FY11 legislation.

As the state's *Orlando Sentinel* put it, "NASA is...caught in a tug of war" between President Obama's budget, which ends the program, and congressional legislation preventing the program from ending without its approval.

Some NASA engineers are continuing to develop components of the program, while other NASA staffers are canceling solicitations for components for which contracts have not yet been written. NASA is still working on Ares I,



Sen. Bill Nelson



F-18



F-16



F-15

Delays in the JSF program have the services looking at upgrades for the older fighters.

arguing that it may have applications for undefined future programs.

At press time, the agency was awaiting the April 18 return of the space shuttle *Discovery* on STS-131, with Navy Capt. Alan Poindexter leading seven astronauts to the ISS. The 13-day flight delivered supplies, a new crew sleeping quarters and science racks that will be transferred to the station's laboratories. A Russian TMA-18 Soyuz mission to the ISS also took place in the first week in April. The final flight in the shuttle program, STS-133, is scheduled for a September 16 launch, but an analysis by the agency office of the inspector general indicates that delays may extend shuttle operations.

Fighter shortfall

With the F-35 Lightning II Joint Strike Fighter (JSF) confronting significant cost overruns and schedule delays, some in Congress and industry are arguing for an increased buy of F/A-18E/F Super Hornets, the Navy's current, carrier-based strike fighters. Production of 493 Super Hornets was scheduled to end next year, when it was expected that the F-35C would begin replacing them on carrier decks. Now, four senior members of the House Armed Services Committee have warned Defense Secretary Robert Gates that the Navy and Marine Corps face a much larger shortfall of fighter jets than expected. The Marine Corps never invested in the F-18E/F but is counting on the F-35B version of the JSF to replace its older F/A-18C/D Hornets.

In a letter to Gates that was also sent to Adm. Michael Mullen, chairman of the Joint Chiefs of Staff, the legislators said the Pentagon expectation of a looming "fighter gap" of 100 aircraft is

"too optimistic." Armed Services Chairman Rep. Ike Skelton (D-Mo.) signed the letter along with ranking Republican Rep. Buck McKeon (R-Calif.) and Reps. Gene Taylor (D-Miss.) and Todd Akin (R-Mo.). Analysts have long spoken of a Navy-Marine fighter shortfall that could leave the sea services with 300 fewer fighters than their force structure calls for. Boeing assembles the Super Hornet in Missouri and uses components built by Northrop Grumman in California.

Gates called a Boeing proposal to supply an additional 124 Super Hornets an "interesting offer." Previously, the Pentagon boss was opposed to any purchase of fighters that would be perceived as interfering with the JSF program. The Pentagon is also considering upgrades to 150 older F/A-18C/D Hornets—used by both the Navy and the Marine Corps—and reducing the number of fighters in expeditionary squadrons. So far, no funds have been appropriated for a life extension of the Hornets, estimated at \$3.5 billion.

The fighter shortfall is not limited to the Navy and Marine Corps. In what outsiders call a pending "fighter gap"—officials say they do not use the term—the Air National Guard and Air Force Reserve F-16 Fighting Falcons that provide 80% of the air defense of North America will exhaust their airframe hours by 2017. In the FY10 defense appropriations bill, Congress halted plans to retire about 250 F-15 Eagles and F-16s until a review of the situation could be completed and a report issued. That report, once scheduled for April, "keeps slipping to the right," an official tells this author. But even without retiring its so-called "legacy" fighters, the air defense mission (officially called air sovereignty alert) may

suffer unless a decision is made to purchase new aircraft.

FAA funding

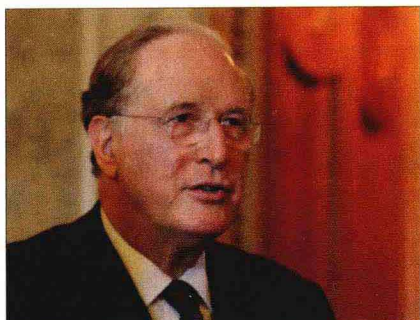
It may take months for the Senate and House of Representatives to reconcile differing versions of a \$34.5-billion two-year authorization bill for the FAA following the Senate's passage of its version on March 22. In a situation not atypical in Washington, the FAA's statutory authorization expired on September 30, 2007, and the aviation agency has continued to function since then under a series of temporary extensions passed by Congress.

