8 AEROSPACE AMERICA SEPTEMBER 2012

September 2012

AEROSPACE AMERICA

Curiosity triumphs

Declassifying the space race

Aeronautics: Frontiers of the imaginable

A PUBLICATION OF THE AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

AIAA

AEROSPACE AMERICA

September 2012

DEPARTMENTS

COMMENTARY 3
EU ETS: The wrong approach.

INTERNATIONAL BEAT 4
Russian helicopters on the ascent.

WASHINGTON WATCH 8
Curiosity triumphs amidst business as usual.

ASIA UPDATE 12
Safety is much more than no accident.

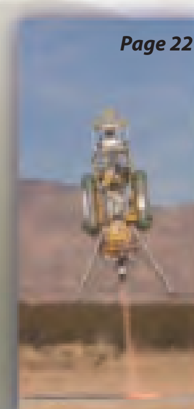
CONVERSATIONS 16
With Isaac Valero-Ladrón.

SPACE UPDATE 20
Balance of space launches shifts.

ENGINEERING NOTEBOOK 22
Will GENIE guide Xombie to a landing?

OUT OF THE PAST 44

CAREER OPPORTUNITIES 46



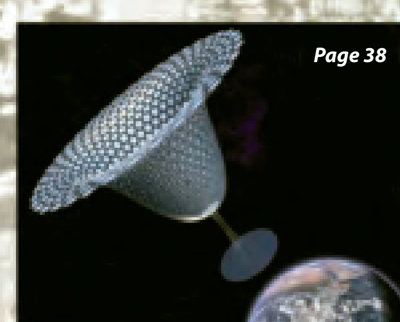
FEATURES

AERONAUTICS: FRONTIERS OF THE IMAGINABLE 26
The technology revolution is rapidly changing the entire range of aeronautics, leading to startling possibilities.
by Dennis M. Bushnell

DECLASSIFYING THE SPACE RACE, PART 1: SURVEILLANCE SYSTEMS 32
What—and how—the U.S. knew about the Soviet space program is beginning to emerge from the shadows of secrecy.
by Peter Pesavento

SPACE SOLAR POWER: PANACEA, OR PIE IN THE SKY? 38
Beaming electricity to Earth from solar power satellites could be brought a step closer with sufficient investment.
by Jerry Grey

Page 32



BULLETIN

AIAA Meeting Schedule B2
AIAA Courses and Training Program B4
AIAA News B5
Meetings Programs B13
Call for Papers B16

COVER

The Mars Science Laboratory team in the MSL Mission Support Area reacts after learning the Curiosity rover has landed safely on Mars and images start coming into JPL. Photo Credit: NASA/Bill Ingalls.

Aerospace America (ISSN 0740-722X) is published monthly, except August, by the American Institute of Aeronautics and Astronautics, Inc. at 1801 Alexander Bell Drive, Reston, Va. 20191-4344 [703/264-7500]. Subscription rate is 50% of dues for AIAA members (and is not deductible therefrom). Nonmember subscription price: U.S. and Canada, $163, foreign, $200. Single copies $20 each. **Postmaster: Send address changes and subscription orders to address above, attention AIAA Customer Service, 703/264-7500.** Periodical postage paid at Herndon, VA, and at additional mailing offices.

40,000 copies of this issue printed. This is Volume 50, No. 8.

September 2012, Vol. 50, No. 8

Commentary

EU ETS: The wrong approach

The moment any Europe-bound plane starts its engine—before it begins to taxi on the runway, no matter where that runway is—the European Union begins to tax the airline and its passengers under the guise of its Emissions Trading Scheme (ETS).

There are three major problems with the ETS. First, the EU's assertion of regulatory and tax authority over emissions from aircraft while on the ground in the United States and in its airspace is a violation of national sovereignty. Left unchecked, the consequences of this are enormous, as airlines will be exposed to multiple, overlapping taxes and regulations that may be imposed by any and all nations of the world. Second, this unilateral tax siphons away from aviation the very funds needed to continue to invest in new aircraft, retrofits, and operational innovations that bring real environmental improvements. Third, adding insult to injury, the revenue collected does not even have to be used to help the environment: Under European law, countries may use this money for any purpose.

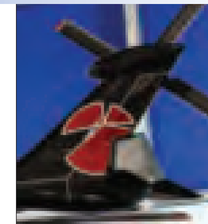
While airlines and the aviation sector more broadly should care about this, so too should all U.S. businesses and policymakers. Simply put, if the EU can tax emissions over an entire flight merely because that flight touches down in Europe, what prevents it from imposing emission taxes on the import of U.S.-manufactured goods?

With fuel as the airlines' largest and most volatile expense, U.S. airlines have dedicated themselves to reducing fuel burn and resulting carbon emissions. Between 1978 and 2011, the U.S. airline industry improved its fuel efficiency by 120%, resulting in emissions savings equivalent to taking 22 million cars off the road annually. U.S. airlines burned 11% less fuel in 2011 than in 2000 even though they carried almost 16% more cargo and passengers. The U.S. airline industry is committed to continuing this trend as supporters of the worldwide aviation industry's plan for further fuel efficiency improvements by an average of 1.5% a year through 2020 and carbon-neutral growth thereafter. However, meeting these goals requires supportive policies from governments in areas like air traffic management modernization and aviation technology research and development—taxation policies like the EU ETS undermine them.

Airlines are working closely on a proposal with the International Civil Aviation Organization, the division of the United Nations responsible for setting aviation standards. The aviation industry and its government allies strongly believe that ICAO is the proper body to establish any aviation emissions program. ICAO approved the outline of the airlines' emissions-reduction proposal back in 2010 and continues to move it forward.

Until now, diplomacy has failed to deter the EU from taxing the world's airlines. The Obama administration, congressional leaders from both political parties, and most non-European nations denounce the EU ETS. They correctly call it an illegal money grab. But EU officials show no sign of backing off. Congress and the administration need to take action—both legal and legislative—to block this unlawful tax. A global approach to lowering emissions would be welcome, European taxation is not.

Nancy Young
Vice President, Environmental Affairs, Airlines for America



Russian helicopters on the ascent

WITH SIX NEW MODELS IN VARIOUS stages of development, these are busy times for Russian Helicopters. The company is one of Russia's biggest recent success stories in the aerospace arena, with deliveries set to reach 300 helicopters this year—up from 262 in 2011. Its business plan focuses on a new range of models to attract civilian customers in the global market and a growing income stream from support services. The company also has benefitted from the upturn in the Russian economy, which has seen an increase in both defense and military procurement budgets.

Established in 2007, the firm has been consolidating helicopter design and manufacturing facilities throughout the country into a single entity ever since. It now employs around 40,000 people. Most recently, in 2011, the Ulan-Ude Aviation Plant (UUAP), which produces the Mi-8, Mi-17, and Mi-171 helicopters, was incorporated into the umbrella organization. The company now includes helicopter production facilities throughout Russia, the Mil and Kamov design bureaus, a wide network of spare parts production and repair facilities, plus a growing number of joint ventures with Western companies.

In 2010 AgustaWestland and Russian Helicopters had established a joint venture company, HeliVert, to assemble AW139 helicopters at a new plant in Tomilino, near Moscow.

The most recent of these ventures was announced at the Farnborough International Air Show in July, when Anglo-Italian helicopter manufacturer AgustaWestland and Russian Helicopters outlined a plan for joint development of a new 2.5-tonne civil single-engine helicopter, which would sit between the latter company's Mi-34C1 and Ansat products.

Challenging civil markets

In launching helicopters in the civil sector—to compete with piston-engine products from Robinson and turboshaft-powered executive models from Eurocopter, Bell, and Sikorsky—the Russian company has both challenges and attributes. Most of its products have been aimed at the military market; the London-based Clearwater Corporate Finance *Aerospace Global Report 2011* suggests the company has 14% of the global military market but just 3% of the civil sector. It will have an uphill struggle breaking into the North American market (by far the world's largest), which currently accounts for just 0.5% of the company's customer base, by geographic region.

AgustaWestland and Russian Helicopters established a joint venture to assemble AW139s.

At HeliExpo in Dallas earlier this year the company exhibited its Mi-171A2, a modernized version of its venerable Mi-8/17 cargo transporter, alongside another upgraded utility model aimed at the fire-fighting and special missions markets, the Ka-32A 11BC. More than 12,000 Mi-8/17s have been sold to civil and military customers around the world, and in 2011 the U.S. government ordered 21 Mi-17V5 military transport helicopters for the Afghan army in a deal worth about $300 million—a landmark agreement in the relatively short post-WW II history of U.S./Russian military cooperation.

But finding U.S. customers for its new range of civil passenger helicopters will be a tougher challenge. The great advantage that many Russian helicopters have over Western competitors is price. According to Russian Helicopter officials speaking at Farnborough, the new Ka-62, for example, will have performance characteristics competitive with Western types but at a price range 15-20% lower.

A new generation

The piston-powered Mi-34C1, the Pratt & Whitney Canada-powered Ansat, and the Turbomeca Ardiden-powered Ka-62 are the vanguard of the new generation of Russian Helicopter models aimed primarily at the civil sector and at customers in Europe and North America. They all feature technologies

The U.S. government ordered 21 Mi-17V5s for the Afghan army.

The Mi-34C1, Ansat, and Ka-62 are the vanguard of the new generation of Russian Helicopters models aimed primarily at the civil sector.

and operating performances competitive with U.S. and Western European models. The Ansat, for example, has a FADEC (full-authority digital engine control) controlled engine, a fly-by-wire control system (in the training variant), fiberglass main and tail rotor blades, and a hingeless main rotor hub with composite torsions.