A key provision in both versions of the new bill would provide funding for the FAA's NextGen (next generation) program to update the nation's air traffic system. A new navigation system for the nation's airways has been stalled for years, but the measure would require "key elements" to be in use by 2014 at the busiest airports.

The bill funds NextGen in part by an increase in general aviation jet fuel taxes—21.9 cents to 36 cents a gallon—but does not impose new user fees. Supporters of the general aviation community say they have done their part and



Sen. Byron Dorgan



Sen. Jay Rockefeller IV

that any additional taxes or fees would harm small operators at the nation's smaller airfields. Sen. Byron Dorgan (D-N.D.), chair of the aviation subcommittee, told the Senate floor of the value of small aircraft—"to travel around the state and the country to do commerce, to haul parts, to haul people." Sen. Jay Rockefeller IV (D-W.Va.), chairman of the Senate Commerce Committee, said "air-

ports are economic engines for many small communities, and everyone, everywhere, needs to be connected to our national air transportation system."

Missing from both bills is language that mandates installation of monitoring cameras on the flight decks of airliners. Several recent incidents, including one fatal crash, have been blamed on pilot inattentiveness, and safety officials favor cameras that would supplement existing voice recorders. Pilots and privacy advocates oppose installing cameras, and the idea is on hold for now.

The biggest difference between the two bills relates to an ongoing debate about unionization within the airline and air cargo industry. The House bill would make it easier for FedEx employees to organize locally into union chapters. FedEx opposes this language, while their rival UPS supports it. The conflict is expected to set up a difficult conference be-

tween the two branches of the legislature, because the Senate bill contains no language on the issue.

The Senate measure includes provisions aimed at improving cockpit safety, including pilot rest rules and a law against pilots using laptops, cell phones and hand-held devices while piloting. The measure also strengthens a federal rule, scheduled to take effect April 29, forbidding planes in most situations from sitting unmoving—and loaded with passengers—for more than 3 hr on the tarmac. Major airlines object to the 3-hr federal rule, citing backups at New York-JFK when a runway is down. Critics say the rule is the wrong approach to the problem of being stranded on the runway: Airlines simply cancel flights to keep from breaking the rule, adding to crowding and frustration at airports.

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Intelligent Light

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Powerful, flexible automation with Novel Universal Ensemble (NUE)

Intelligent Light has been awarded a NASA Phase I SBIR contract to develop a universal capability to manage overset grid tools. NUE will accept inputs from any solver, grid generator, and grid type, enabling FieldView to identify grid flaws, create objects for grid refinement, and deliver custom reports to a browser window. NUE represents a novel and standardized capability that will allow all components of an overset ensemble of tools to interact in a consistent manner, reducing the overall time that practitioners spend in managing their simulations.

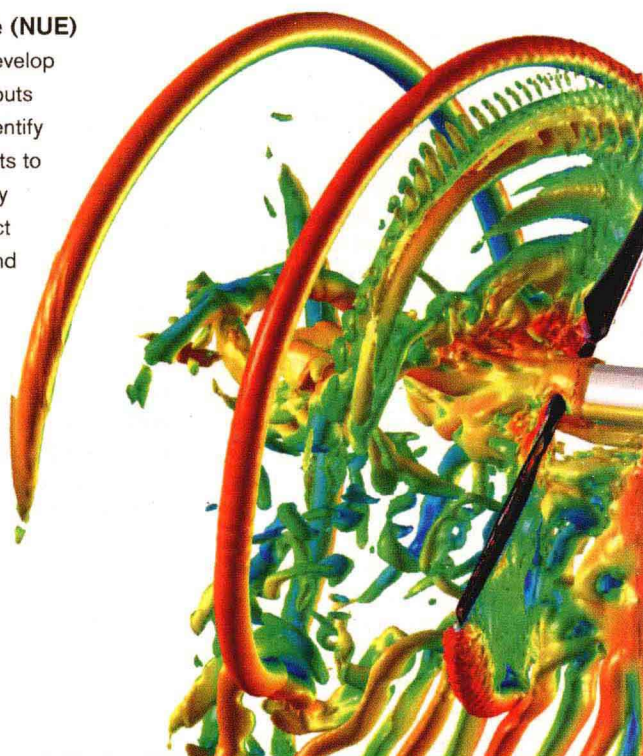
From research to the real world: OVERFLOW-2 direct reader

FieldView users now have the option of reading OVERFLOW-2 results files directly into FieldView, saving time and data storage space. Commercialized from a NASA Langley Phase II SBIR project, the reader is fully compatible with FieldView Parallel operations and all automation tools and functions.

Image: Invisible to the eye, but seen as iso-pressure surfaces in this FieldView image, disrupted flow around a wind turbine results in noise, blade stress, most critically, the loss of potential energy.

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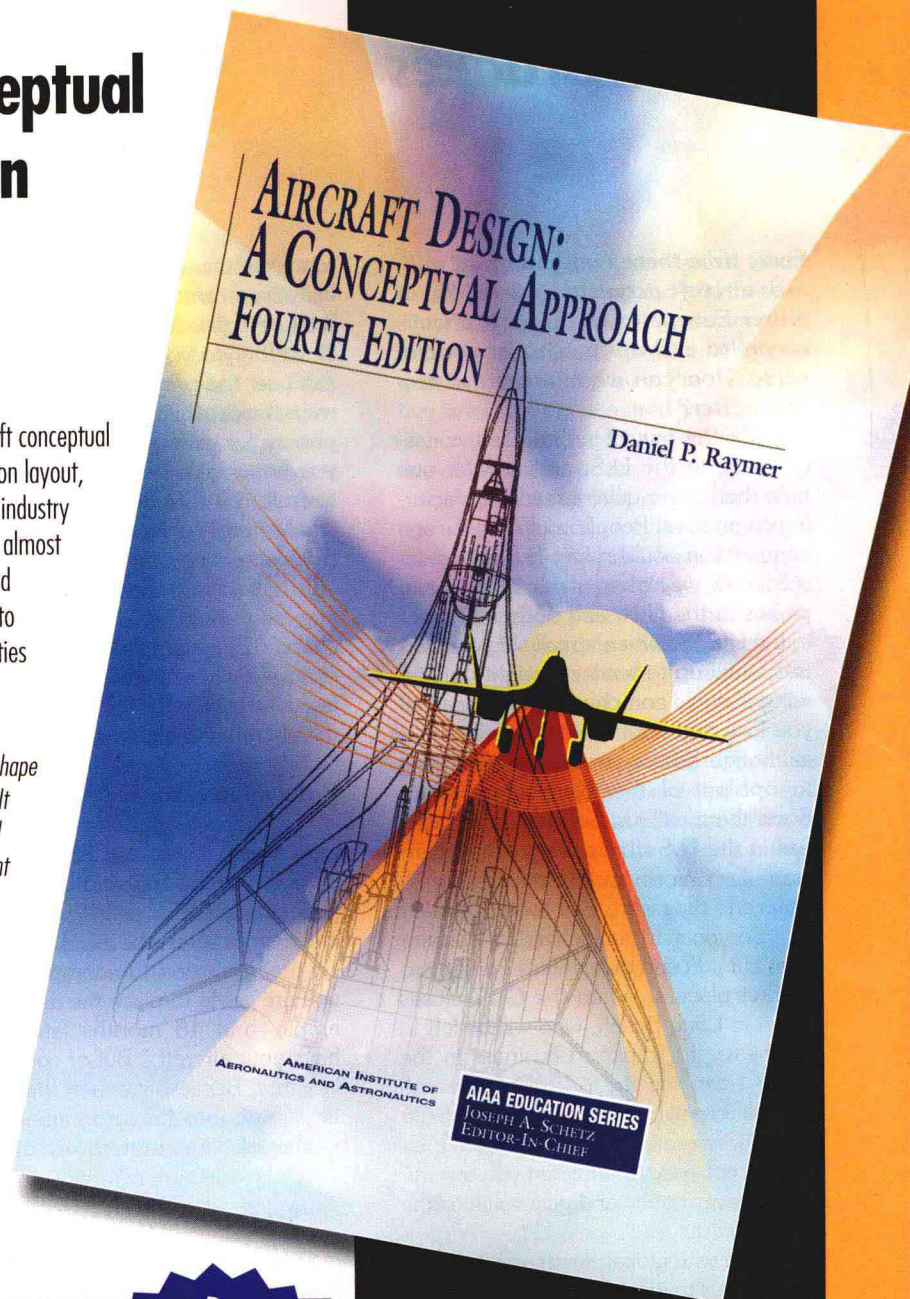
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Andrew Brookes