Polymer composites comprise 60% of the weight of the Ka-62 rotor blades and airframe, which also features a five-blade rotor system, a health and usage management system unit, a glass cockpit, and a fuel system provided by French company Aerazur.

A critical sales point will be the provision of support services to civil customers and the competitive reliability of systems. Russian Helicopters is advertising 5,000 flight-hour maintenance intervals for the Ka-62's main airframe components, and 10,000 hr for the main and tail rotorblades.

But it is likely to be some time before these models are certified and available in North America. Russia is working closely with the Cologne-based European Aviation Safety Agency (EASA) to certify its models to global standards—at least two EASA-certified Ka-32A11BCs have been supplied to India following the EASA certificate award for the type in 2009.

RUSSIAN HELICOPTERS MODELS DELIVERED

China	300
Europe	615
India	270
Latin America	390
North Africa	400
North America	40
Middle East	450
Russia	4,300
Southeast Asia	300
Southern Africa	150

Source: Russian Helicopters.

In the meantime, the company has been developing its business in traditional markets such as India and China, while breaking new ground in Brazil. New service centers for civil models have been opened or are under way in India and China—the new Chinese civil support facilities should be completed in 2013—while Mi-171A1s have been sold to Brazil's national oil company Petrobras and Ka-32A11BC multipurpose helicopters to Brazil's Helipark Taxi Aereo. The Petrobras order for helicopters to operate in the Amazon basin was part of a competitive process involving Sikorksy and Eurocopter. In 2011 these models became the first Russian civil rotorcraft to be delivered in Brazil.

Meanwhile, Russian President Vladimir Putin, in June, announced that the country will liberalize light aircraft and helicopter operating rules throughout Russia. This, along with the recent upsurge in Russia's economy, will also improve the company's domestic civil opportunities.

Reasons for optimism

Russian Helicopters still has some way to go to match the production levels of its major Western competitors—Eurocopter delivered 503 models in 2011. But production numbers are rising rapidly—214 in 2010, 262 in 2011, and at least 400 a year by 2020, according to the company's strategic plans. In 2011 revenue was up 27.8% over 2010, at 103.9 billion rubles ($3.43 billion), and profit before tax rose 12.7% over the same period, to 7 billion rubles ($233 million).

According to Russian Helicopters CEO Dmitry Petrov, speaking earlier in the year, "We increased deliveries [in 2011] by 22.4% to 262 helicopters to our customers from 19 countries, which allowed us to achieve a market share of 14% of the world's helicopter market in money terms. Moreover, we succeeded in doubling [the] company's firm backlog, which reached 859 helicopters with a value in excess of 330 billion rubles [$11 billion] by year-end."

Most of these sales were to military customers. The Russian export organization Rosoboronexport has quadrupled the sales of attack and military transport helicopters over the past few years, up from 15 in 2007 to 99 in 2011. Since 2001, Rosoboronexport has delivered 420+ helicopters to 33 countries. These sales have included 80 Mi-17V-5 military transport models to India for delivery by the end of 2013, and extensive sales to China.

Defense increases

Russia's own domestic defense budget has been bolstered by increased economic revenues, and procurement budgets are growing. In March Putin announced a proposal to increase defense spending from $650 billion a year in 2014 to $770 billion in 2020.

THE RUSSIAN HELICOPTERS PRODUCT RANGE

Program	Helicopter type	Program information
Mi-34C1	MTOW 1.45 tonnes; single pilot and three passengers; 400-kg payload; powered by a single Voronez M9FV piston engine.	First flight at Tomilino, Moscow, in August 2011, with first deliveries planned for later this year.
Ansat	MTOW 3.3 tonnes; one (or two) pilots and up to eight passengers; 1.184-tonne payload; powered by two Pratt & Whitney Canada PW-207K engines.	Certification planned for this year. Production estimated at 20 units this year.
Ka-226T	MTOW 3.6 tonnes; one (or two) pilots and seven passengers; 1.2-tonne payload; powered by two Turbomeca Arrius-2G1 engines.	Flight trials began in 2009; full-rate production planned for 2013.
Ka-27/ Ka-32A11BC	MTOW 11 tonnes; two pilots and 13 passengers; 3.7-tonne internal and 5-tonne external payload; two Motor Sich TV3-117VMA engines.	In extensive use for a wide range of military and civil (including fire-fighting) applications.
Ka-31	MTOW 12.6 tonnes; radar surveillance helicopter; two Klimov TV3-117VMA engines.	In military service in Russia, China, and India.
Ka-52	MTOW 12.6 tonnes; two pilots; attack helicopter; two Klimov TV3-117VMA turboshaft engines.	In military service in Russia.
Ka-60	MTOW 6.5 tonnes; military transport and utility helicopter; two pilots and 14 passengers or 2 tonnes of payload; two Rybinsk RD-600V engines.	In military service in Russia.
Ka-62	MTOW 6.5 tonnes; two pilots and up to 15 passengers; 2.1-tonne payload; powered by Turbomeca Ardiden-3G engines.	First flight this year and full-scale production in 2015. EASA certification 2018.
Mi-8/17	MTOW 13 tonnes; three flight crew and 26 passengers; 4-tonne payload; powered by two Motor Sich TV3-117VM engines.	Over 11,000 Mi-8/Mi-17 helicopters have been produced to date. They are in service in 80 countries.
Mi-171A2	MTOW 13 tonnes; two flight crew and 26 passengers; 4-tonne internal and 5-tonne external payload; powered by two Klimov VK-2500PS-03 engines.	Full-scale production planned for 2014.
Mi-28NE	MTOW 12.1 tonnes; attack helicopter; powered by two Motor Sich TV3-117VMA engines.	Export version of the Mi-28N under production for the Russian armed forces.
Mi-35M	MTOW 11/5 tonnes; attack and transport helicopter; powered by two Klimov VK-2500 engines.	The Mi-35M is an export version of the Mi-24. Delivered to Venezuela, Brazil, and Indonesia.
Mi-38	MTOW 16.2 tonnes; two pilots and 30 passengers; 6 -tonne internal payload and 7-tonne external payload; powered by two Motor Sich TV7-117V or PW127T/S engines.	Flight trials under way with full-scale production in 2015.
Mi-26T2	MTOW 56 tonnes; two pilots and 70-100 passengers; 20-tonne internal and 20-tonne external payload; powered by two Motor Sich D-136 engines.	Undergoing flight trials.

Russian Helicopters displayed the RACHEL at an expo earlier this year.

According to military expenditure data compiled by the Stockholm International Peace Research Institute (SIPRI) in April, Russia increased military spending by 16% in real terms between 2008 and 2011, with draft budget plans showing a 53% increase (also in real terms) of funds allocated to national defense up to 2014.

Says SIPRI: "In the longer term, Russia plans to spend 23 trillion rubles [$749 billion] on equipment, research and development and support for the Russian arms and military services industry over the period 2011–2020, with plans to replace 70% of Russia's mostly Soviet-era military equipment with modern weaponry by 2020."

In the short term, according to various reports, the government has purchased 140 Ka-52 attack helicopters, and these are now being delivered. In the longer term the current generations of transport and attack helicopters will be upgraded and replaced.

Growth areas

Another key area of future growth for Russian Helicopters will be increasing revenues from maintenance and training. The company recently opened a helicopter training academy near Moscow, to be complete by 2015, and is setting up a global network of servicing centers. According to CEO Petrov: "Today there are more than 8,500 registered Russian helicopters around the world, and we see substantial opportunity to develop our after-sales service network. This year we opened a new service center in India, and we plan to open new service centers in other priority markets such as China, Latin America, and the Middle East, in addition to certifying third-party service centers."

The company is also likely to return to the international stock markets at some stage, after the failure in 2011 of a $500-million initial public offering on the London stock exchange—at a time of extraordinary volatility in the global financial system.

Also, both Mil and Kamov are developing designs for a high-speed helicopter to compete with Eurocopter's X3 and Sikorsky's X2/S-97 demonstrators. Russian Helicopters is reported to be proceeding with both Mil and Kamov versions of a 'Russian Advanced Commercial Helicopter,' or RACHEL, in the 10-12-tonne payload range and accommodating 21-24 people.

Philip Butterworth-Hayes
Phayes@mistral.co.uk
Brighton, U.K.

Correspondence

In **Hypersonic transport...30 years and holding?** (May, p. 40) Mark Williamson says, after commenting on the X-15, "One could say it also begat NASA's ill-fated X-30/National Aero-Space Plane…." I must take exception. NASP was not a NASA run project! It was an Air Force project and was managed by an Air Force SPO. NASA agreed to cooperate on the technology issues.

NASP was born from a DARPA study that showed it was possible to build an air-breathing, single-stage-to-orbit vehicle that could go from a runway to low Earth orbit and return. The Air Force set out to develop a prototype of such a vehicle.

From the beginning, hypersonic experts at NASA Langley and Ames said forcefully that the mass fractions assumed in the DARPA study were far too low and could not be achieved within any reasonable time frame, if ever. They were roundly criticized for being negative. The funding was available, so the centers worked hard on the necessary hypersonic technologies. After about four years, the Air Force project managers finally realized that there was no way to build a vehicle that could get to orbit. They tried to sell a less capable (Mach 12?) vehicle to their superiors, but the project quickly fell apart and was cancelled.

From my perspective, the problem was that the Air Force wanted to develop NASP as a prototype, and there was no way that such a vehicle could be developed at that time. What was needed was a research aircraft capable of reaching Mach 12 with ramjet and scramjet power. NASA Langley believed that such an aircraft was feasible (and it still is!). This research aircraft would prove out the technology so that an air-breathing launch vehicle or a hypersonic transport could be developed. However, the launch vehicle probably would have two stages, with the second stage being a small rocket spacecraft. This would provide a fully reusable launch system.

NASP supporters tried to make a huge leap in technology by going directly to a prototype. Such attempts almost invariably have failed after spending large amounts of money. Prototypes are suitable when small increases in technology are required. When big jumps in technology are needed, the choice should be a research aircraft to develop and prove the necessary technologies.

Pete Petersen
Retired Director, NASA Langley

✈✈✈

The May issue had excellent coverage of the topic of human space exploration and international cooperation. **Getting there together**, the editorial, and **Human exploration—A global quest**, by Leonard David, properly pointed toward the need for nations to work together in the endeavor. I would only caution that having plans that take humans to Mars should not be the 'ultimate' goal. Human exploration should eventually lead to a colony. Until that time, exploration should be planned to best answer the questions of how and where to plan that colony. A trip to Mars may be an important step in that quest, but it is not the end.

James A. Martin
Huntington Beach, California

All letters addressed to the editor are considered to be submitted for possible publication, unless it is expressly stated otherwise. All letters are subject to editing for length and to author response. Letters should be sent to: Correspondence, Aerospace America, 1801 Alexander Bell Drive, Suite 500, Reston, VA 20191-4344, or by e-mail to: elainec@aiaa.org.

Events Calendar

SEPT. 11-13
AIAA Space 2012 Conference and Exposition, Pasadena, California.
Contact: 703/264-7500.

SEPT. 11-13
AIAA Complex Aerospace Systems Exchange Event, Pasadena, California.
Contact: 703/264-7500.

SEPT. 17-19
Twelfth AIAA Aviation Technology, Integration, and Operations Conference; 14th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference. Indianapolis, Indiana.
Contact: 703/264-7500.

SEPT. 23-28
Twenty-eighth Congress of the International Council of the Aeronautical Sciences, Brisbane, Australia.
Contact: http://www.icas2012.com

SEPT. 24-27
Thirtieth AIAA International Communications Satellite Systems Conference; 18th Ka and Broadband Communications, Navigation and Earth Observation Conference. Ottawa, Ontario, Canada.
Contact: Frank Gargione, frankgargione3@msn.com; www.kaconf.org

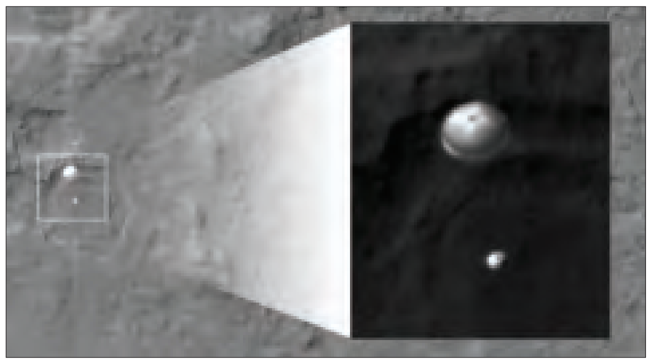
SEPT. 24-28
Eighteenth AIAA International Space Planes and Hypersonic Systems and Technologies Conference, Tours, France.
Contact: 703/264-7500.

OCT. 1-5
Sixty-third International Astronautical Congress, Naples, Italy.
Contact: www.iafastro.org

OCT. 11-12
Aeroacoustic Installation Effects and Novel Aircraft Architectures, Braunschweig, Germany.
Contact: Cornelia Delfs, +49 531 295 2320; cornelia.delfs@dlr.de

Curiosity triumphs amidst business as usual

THE SCIENTISTS AND ENGINEERS at NASA's Joint Propulsion Laboratory collectively held their breath, then exploded into shouts of joy, as their $1.5-billion baby came safely to rest on Mars. But elsewhere around the world, it was business as usual.



An image from the High Resolution Imaging Science Experiment camera aboard NASA's Mars Reconnaissance Orbiter captured the Curiosity rover still connected to its 51-ft-wide parachute as it descended toward its landing site at Gale Crater. Image Credit: NASA/JPL-Caltech.

New announcement from NASA…

In August, NASA had some good news to share with three commercial space companies, and later had even better news to share with everyone with any 'curiosity' about space.

On August 3, NASA announced new agreements with three U.S. companies involved in the development of human spaceflight capabilities. These contracts, through the the agency's Commercial Crew Integrated Capability (CCiCap) initiative, were awarded to Sierra Nevada, Louisville, Colorado ($212.5 million); SpaceX, Hawthorne, California ($440 million); and Boeing, Houston, Texas ($460 million).

These agreements were the latest in a series of contracts awarded to various companies to develop a human space transportation capability. According to the agreements, "between now and May 31, 2014, NASA's partners will perform tests and mature integrated designs. This would then set the stage for a future activity that will launch crewed orbital demonstration missions to low Earth orbit by the middle of the decade."

…and seven minutes of terror become hours of joy

A week later, as space enthusiasts and insomniacs around the world gathered at computer screens and television sets to watch the most complex landing ever attempted on another planet, cheers and tears erupted as telemetry, and later images, declared the mission a spectacular success. Monitored by ESA's passing Mars Express and the MRO and Odyssey satellites, touchdown was confirmed at 22:32 PDT on August 5, after a journey that began on November 26, 2011. The landing was flawless—right on time and just where it was supposed to be.

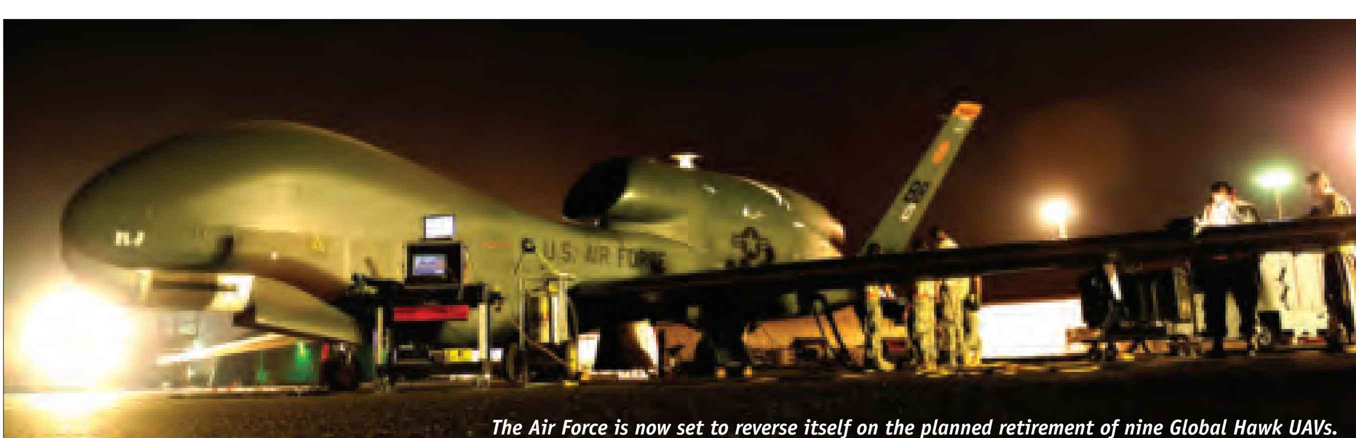
Curiosity's mission will be to discover whether there are or ever were present the resources necessary to support life on Mars.

Weapons of a different kind

Fereydoon Abbasi, the head of Iran's Atomic Energy Organization, complained in July that his country's nuclear facilities are coming under cyber attack—but insisted that Iranian cyber experts can defeat any offensive.

In Washington, news stories based on leaks have alleged that the U.S. and Israel carried out a joint cyber effort against Iran's uranium enrichment capabilities. In London, an annual report to parliament said publicly that a British cyber effort has accessed "networks or systems [in Iran] to hamper their activities or capabilities without detection."

Cyber attacks can, of course, move in any direction.



The Air Force is now set to reverse itself on the planned retirement of nine Global Hawk UAVs.

The vulnerability of U.S. networks to cyber assault was the topic of an unusual July 19 op-ed piece by President Barack Obama in the *Wall Street Journal*—a daily newspaper not usually friendly to the administration.

Obama evoked images of doomsday, or something close to it, in warning of how a cyber attack could immobilize the nation's water and transportation systems. He called on Congress to pass a new bill, called the Cybersecurity Act of 2012, sponsored by Sen. Joseph Lieberman (I-Conn.). The legislation would provide legal immunity and a structured system for private companies and U.S. intelligence agencies to share information about national cyber threats.

"Last month [in June] I convened an emergency meeting of my cabinet and top homeland security, intelligence, and defense officials," wrote Obama, referring to a mock exercise. "Across the country trains had derailed, including one carrying industrial chemicals that exploded into a toxic cloud. Water treatment plants in several states had shut down, contaminating drinking water and causing Americans to fall ill….Our nation, it appeared, was under cyber attack. Unknown hackers, perhaps a world away, had inserted malicious software into the computer networks of private-sector companies that operate most of our transportation, water and other critical infrastructure systems."

With a congressional recess at hand and an election looming on November 6, the Lieberman bill is expected to go nowhere. It does not help that both parties have long invoked a filibuster rule that defines a majority in the Senate as 60 votes out of 100—math that works only in Washington and has hobbled the upper house for years. Moreover, with Congress postponing even routine budget deliberations, no one on Capitol Hill is expected to convene hearings about U.S. vulnerability to cyber strikes, let alone the U.S. using cyber warfare to attack Iran.

Modernization of the C-130 fleet has been moving in fits and starts.

Another kind of strike?