Every time there's an important military aircraft acquisition decision, in either Europe or the U.S., it always seems to end up in a major controversy. How can we manage the process better?

It's the law of unintended consequences. In the U.S. and here at one time there were quite a few manufacturing companies. People could choose and competition could reign. But after consolidation, we arrived at one or two companies in the U.K. and not many more in the U.S. So when a really big contract is opened up to tender it might only involve a single company—which means if you lose that contract it suddenly looks as though Boeing, or whoever, is going to opt out of the fixed-wing market. Soon there will just be two major facilities in the U.S. for making military aircraft—Fort Worth and Seattle. Ten or 15 years ago they were everywhere.

So you start by looking for efficiencies, but you end up with just one or two market players. When the C-17 closes down in Long Beach, who will be left in the heavy-lift transport business in the U.S.? I can see the A400M becoming the great transport aircraft of the USAF.

There are better ways of doing it—but it's not easy to do when you are trying to save money and give value to the taxpayer.

And with globalization you have the ridiculous situation where Boeing is trying to be the U.S. tanker leader against the wicked Europeans, when Boeing is widely subcontracting across the Pacific. Boeing is arguably not much more American when it comes to components than the EADS/Northrop Grumman aircraft. It's just that one is trading on its past and the other is trying to make up ground.

But it's not just the recent tanker bid—it seems we still don't know how to procure military aircraft in general.

It's because everything now is a system. The temptation is to hang more and more bells and whistles on the sys-

tem. You can now hang so much capability on an aircraft in the 10 to 15 years it takes to develop it.

How do you get around that? You can't set the program in aspic. In many ways the capability of the Eurofighter Typhoon, for example, was set in 1986. If you bought all the components for the aircraft in 1986, and we bought quite a few Motorola chips then for Eurofighter, they would now be totally useless. So you have the dilemma about when to buy, as over 10 years there is so much change. For example, the F-22 is a good example where there is so much obsolescence built in that you end up with not the aircraft you planned in the first place.

But a military tanker isn't like that.

If there is anything that should be easy to do, it's an A400M. I remember being briefed at the start of the A400M program by EADS staff. "We can design it like an airliner," they said. "We'll agree on the design on the computer—where you are going to place the doors, for example—and 48 months later you will have your aircraft." But of course it isn't like that. Because it's then that the politics come into the program—from the politics of "you mustn't close the aircraft

"So the answer to the question is to take politics out of the equation and go to the marketplace and buy what you want. But I'm not naïve enough to think that's how the business works."

factory in my state" to the politics of "you mustn't have a Pratt & Whitney engine on it." Even though it's not high technology it's the political interference that stops these programs from progressing as they should.

So the answer to the question is to take politics out of the equation and go to the marketplace and buy what you want. But I'm not naïve enough to think that's how the business works.

Politicians have a duty to protect the country's strategic industrial base and technical know-how. By going to the open market you can lose valuable skills and knowledge—some would argue that has already happened in the U.K., where we have lost our space technology capability, for example. So is there a better way to protect a skills base without distorting the market? The current system is not working—with the Joint Strike Fighter, for example, there are still client countries trying to access the software they will need to operate the aircraft in the way they want.

If you look at what's happened in the U.K. with the helicopter sector, you had a government minister, Lord Drayson, respected by everyone in the industry, who said that in exchange for receiving major orders the U.K. manufacturer would have to set up centers of excellence in the U.K. at Yeovilton. This was an idea that was also agreed to by the Italian partner who brought over the design office from Rome. But look what happens. The minister leaves and the whole strategy falls apart. If you look at the major international helicopter orders recently, they've gone to Sikorsky, to everybody, in fact, apart from those based in the U.K.