Paradoxically, at a time when very little seems to be getting accomplished in the capital, a debate is taking place behind the scenes about a different option toward Iran—a preemptive military strike aimed at setting back the Iranian nuclear program. It is not being discussed openly, at least not much, but behind closed doors officials are pondering a military strike by Israel, the U.S., or both. Critics of the administration argue that an incumbent president always gains popular support during a military crisis and that Obama—who, unlike his predecessor, is very much a 'hands on' commander-in-chief—could be tempted to attack shortly before Americans go to the polls.

Lt. Gen. James R. Clapper, USAF, ret.

Others in the know, reportedly including Secretary of State Hillary Clinton, would prefer negotiations aimed at reaching out to moderate elements in Iran, although diplomatic advances have been stymied in recent months. Some military experts insist a strike would not accomplish much. According to retired USAF Lt. Gen. James R. Clapper, the director of national intelligence, an attack on Iran would delay that country's ability to develop a nuclear weapon "by two years at most," while worldwide repercussions would be "detrimental to U.S. interests."

Air Force testimony

Gen. Mark Welsh III, slated to become Air Force chief of staff in midsummer, uttered surprisingly blunt talk in his confirmation hearing before the Senate Armed Services Committee in July. According to an unscientific poll, airmen eager to have a leader who will express an unpopular opinion when necessary were cautiously applauding Welsh for telling senators that the Obama administration's FY13 budget proposal is 'simply not executable.'

Welsh was contradicting administration policy, but for the most part was telling the lawmakers what they wanted to hear, and was almost certainly doing so after clearing his text with his mentor, Defense Secretary Leon Panetta—for whom Welsh worked previously when Panetta was director of the CIA.

And while clearly more willing to ignite controversy than his soft-spoken predecessor, Gen. Norton Schwartz, Welsh was saying little that would arouse any ire among the senators. Many in both houses of Congress oppose the budget proposal's 'iron flow,' the popular term for transfers of aircraft that would take missions away from hometown military bases.

Welsh told senators that he was not yet part of the decision-making process that went into the budget proposal, but that he would "work very hard" with the National Guard Bureau and Air National Guard "so that we never end up here again." Welsh acknowledged that there has been acrimony between the active-duty and Guard components over the proposal's scheme to retire C-27J Spartan airlift planes and A-10C Thunderbolt II attack jets. He pledged that the proposal would get a fresh look, "because we are in a place we cannot stay."

Welsh said the Air Force would reverse itself on the planned retirement of nine RQ-4B Block 30 Global Hawk drones now in use by the Central, Pacific, and European Commands and being groomed to replace U-2 manned spy planes. He implied the service would proceed with a longstanding plan to raise the total to 18. Schwartz had previously told lawmakers the Block 30s would be retired, partly as an economy move and partly because they cannot accommodate all the reconnaissance sensors carried by U-2s.

The House of Representatives had voted against the proposal to retire the Block 30s, but the Senate had been mute on the subject and, as recently as June, Schwartz was sticking with a schedule to bring the nine Global Hawks back to the U.S. to be mothballed. "That isn't going to happen," said Welsh.

In another change affecting the active duty force, Welsh confirmed that the Air Force is backpedaling from its plan to transfer F-16 Fighting Falcons from Fairbanks to Anchorage. The decision not to proceed was first disclosed when Sen. Mark Begich (D-Alaska) and Gen. Schwartz had what Begich called a "tense but pleasant meeting." Welsh confirmed that for all practical purposes the F-16 transfer, aimed at consolidating forces as an economy measure, is now dead.


Gen. Mark Welsh III

Sen. James Inhofe (R-Okla.), who like Welsh is a pilot, got the nominee to agree to review the C-130 Hercules Avionics Modernization Program, an effort to install uniform, digital cockpits in some 480 tactical airlifters. The program has been moving in fits and starts for almost a decade after beginning modestly as an effort to standardize the C-130 fleet. In a slap at military experiments using environmentally friendly but costly biofuels, Inhofe said, "It is a disgrace the president is willing to put our military at risk with aging equipment by cutting the C-130 program so he can push his progressive EPA agenda through the wrong department."

Observers believe, as forecast in this space two months ago, that the administration is using the Welsh appointment as a reason to back away from its 2013 budget plan—which made sense to many on military and fiscal grounds but was never going to survive in Congress. This does not mean Welsh will be a pushover for legislators: He is expected to lobby hard for the new bomber, which the Air Force has wanted for years, and for other programs aimed not so much at an insurgency situation like the one in Afghanistan but at a 'near peer' adversary like North Korea or Iran.

TSA training tribulation

The Washington agency that everyone loves to hate, the Transportation Security Administration, is being criticized, and this time it is not about pat-downs in the boarding area. A July report by the Government Accountability Office slams the agency's "process for ensuring [that] foreign flight students do not pose a security risk." Some of the 19 hijackers on September 11, 2001, were able to pilot airliners they seized because they had learned how to use a yoke, throttle, and rudder at U.S. flight schools. Since then, everyone who applies for flight training is vetted with TSA, but the GAO and lawmakers say the vetting process is flawed.

The report found that under existing practices, certain U.S. citizens are able to receive flying lessons even though their names appear on the government's No-Fly List, which prohibits them from being airline passengers.

"It is completely unacceptable that a decade after 9/11, GAO has uncovered weaknesses in our security controls that were supposed to be fixed a decade ago," says Rep. Mike Rogers (R-Ala.), chair of the House of Representatives' transportation subcommittee. "[This] just caught me completely off guard, and I'm pretty angry about it," Rogers adds.

Rep. Bennie Thompson (D-Miss.) says that the government has procedures in place to prevent a person on the No-Fly List from receiving a pilot's license. None of the 9/11 hijackers had, or needed, licenses. "We should not be training them to become pilots anyway," Thompson acknowledges.


Rep. Mike Rogers

As reported by the conservative columnist Michelle Malkin in the *New York Post*, the GAO report includes references to a flight school in the Boston area that has allegedly provided flight training to undocumented immigrants. The report notes: “Eight of 25 foreign nationals who [erroneously] received approval by the TSA to begin flight training were in ‘entry without inspection’ status, meaning they had entered the country illegally. Three of these had obtained FAA airman certificates. Two held FAA private pilot certificates and one held an FAA commercial pilot certificate.”

The GAO also found that TSA had approved flight training for 17 ‘overstays,’ who had arrived with valid visas but had remained in the U.S. longer than permitted. It also found that some flight schools had not undergone TSA security threat assessment as required by law.

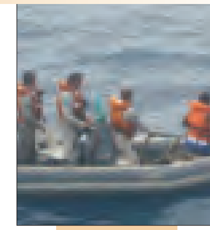

Rep. Bennie Thompson

The No-Fly List, maintained by TSA for the joint-agency Terrorist Screening Center and policed by several agencies, has about 10,000 names. TSA says the list “has been an essential element of the [sic] aviation security—it keeps known terrorists off planes.” Details on how the list is administered are a closely held secret, but an alleged copy of it is readily accessible on the Internet. It has been controversial for years and is often criticized for having so many names that it is all but impossible to enforce reliably.

Even so, the No-Fly List is different from the Terrorist Watch List, a much longer roster of people suspected of some involvement with terrorism, containing around 400,000 names.

At one time, the No-Fly List included some names in common use, such as Daniel Brown, Robert Johnson, Edward Kennedy, and David Nelson. There have been recurring problems because names in other languages can be spelled more than one way, and the list has no way to catch all the possibilities. Rep. Steny Hoyer (D-Md.) has long argued for a shorter list, one more narrowly focused on what he calls “real threats,” and for an appeals process for anyone listed.

Robert F. Dorr
robert.f.dorr@cox.net



Safety is much more than no accident

It has taken more than three years of total time, but really a little less than four-and-a-half minutes, to put aircrew training, management styles, regulators, and aircraft manufacturers under the spotlight again. The 'singularity' that achieved this, rightly or wrongly, was the crash of Air France Flight AF447, an Airbus A330-200, in the South Atlantic on June 1, 2009, with the loss of 228 lives. The repercussions of the accident investigation have had ramifications worldwide, and have already touched operators and regulators in Asia as well as in Europe and the U.S.

A previous disaster, the February 12, 2009, crash of a Colgan Air Bombardier Dash 8 Q400 turboprop near Buffalo, New York, killing 50 people, sparked a U.S. congressional proposal that would increase the experience required for first officers to 1,500 hours, beginning 2013; require them to possess an air transport pilot (ATP) certificate; and adopt stricter rules governing aircrew fatigue.

But in the rest of the world the crash was largely viewed as a U.S. matter, and the congressional move was seen as having little or no relevance outside the U.S. That attitude is especially prevalent in Asia and Europe, where many major airlines run their own internal cadet pilot training programs in concert with certified flight schools, and aircrew working hours have long been less onerous than in the U.S. In any case, the Colgan Air first officer had 2,244 flying hours (though she had a Commercial Pilot certificate, lower than an ATP).

Flight AF447 changed that perception. The need to improve various aspects of pilot training has been studied for some years but is now coming into sharper focus, with emphasis not just on training and flying hours but also on the quality of training.

Part of the push has come from Australia's regulatory Civil Aviation Safety Authority (CASA), and from Asia, where several airlines—among them Hong Kong-based Cathay Pacific Airways, Japan's All Nippon and Japan Airlines, Taiwan's EVA Airlines, and Australia's Qantas—have been part of working groups partnering with FAA and manufacturers to look at improving aircraft upset recovery programs.

Proper training and proper tools

Without becoming bogged down in the intricacies of either accident investigation, what happened in essence was that each pilot pulled the aircraft's nose up when it should have been pushed down. For different reasons, both aircraft were mishandled and then stalled, and both crashed—the Q400 landed on a house well short of Buffalo's airport, and AF447 remained stalled while dropping about 37,000 ft to crash into the Atlantic Ocean off South America.

The Buffalo accident raised issues of crew training—the captain was recorded as having had problems upgrading to command, and the first officer raised the flaps (unbidden) at a critical time and so contributed to the aircraft's wing becoming stalled.

Fatigue was another issue raised by both mishaps, because these pilots regularly commuted considerable distances to reach their working bases. The A330 accident also highlighted the issue of training, but added elements of regulatory and aircraft certification concern: The captain was resting, and it seems that neither of the relief pilots recognized what was happening when airspeed indications became unreliable. Instead of maintaining a level attitude and constant engine thrust, one pilot pulled the nose up and stalled the aircraft while the other became immersed in trying to work out what was happening as automatic system after automatic system dropped offline for want of credible airspeed readings.

The problem of 'unreliable airspeed' (UAS) is well known, if infrequent, having contributed to crashes of Boeing as well as Airbus products. In Airbus's case, most often it has been caused by ice crystals at high altitude blocking external sensors. This causes the autopilot and autothrottle to drop offline, throwing the job of managing the aircraft back to the pilot or pilots. The proper drill is to hold the aircraft level manually until the external probes' heating elements manage to melt the ice and the air can flow through them again.

Over the past few years there have

The Air France Flight AF447 crash highlighted the need for improved pilot training.

been 38 Airbus unreliable airspeed incidents reported, of which only one—AF447—ended in a crash. But in many of those events, it was found that the correct procedure had not been followed—the aircraft had been manually guided correctly, but without formal use of the UAS drill, until the problem had resolved itself a few minutes later.

This seems to condemn the AF447 first officers out of hand, because of what looks to have been a complete breakdown in their situational awareness. However, this might be unfair: First, the numbers are too small a sample to say whether they represent a trend or merely an aberration. Second, a look at the UAS training regimen seems to show that the officers had not been given the proper tools to do their job of looking after a large airliner at high altitude—and this is where airlines and regulators have major roles to play.

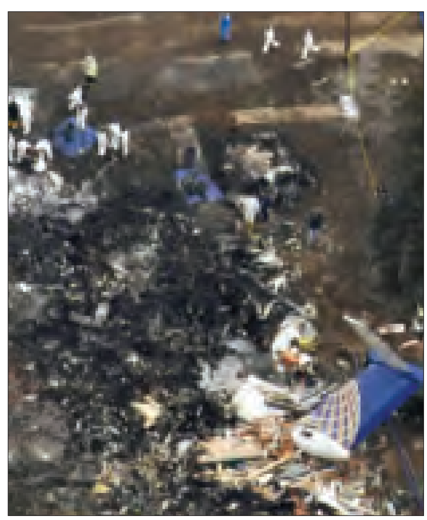
A changing field

The job of piloting has changed, and so have many of the people who now work for airlines, both as pilots and as managers. Technology has brought increased automation, offering greater safety and reliability as well as financial savings through greater efficiency. To some extent, pilots—particularly on long-range flights—are more machine minders than flyers. Simulators enable pilots to practice emergency procedures that would be too dangerous to use in the real aircraft except in a genuine emergency. Safety overall has indeed improved, and accident rates have declined.

But it is not all good. As a British former test pilot put it, "The problem with large aircraft…particularly with modern airliners, is that for 99.9% of the time everything is very simple and the systems don't require any attention once the initial settings have been made. The pilot is therefore sitting comfortably, fully relaxed, but at any moment he or she might suddenly have to take emergency action which he has to remember and get right. Obviously these days a pilot can practice in a simulator…[but] a pilot in a simulator knows that there is going to be a malfunction, so the realism is spoilt…."

In short, no one dies from crashing a simulator, so there is none, or very little, of the 'startle' factor (read fear) cited in the AF447 investigation as possibly contributing to the crew's lack of proper performance.

An Australian pilot said long ago that his job was not to fly an aircraft, but to save it when things went wrong. In this regard regulators and operators have been deficient as airline operations have changed. Many of today's junior airline pilots have received excellent training (particularly those from the military) in handling aircraft near the ground—for taking off and landing. But surprisingly little attention is paid to high-altitude flight, where an aircraft is much nearer the edges of its performance 'envelope.'



In 2009, a Bombardier Dash 8 Q400 turboprop crashed near Buffalo, New York.

It is much easier then for a small error or slight mishandling to develop into a full-blown loss of control such as a stall, because up high the margins between flying too fast or too slowly are far narrower than they are at lower heights. Yet very little training time is spent flying manually at high altitudes. This is a gap that the AF447 investigators recommended be closed as soon as possible; it would also let pilots experience full-stall behavior and recovery instead of merely approaching a stall and then powering away from it.

This has its own problems, not least the fact that most simulators do not fully replicate aircraft behavior at the outer edges of performance. There are not enough data points from the real aircraft to do so, and in any case they cannot replicate the sensation of sustained *g*-forces. Nevertheless, simulators are excellent teaching aids, and recovery from unusual attitudes can still be taught, even if it is necessary to remember that the real aircraft's behavior may be even more unpleasant.

Overall, the push is to ensure that a pilot building up hours does so in a useful way, instead of merely bashing around a small airport in a small aircraft as an instructor while awaiting an airline job—that is, to ensure that 1,500 hours are occupied usefully, rather than in simply repeating one hour's 'circuits and bumps' 1,500 times.

Underlying the entire discussion is dependency on automation and a resulting loss of basic flying skills. The subject has been on the table for years. For example, a paper entitled "Automatic Complacency" was written by SAS Captain Hans Fugl-Svendsen in the 1960s. More recently, an excellent presentation by an American Airlines pilot in 1997 was entitled "Children of the Magenta" and cited examples of pilots relying on automation that was actually getting in the way.

Recommendations and change

One recommendation the AF447 investigators made was for European and U.S. regulators to evaluate requiring aircraft makers to install angle-of-attack indicators. These would help pilots avoid stalls by better informing them about the direction of airflow over the wing. That information is available in aircraft systems but is not usually displayed, and it would help considerably in the event of an unreliable airspeed problem.

Another suggestion was for regulators to change training requirements to emphasize better knowledge of the aircraft concerned and to ensure that pilots are properly schooled in flying basics, in crew resource management for problem solving, and in handling the unexpected.

During the two years before the voice and data recorders were recovered from AF447's wreckage on the sea bed, the investigators had been looking at unreliable airspeed as a likely factor in the accident. Air France devised a revamped training scheme for its crews in the area of UAS and stalls before the final accident report was published on July 5, and other airlines followed suit rapidly in response to recommendations from Airbus and Boeing as well as European and U.S. regulators.

Australian regulatory reaction to A330 UAS events has been similar, specifically in response to an incident experienced by Qantas subsidiary Jetstar at high altitude in June 2009, though a total of three such events were noted. That flight (and the other two) continued without problems, but it was found that training for most of the pilots involved had not included UAS procedures. The airline's pilot training was done by a third party—ironically, a Boeing subsidiary that received its training materials from a U.S. source rather than directly from Airbus (which has included UAS training since 2003).

CASA is proposing legislation to close some regulatory gaps, but has also reminded operators that whatever items might be outsourced, responsibility is not among them.

✈✈✈

In the end, aviation involves operating in a medium that can turn hostile very rapidly and in which human or mechanical failure can bring appalling consequences.

While today's management-speak contains many terms such as 'risk management' and 'risk mitigation,' there is no such thing as risk elimination. That is why accepting responsibility for people's lives inevitably means that airline flying is always going to be more than just a job: It is a matter of trust.

In turn, that is why the regulators' duty of care to the public involves more than just checking lists and rote performance in obedience of rules; it is to see that the people at the sharp end of aircraft are equipped with the proper tools to do their jobs and deliver their passengers safely.

Michael Westlake
Hong Kong
michael_westlake@yahoo.com

Aircraft Design
A Conceptual Approach
Fifth Edition
Daniel P. Raymer
Winner of the Summerfield Book Award

Isaac Valero-Ladrón

How serious a challenge do you consider aviation to be in terms of the global problem of controlling those emissions that are factors in climate change?

Emissions from international aviation in Europe have doubled since 1990 and may even triple by 2020, while most other sectors' emissions have decreased. The large majority of these emissions comes from international flights. Normal, since air travel became cheaper while its environmental impacts have not been addressed for too long.

Can you believe that someone flying from New York to London and back generates roughly the same level of emissions as the average person in cold Europe does by heating their home for a whole year?

As a result, emissions from aviation are higher than from certain entire sectors covered by the European Union emissions trading scheme (EU ETS), for example refineries and steel production. When aviation joins the EU ETS it is forecast to be the second largest sector in terms of emissions, second only to electricity generation: About 3% of our total greenhouse gas emissions in the EU are direct emissions from aviation. That is a lot.

"We have proved wrong those who claim emissions can't be cut without sacrificing the economy."

Could you briefly outline aims of the EU ETS program, when it will take effect, and what aircraft operators from inside and outside the EU will have to do to comply?

The EU emissions trading system is a cap-and-trade system, which means there is a 'cap,' or limit, put on the total amount of greenhouse gases that can be emitted—and this cap is being lowered every year. As a result, emissions will decline gradually, giving industry a chance to adapt step by step to the development.

Within the cap, one tonne of carbon dioxide or the equivalent amount of another greenhouse gas has the value of one 'allowance,' and at the end of each year, participants must surrender allowances equivalent to their emissions. Basically, they pay for the amount of pollution they produced.