It's back to joined-up thinking. The folks who are issuing the contracts for search and rescue aren't necessarily the military who have signed up to the defense industry strategy—the Treasury [the U.K.'s government finance department] aren't signed up either, they just want value for money. So how do you get all the stakeholders to sign up to the strategy? If the strategy is to keep all these core skills within your country, it will only work as long as people keep buying the kit. And as we haven't had any money to keep buying the kit, we

have not been keeping the strategy going. It's fallen flat on its face.

Are we becoming more protectionist, on both sides of the Atlantic?

The U.S. certainly—all this ITAR waiver issue is nothing to do with technology issues; it's to do with keeping jobs. I've been somewhat appalled, as someone half American, that there is this perception in the U.S. that it's not the American way to do the terrible things we do in Europe such as subsidiz-

"We're really Western focused—the U.S. vs. Europe—and in the meantime the real advances are being made in the Far East."

ing our industries. But everyone does it. The loss by EADS/Northrop Grumman of the tanker contract was a classic piece of *dirigiste* policy—the French could have done it, but with much more panache.

It's not the way to do business. The B2 contract keeps going because the government has deliberately contracted out work on the B2 to each of the 50 states. So you know you have 50 states signed up to the program. It might make political sense but it does not make any industrial sense—the best suppliers might be in just five states.

It's a great shame because increasingly protectionism will now rise in Europe as a result [of the KC-X tanker decision], which for someone like me, dedicated to moving on, is very sad. It will give ammunition to those Europeans who should know better but who will now say: "We tried the American market, with the presidential helicopter, with the tanker, but when we win fair and square suddenly the goalposts are changed." They will now start saying "why bother?" That worries me because as taxpayers we will all lose and the vested interests will win out.

So where does that leave the global

aerospace industry, especially in the wake of the recent World Trade Organization ruling [on European government grants to Airbus]? Will it mean that every contract will now become even more political, even more influenced by government-to-government relations and less about what the end user really wants? Is that where we are heading?

We are heading to a world which we in the West have not really thought through. We're really Western focused—

the U.S. vs. Europe—and in the meantime the real advances are being made in the Far East. While we are squabbling over these matters there are remarkable advances being made there.

The received wisdom is that China is just very good at copying and that's it. The reality is China is very, very good at copying. The latest Chinese helicopter gunship is powered by a Pratt & Whitney engine they acquired via Canada. This will continue to happen, irrespective of any embargoes.

Airbus has already given China Airbus wing technology for the older Airbus wings, but as I said to Airbus: "If you are giving them the technology, don't you think that in 15 years' time they will be beating you in composites?" Once you give away the technology, even older technology, they will soon be adding the new technology themselves.

What worries me is that we will become too involved in these trade issues between the U.S. and Europe. Chinese military aircraft and the weapons they carry are becoming awesome, and they have acquired them through throwing money at the industry. China plans to put a man on the Moon by 2020. There

After graduating from Leeds University in the U.K., Andrew Brookes completed Royal Air Force pilot training and then logged 3,500 flying hours on reconnaissance and strike tours. He then joined the triservice policy and plans staff of Commander British Forces, Hong Kong. After serving on the HQ Strike Command Plans staff, and then in charge of the multiengine, training and rotary wing desks in the Inspectorate of Flight Safety, he was appointed as the last operational RAF commander at the Greenham Common cruise missile base.

He spent a year studying international relations as fellow commoner at Downing College, Cambridge, before becoming a group director at the RAF Advanced Staff College and then coordinator of air power studies at the Joint Services Command and

Staff College. He earned an Open University MBA in 1995 and was trained in management consultancy at the Civil Service Staff College. His final tour was in Ministry of Defence Consultancy and Management Services.

From 1999-2009 Brookes was an aerospace analyst at the International Institute for Strategic Studies in London before being appointed as director of the Air League, an organization that seeks to influence U.K. government policy on behalf of the aviation industry.



will also be superb long-range fighters, supported by all the necessary infrastructure and support assets, over the Taiwan Straits by 2020.