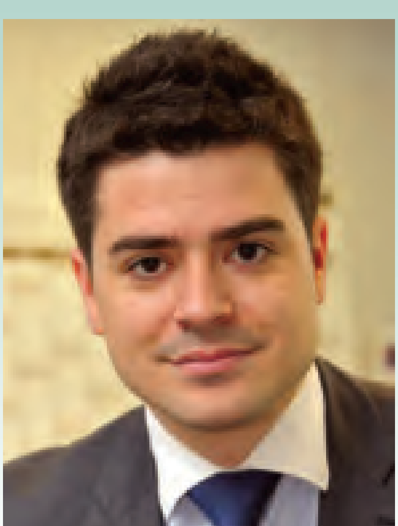
This setup creates a free market for emissions. Companies that keep their emissions below the cap can sell their excess allowances and make a profit. Those facing difficulties keeping their emissions in line with their allowances have a choice between taking measures to reduce their emissions—such as investing in more efficient technology or using less carbon-intensive energy sources—or buying the extra allowances they need on the market, or a combination of the two.

By continuously decreasing the cap, participants in the ETS have a strong incentive to reduce their emissions and find new, cost-effective ways of producing, transporting, or what else it is they are doing that creates emissions.

The ETS was launched in 2005 and is a cornerstone of the European Union's action against climate change, covering some 11,000 power stations and industrial plants in 30 countries. Aircraft operators have been included as of 1 January 2012, and will for the first time surrender allowances in 2013, once their emissions for the year 2012 have been calculated and reported.

You can see that the system in itself is very different from a tax—but still we often see media refer to the ETS as a carbon tax. This is regrettable,

Since February 2011 Isaac Valero-Ladrón has served as spokesperson for climate action within the department of Connie Hedegaard, European commissioner for climate action. From 2009 until the end of 2010 he served as climate adviser in the Delegation of the European Union to Mexico in the run up to the United Nations Climate Change Conference, held in Cancun in December 2010.



Previously, he held other positions in the European Commission's Directorate General for Communication and for External Relations.

Valero-Ladrón holds a law degree from the University of Zaragoza (Spain), a master's in European law from the Royal Spanish Institute of European Studies (Spain), a master's in European politics from the College of Europe Natolin Campus (Poland), a master's in corporate communication and public affairs from the Robert Gordon University (U.K.), and a postgraduate diploma in global climate change from Harvard University (U.S.).

Interview by Philip Butterworth-Hayes

since it is wrong and misleads the public. A tax would not create the same set of incentives we have introduced with the ETS; there would be no reason for the industry to become 'greener,' moving toward more sustainable and energy-efficient production, and reducing garbage.

"By continuously decreasing the cap, participants in the ETS have a strong incentive to reduce their emissions and find new, cost-effective ways of producing, transporting, or what else it is they are doing that creates emissions."

What will be the impact of EU-ETS on the global amount of CO_2 and NO emissions from aviation?

Aviation emissions account for about 3% of the global total of human-produced greenhouse gases. The European system would regulate about one third of that amount, and the environmental impact of this will be significant, because aviation emissions are currently growing rapidly and they will be capped at below their average level in 2004-2006. With this we incentivize the aviation sector to grow more sustainably, and more environmentally friendly.

By 2020 it is estimated that a total of 183 million tonnes of CO_2 will be saved per year on the flights covered, which would mean a 46% reduction compared with business as usual. This is equivalent, for instance, to the annual greenhouse gas emissions from a small country like Austria or all U.S. refineries together.

What has been the impact of the EU ETS on the industry sectors that have so far applied it—both in terms of measurable improvements in emissions and the impact on commercial costs and benefits?

The ETS currently covers CO_2 emissions from installations such as power stations, combustion plants, oil refineries and iron and steel works, as well as factories making cement, glass, lime, bricks, ceramics, pulp, paper, and board in 30 countries. Nitrous oxide emissions from certain processes are also covered.

Between them, the installations currently in the scheme account for almost half of the EU's CO_2 emissions and 40% of its total greenhouse gas emissions. And by reducing the number of allowances over time, these emissions decrease: In 2020, EU emissions will be 21% lower than in 2005. In the last year alone, while the European economy expanded, emissions of greenhouse gases dropped to 1,898 billion tonnes, which is more than 2% below the 2010 level. Emissions from each installation are now on average 8.3% lower than when we launched the system in 2005. Beyond the recession, the ETS itself is delivering genuine reductions.

More broadly, while our economy grew 40% since 1990, emissions are down 16%. We have proved wrong those who claim emissions can't be cut without sacrificing the economy.

Emissions trading will remain center stage as the EU moves toward its longer term goal of 80-95% emissions reduction below 1990 levels by 2050. The advantages of carbon pricing are increasingly being recognized around the world. Besides Europe, emissions trading is spreading through different models to New Zealand, large U.S. states like California, Canadian provinces, South Korea, and now China, whose pilots will lead to a national system from 2015.

There seems to be a multiplicity of environmental measures at local, national, regional, and global levels on cutting emissions being applied to aircraft operators. Is not the preferred regulator in this area the UN's International Civil Aviation Organization, and how might the ETS fit into a single global framework?

We have been seeking global agreement through the International Civil Aviation Organization for more than 15 years to tackle the increasing emissions from aviation. But there was really very little progress at international level, so, after years of pushing in vain, we have decided to act—simply because something needed to happen. To wait any longer would have been irresponsible.

"…after years of pushing in vain, we have decided to act—simply because something needed to happen. To wait any longer would have been irresponsible."

But we made sure that we stayed fully in line with ICAO principles when including aviation in the EU ETS: Already in 2001, ICAO had endorsed the development of 'open' emissions trading for international aviation—and recognized in 2004 that one option for states would be to incorporate international aviation into their emissions trading systems.

In 2005, ICAO decided to continue to support the development of emissions trading, but clearly ruled out the development of a single global system under ICAO auspices. And finally in 2008, something very important happened: ICAO rejected an 'airspace based approach' as impracticable—flight emissions have to be taken into account from departure until landing.

And while including aviation in the EU ETS exactly as ICAO invited its members all to do, we continue to push for a global agreement, which, one day in force, might replace the setup of the EU ETS for aviation.

"Science tells us that we have to act now, and as quickly as possible."

In 2008 at the Geneva conference on aviation and the environment the leaders of the world's airlines, airports, and aircraft builders came together to agree to cap net aircraft carbon emissions from 2020—no matter how fast aircraft numbers might be growing—and work toward reducing net carbon emissions from aircraft by half in 2050, compared to 2005 levels. Many argue that these goals are being met, decoupling aviation growth from aviation impact. What is your view?

Science tells us that we have to act now, and as quickly as possible. Working toward 2050 is good—we need long-term goals—but we still have to take concrete steps as quickly as possible. And this is what we are doing.

How would you characterize the response from non-European regions of the world to the introduction of EU ETS on all airlines flying into the EU? Is the EU's scheme being followed elsewhere?

As everybody knows, there were quite a few voices here and there that criticized us for including aviation in the EU ETS. But we did a lot of explaining and were very open to discuss our system and its advantages.

At the end of May, all airlines flying to and from the EU had to submit their 2011 data—which is one step in complying with the ETS. And we were happy to see that the overwhelming majority of companies worldwide—1,200 in total—and all U.S. aircraft operators complied.

In the meantime, of course, we continue to work with our partners worldwide—we are open as ever to finding a solution that makes everybody happy.

How did you involve military flights into the EU ETS—are they exempt?

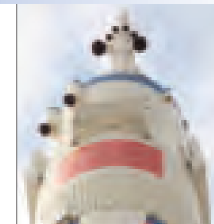
In fact there are several categories of flight which are exempt from the EU ETS, including military, but also police, customs and rescue flights, flights on state and government business, and training or testing flights. These types of flights have special codes which the flight operator inserts into the flight plan.

What impact do you think the current economic problems in Europe are having on aircraft operators' ability to fund compliance mechanisms while remaining competitive in the global market?

This has nothing to do with the economic problem in Europe, this is about being serious in tackling climate change, and preventing more serious impacts in the future.

As to the costs of the inclusion of aviation in the ETS, they are in fact very negligible for airline operators. You have to remember that under our system, airlines have choices: The first choice is to introduce measures that reduce emissions, or to pay for their emissions. If they choose to continue to emit more than our scientifically based cap allows, they can decide to either pay themselves, or to pass on the costs to their passengers.

If they choose the latter, this will mean a price increase of a one-way ticket from New York to London of approximately €1.34—an extra cost each passenger that can afford such tickets should be able to absorb.



Balance of space launches shifts

DURING THE SECOND HALF OF 2011 there have consistently been more orbital space launches attempted than during the first half. The last exceptions to this pattern were in 2002 and 2003. In both of those years, the number of attempted launches in January-June equaled the number for July-December: 66 launches in 2002 and 62 in 2003. Since then, except for 2011, the number of launches attempted in the first six months of each year has accounted for 42-48% of the total launches each year.

In 2011, the percentage noticeably dropped to 38, with 30 launches in the first half of the year and 49 in the second. The significant increase in activity during the second half was fueled largely by 14 Long March rocket missions and 11 Soyuz missions.

Long March

Assuming that the increased launch activity in last year's second half was an anomaly, this year's total number of launches could surpass 80. With a total of 35 launches attempted during the first six months of this year, and given the launch trends we have observed over most of the past decade, it would be reasonable to project some 45 launches for July through December. On the other hand, if we were to assume last year was not an aberration, but rather the start of a new pattern, then it is entirely possible that this year's launch total could surpass 90. The last year there was anything close to this level of launch activity was in 2000, with a total of 87 launch attempts.

The difference between the kind of launch activity that occurred in 2000 versus today is that there was much less balance then in the distribution of missions by country. In 2000, for example, rockets belonging to the U.S. government or U.S. companies (Atlas II, Delta II, Delta III, Minotaur I, Pegasus XL, space shuttle, Taurus I, Titan 23G, Titan 4B, and Zenit 3SL) accounted for 36% of the launches; Russian/Ukrainian rockets (Cosmos, Dnepr, Proton K, Rockot, Soyuz, Start, Tsyklon 3, and Zenit 2), 41%; European rockets (Ariane 4 and Ariane 5), 18%; and Chinese launchers (Long March), 5%. Japan barely registered that year, with only one, unsuccessful, launch of its M-5.

If we look now at launches during January-June, U.S. rockets (Atlas V, Delta IV, Falcon 9, and Pegasus XL) accounted for 23% of the missions; Russian/Ukrainian rockets (Proton M, Soyuz, and Zenit 3SL), 29%; Chinese (Long March), 29%; European (Ariane 5 and Vega), 11%; with Japanese (H-2A), Indian (PSLV XL), Iranian (Safir 1B), and North Korean (Unha 3) rockets making up the remaining 8%.

A three-country race

The launch market—in terms of number of missions—is no longer dominated by the U.S. and Russia; it has definitely become a three-country race, with China picking up the pace over the past year to establish its preeminence. If we combine the number of Long March vehicles launched during the second half of 2011 and the first half of 2012, the Chinese have launched 24 rockets—an average of two missions per month over that period.

A shift is clearly occurring, and it is happening despite China's relative handicap when it comes to competing for commercial launch contracts around the world due to the U.S. government's ITAR (International Traffic in Arms Regulations) restrictions. These are measures that discourage Western satellite manufacturers from securing launch deals with the Chinese. However, this situation is gradually changing: Countries such as oil-rich Venezuela and Nigeria are moving to purchase Chinese-built satellites and paying to have them launched aboard Long March vehicles, while other countries are proceeding to buy 'ITAR-free' (carrying no U.S. content) satellites from European companies and simply thumbing their noses at the de-facto U.S. embargo against the Long March.

What China offers

The truth is that China's Long March program has an excellent launch record. Its rockets almost never fail and are priced extremely competitively. In addition, there is a wider degree of diversity in the variants of these vehicles than in perhaps any launch program—enabling the rocket's marketer, China Great Wall Industry, tremendous flexibility in promoting the vehicle for different size satellites and different orbital destinations.

While Western, Russian/Ukrainian, Japanese, and Indian launch programs tend to use no more than two or three variants of their rockets on a regular basis, the Chinese make a habit of using a much wider range of Long March models. For the 10 Long March missions conducted through June since the start of the year, seven different models were used: Long March CZ-2D, CZ-2F, CZ-3A, CZ-3B, CZ-3C, CZ-4B, and CZ-4C.

This was no fluke. If we look at the 14 Long March missions launched during the second half of 2011, we see that eight models were used: CZ-2C, CZ-2D, CZ-2F, CZ-3A, CZ-3B, CZ-3B/E, CZ-3C, and CZ-4B.

The point is that China is well positioned to dominate the international launch market eventually—unless, of course, the current launch services paradigm is changed by pioneers such as Space Exploration Technologies (SpaceX) and other startup companies seeking to offer newer low-cost launchers employing reusable technologies, stimulating new user applications and markets.

Payload trends

Along with the shift in the makeup and launch rates of the launch services providers, there has been a noticeable change since the turn of the century in terms of the types of payloads being launched.

While there are still more than 100 payloads launched annually, a greater proportion of them are military satellites and tiny university spacecraft. Of the 134 payloads launched in 2000, 38% were civil (government nonmilitary), 34% commercial, 20% military, and 8% university. By comparison, of the 52 payloads launched during the first half of this year, 33% were civil, 25% military, 21% commercial, and 21% university.

It is too soon to tell for certain if the relative drop in civil and commercial payloads versus the rise in military and university payloads is a changing trend. We will have a better sense of whether this shift will hold when we analyze the data for the full year.

But if we take into account the payloads launched in 2011, it does seem clear that, at the very least, military payloads have become more prominent, commercial ones less so. Of the 130 payloads launched last year, 41% were civil, 27% commercial, 25% military, and 8% university.

The 7% decline in commercial payloads and the 5% increase in military, as well as the 3% increase in civil, can be explained, in part, by the spike in Chinese launches—three-quarters of which were civil or military payloads. This preponderance of civil and military payloads by the Chinese has continued in 2012. Of the 13 payloads launched by Long Marches through June, 77% were civil or military.

China is launching very few commercial payloads, because it is still largely locked out of the commercial launch market as a result of ITAR, but also because it is very busy launching so many civil and military payloads. In other words, the country already has its hands full with its government space programs.

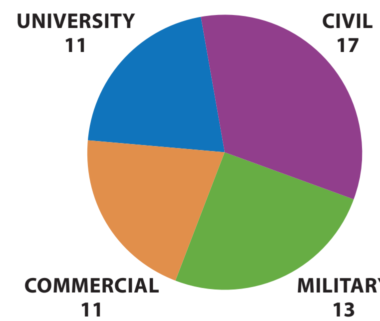
Most of China's payloads from January 2011 through June 2012 have been satellites weighing less than 3,000 kg. Nearly two-thirds of these have been launched to LEO and the rest to geostationary orbit. But there are also a fair number of payloads with a mass of over 5,000 kg, including Apstar 7A, Chinasat 10, Eutelsat W3C, Nigcomsat-1R, Paksat 1 commercial communications satellites, Shenzhou manned capsules, and the 8,500-kg Tiangong-1 space module designed to test rendezvous and docking capabilities for a future space station.

The payloads under 3,000 kg have included a wide mix of data relay, navigation, scientific, meteorological, geological mapping, surveillance and reconnaissance, asset tracking, disaster monitoring, ocean resources, and technology development satellites. They have also come in a wide range of sizes, including the 9-kg Tiantuo-1; the 300-kg Chuangxin 1-3 and Tansuo 4; 1,040-kg Yaogan Weixing 15; 1,200-kg Shijian 3; 2,200-kg Beidous and Feng Yuns; and 2,630-kg Ziyuan 3.

The diversity of China's launch activity helps explain the use of so many

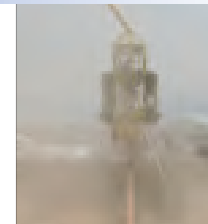
(Continued on page 43)

PAYLOADS LAUNCHED
by type, January-June 2012
Total: 52



LAUNCH MISSIONS
by vehicle
January-June 2012

Long March, China	10
Proton, Russia	5
Soyuz, Russia	4
Atlas V, U.S.	3
Delta IV, U.S.	3
Ariane 5, Europe	2
Falcon 9, U.S.	1
H-2, Japan	1
Pegasus, U.S.	1
PSLV, India	1
Safir, Iran	1
Unha, North Korea	1
Vega, Europe	1
Zenit Sea Launch, Russia	1
Total	**35**



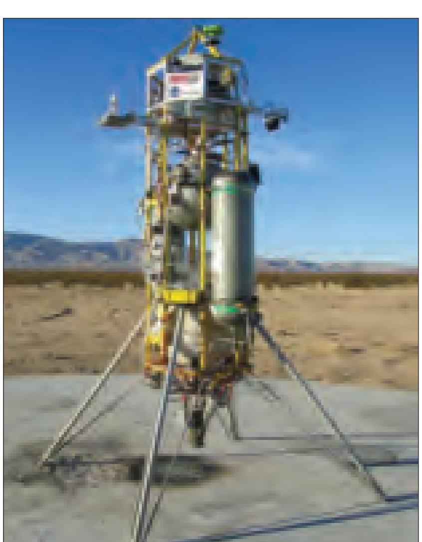
Will GENIE guide Xombie to a landing?

ONE OF THE HURDLES TO DELIVERING humans or robots to the surface of asteroids, the Moon, or Mars is the lack of options for realistically testing entry, descent, and landing technologies.

"If there's a new laser altimeter out there that's being developed by NASA, the only way [developers] can really get the full testing [of the device]—with the actual velocities and altitudes—is to actually go to the Moon or Mars," says Tye Brady, a systems engineer at the Charles Stark Draper Laboratory NPO in Cambridge, Massachusetts.

That is a problem, Brady says, because more sophisticated navigation systems are at the heart of NASA's desire to land in places that are scientifically more interesting. Safely reaching those destinations will require detecting and avoiding unanticipated hazards in real time, and touching down at precise locations.

Perhaps in light of this, NASA is showing fresh interest in a new class of low-altitude 'terrestrial test rockets' that would fly no higher than kilometers and hurtle back to Earth to mimic the last stages of extraterrestrial descents. New navigation sensors and control software would be tested on the rockets, which also would have their own systems in case one of the new technologies did not perform as expected.



Masten Space Systems' Xombie rocket with Draper Laboratory's GENIE flight control system rests on its launch pad at the Mojave Air and Space Port. Photo Credit: Draper Lab.

Brady and his teammates at Masten Space Systems of Mojave, California, are starting to test an early version of such a terrestrial test rocket, using $2 million from NASA's 2012 budget.

Heart of a Xombie…

Draper chose Masten's open-frame vertical takeoff and landing Xombie rocket as the core of the vehicle, which will be steered by a Draper developed guidance, control, and navigation system. The goal is to mimic the last 1-2 min before a lander touches down. The team has begun a series of incrementally more challenging test flights in hopes of proving the concept before building a successor. That next version would be protected by an aeroshell to fly higher and faster.

As a starter vehicle, NASA likes Draper's choice of Xombie, which is propelled by isopropyl alcohol fuel and liquid oxygen oxidizer. "The Xombie platform offers many advantages for landing technology demonstrations—it has few moving parts, a simple control system, and allows for a high rate of descent," says NASA Dryden's John Kelly, manager of the Flight Opportunities Program, which funds experiments on aircraft and reusable rockets.