If you are in the market for a new fighter you will soon be asking: "Do I really want to buy a JSF with all the caveats or should I get one from Beijing at half the price?" The U.S. is becoming too prescriptive in what it does with U.S. technology.

Was there any way EADS/Northrop Grumman could have won the deal?

They did win it—it was taken off them. I was talking with U.S. chiefs of staff and they said it was their job to give the U.S. public the best product. They said they were not beholden to any company but that their job was to pick the best product for the U.S. Air Force. They went through an exhaustive procedure

"But the trend is that manufacturers in the Far East will make the aircraft, and it's pointless trying to undercut them because they will always be able to beat you."

and concluded that this [the EADS/Northrop Grumman KC-45] was the best product for the Air Force, at a time when they really needed the asset as soon as possible.

The same thing with the presidential helicopter—no one gave that contract to the Europeans because they owed the Europeans anything. They gave it to Europe because it was the best aircraft. Still, what happened? They wanted to strap new equipment on the aircraft. They said, "You've doubled the price," but that only happened because they wanted to strap new equipment on it. So it then became an issue of how can you have an American president flying an Italian helicopter?

But the WTO issue didn't help EADS in the tanker contract.

But that's just a smokescreen to me. There are subsidies all over the place. No one would live in California if the water wasn't subsidized. There are vast sub-

sidies going into communities in the U.S. that would otherwise be unsustainable; I don't see anything wrong with that. But the idea that somehow subsidies only happen in Europe is wrong.

In terms of the WTO, it is true that the Europeans were at fault, but the idea that the pristine U.S. had just been taken to the cleaners is wrong.

But these trade issues have to be properly regulated. In Europe we are moving toward a more openly regulated defense market with the development of the European Defence Agency and the commission's increasing involvement in this area. Would it be possible to set up an organization to regulate transatlantic trade, an open and fair market—or is that just not possible?

No, it's possible. The market should be the market. The market should rule—

the winners should survive and the losers should go to the wall. Airbus started off with a great deal of help but it did get to the stage where it was winning against Boeing on its own merits. You can argue: Would it have got that far without government support? Well maybe not. But once it was up and running it was winning contracts on merit and continuing to win on merit.

Everyone subsidizes, but the idea of bringing bureaucrats to try to regulate it is pure Soviet Union. It doesn't work.

But my point is that we should learn from what has happened and try to put in place a new regime that would look at issues such as the ITAR waiver and what constitutes fair and unfair subsidies. There must be a better way of organizing it.

The WTO is the way. That's where it should be, through processes such as the Doha rounds, which develop procedures we can all sign up to. Unfortu-

nately, the Doha round proved that we are getting poorer at sorting out these issues, not better, because of all the other baggage that comes into world trade talks.

Until recently, far from there being more cooperation since the fall of the Berlin Wall, there seem to be more arguments on issues such as missile defense—an area very conducive to a level playing field—which is a great shame, because we could all end up chasing just one aircraft contract because the process has become so expensive.

What is slightly strange about all this is that operationally we are becoming much better at sharing assets, especially tankers, which are being used in Afghanistan and elsewhere. For example, Australian tankers are fueling aircraft from many of the different coalition forces. At an operational level we're much more advanced, and at the acquisition level we seem to be retreating.

Defense is the last pork barrel in town. As a politician the only lever you have left to pull is defense.

If you were running a European aerospace company now, the biggest market will still be in the U.S., but there are new threats coming from the Far East. How would you align the business to exploit the opportunities and defend yourself against threats? The selling opportunities are narrowing.

The BAE Systems answer is that you opt out of making aircraft and concentrate on systems. In many ways that's a very creditable argument—but to me that means that after Typhoon we will no longer make an aircraft in the U.K. I find that rather sad. But the trend is that manufacturers in the Far East will make the aircraft, and it's pointless trying to undercut them because they will always be able to beat you.

But that's not where the value is in the supply chain.

No, there's no value in that; the value-added is in the systems. The aircraft will be increasingly made outside