Kelly's office oversees the Draper work, which is funded through an existing contract between Draper and NASA Johnson.

…and GENIE for a brain

Steering the rocket is GENIE (guidance embedded navigator integration environment), Draper's 23-kg package measuring 46x46x66 cm. It includes a laser altimeter, inertial measurement unit, GPS receiver, and a processing computer. GENIE is programmed with algorithms that rapidly assess the vehicle's position from a perch atop the Xombie rocket.

NASA likes GENIE for its flexibility. It "allows for quick integration of new landing technology algorithms and hardware onto the test bed," says Kelly.

The Draper terrestrial test rocket is smart enough to fly on its own, but with NASA making plans to send humans into deep space someday, Draper is working to keep those humans in the loop. "We actually have a cockpit here at Draper Lab where we've had Apollo astronauts come in and land these future vehicles interactively with the GENIE algorithms," says Brady.

Twice as smart

One of the Draper terrestrial test rocket's big innovations is that it has two brains—one is GENIE and the other is Xombie's own avionics system, which acts as a backup. Engineers can therefore afford to let GENIE get daring with the descent trajectory. They will need to be daring to create realistic conditions for what the terrestrial rocket might eventually carry—up to 45 kg of prototype sensors and computers.

In some scenarios, the test equipment probably would operate in shadow mode; in others, new sensor data or algorithms might actually be incorporated into GENIE to help steer the vehicle. If GENIE were to lead the rocket astray, the Masten avionics system would step in to try to regain control, landing it straight down in an emergency, or on an abort pad.

"The reason to have this fail-over capability is that it's one thing to hand someone the keys to your car; it's another to make sure you're going to get your car back," says Sean Mahoney,

Masten Space Systems XA0.1E rocket, nicknamed "Xoie" (pronounced Zoey) hovers under rocket thrust at the Mojave Air and Space Port in California. Kluft photo.

Masten's chief operating officer.

GENIE relies on algorithmic software called a Kalman filter to rapidly recalculate the rocket's attitude and location. The filter "blends information from multiple noisy sensors to create a navigation measurement that is better than any of the individual sensors could be alone," Brady says by email.

Still to be worked out for the long term is which organization would own the Draper terrestrial test rocket and operate it as a testbed technology developer.

"NASA could choose to have us stick around and do more, or NASA may want us to transition the whole concept to someone like a commercial suborbital RLV provider," says Draper program manager Rick Loffi by email. "We would then walk away, proud to have helped NASA. This part hasn't been decided—all indications are that [the Flight Opportunities Program] wants us to continue advancing the concept, but there are a lot of variables at play."

No matter who ends up providing the service, project engineers are pretty certain they know how customers in the technology development community would use their terrestrial test rocket.

In the first flight of a prototype altimeter, for instance, the device's readings probably would not be used to steer the terrestrial test rocket. After the flight, the developer would compare the altimeter's readings to those from GENIE to assess how well the altimeter performed over the descent and landing profile. In later flights, the altimeter's readings might actually be used as part of GENIE's overall guidance, navigation, and control solution.

Engineers want the rocket to be reusable, which is a key to the anticipated cost savings. "I don't have to fish the parts out of the ocean. This thing comes right down to the pad," Brady explains.

Playing together

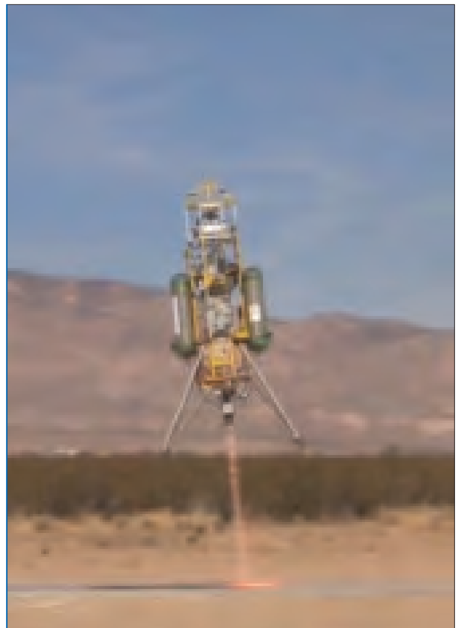
On December 20, 2011, the project team dangled a tether from a wheeled crane and flew the terrestrial test rocket for about 30 sec at the Mojave Air and Space Port. Then, on February 2, the team conducted its first free flight. GENIE steered the rocket to a point 50 m above the pad, moved the rocket laterally 50 m to a spot above another pad, and landed straight down to conclude the 67-sec flight.

Later this year, perhaps this summer, engineers want to begin a series of flights that would more closely resemble a planetary landing. In those flights, the rocket would make arcing descents from higher and higher altitudes. "We're talking about going as high as 240, 250, 260 m, and then shaping that parabolically down, landing 50 m away at the other pad," Brady says.

The first free flight was merely a hop, but project leaders say it was important: "We now know that GENIE and our system can play well together," says Mahoney.

Eventually, Draper wants to install GENIE inside a rocket covered by a composite aeroshell so that GENIE can fly higher and mimic more of the descent trajectory. Xombie's altitude and velocity are limited by its open frame and nonaerodynamic shape.

Masten has an aeroshell rocket in the works. Called Xaero, it is a project whose technical link to a precursor vehicle named Xoie is sometimes overstated. "The connection between Xoie and Xaero is often told as 'just wrap an aeroshell around Xoie,' but in practice it is several steps removed.



Xombie performs a vertical takeoff/vertical landing test flight. Photo courtesy Masten Space Systems.

"The original idea was just that; but as things progressed we realized this would be an entirely new build with the same core design," says Mahoney. The confusion arises because some parts from Xoie are indeed used on Xaero.

Xoie is notable because it won the $1-million top prize in one category of the 2009 Lunar Lander Challenge put on by NASA, Northrop Grumman, and the X-Prize Foundation. The craft took the Level-2 prize, which required it to fly for at least 3 min and avoid obstructions designed to mimic the lunar surface. Xombie—the same vehicle Draper is trying out for NASA—took second place in the less challenging Level-1 category.

For the new Flight Opportunities project, Masten engineers needed to adapt Xombie to carry Draper's navigation system. They built an open-frame extension, which they call the 'GENIE bottle.'

Xaero will be a more aerodynamic successor. The rocket would fly to 30 km at a top speed of Mach 0.9. It would shut off its engine, go through a parabolic coast phase, position itself to fall engine first, then relight its engine to land in that attitude, according to NASA.

Draper is definitely interested in Xaero or 'Xaero-class' vehicles for the future, Brady says. "That is going to be super exciting, when you see a vehicle go maybe to 5 km of altitude. That thing is going to get tiny. It's going to come screaming down at high velocities and land very precisely a kilometer away on this tiny little pad."

Mahoney predicts this will happen quickly: "I imagine in the next year you'll be seeing a lot more capabilities and demonstration of things at much higher speeds," he says.

Heritage

Draper assembled GENIE in the span of seven weeks in 2010. The first users were Johnson's Autonomous Landing Hazard Avoidance Technology program and a related effort called Project M, in which engineers were brainstorming concepts for landing a 'humanoid' walking robot on the surface of the Moon.

To test the necessary control algorithms, Draper flew GENIE on an Armadillo Aerospace Pixel rocket. Moving GENIE to Xombie was a big challenge, because the two rockets have very different designs. Whereas Xombie's fuel and oxidizer are stored in in-line tanks, Pixel's propellants are stored in spherical tanks arrayed on the same plane.

✈✈✈

Brady predicts that if Draper's terrestrial test rocket succeeds, a dam-burst of innovations for entry, descent, and landing technologies will follow.

Today, engineers find it relatively easy to push sensors and algorithms to level 5 on NASA's technical readiness level or TRL scale, which calls for component-level validation. They have a much harder time achieving level 6, which calls for demonstrating prototypes in relevant environments. Too often, the jump to TRL 6 becomes "the valley of death for entry, descent, and landing sensors," laments Brady.

Terrestrial test rockets developed by Draper, Masten, and other organizations could turn out to be the way across.

Ben Iannotta
biannotta@aol.com

Aeronautics

The 'double bubble' design concept comes from a research team led by MIT. Based on a modified tube and wing with a very wide fuselage to provide extra lift, its low sweep wing reduces drag and weight; the embedded engines sit aft of the wings. Image credit: NASA/MIT/Aurora Flight Sciences.

The technology revolution is changing human activities, including aeronautics, with unprecedented speed. Experts who analyze the resulting trends are attempting to project, in a responsible way, what new capabilities are likely to materialize, and how these will alter our daily lives.

by **Dennis M. Bushnell**
Chief scientist, NASA Langley

We are in the midst of a wide-spectrum technological revolution in IT, bio, nano, energetics, and quantum technologies. It is altering, in real time, the entire panoply of human activities, including aeronautics. These changes have implications not just for aeronautical applications and markets but also for the detailed ways in which these applications are achieved.

Exponential IT growth

Since 1959, we have improved computing on silicon by about seven to eight orders of magnitude—the 20-petaflop human-brain-speed machine was delivered this year. Going forward, we will move beyond silicon to bio, optical, nano, molecular, and atomic computing, with estimates of 8-12 orders of magnitude still to be realized in the coming decades. Then there is quantum computing, which for an increasing number of applications is projected to provide improvement of some 44 orders of magnitude.

Frontiers of the imaginable

Dennis M. Bushnell is the chief scientist at NASA Langley. During his more than four decades at NASA, he has served on the Gemini, Apollo, Viking, and space shuttle programs. He invented and developed the riblet for speeding airflow across surfaces, an advance that led to turbulent drag reduction in aeronautics technology. He holds six patents and has authored more than 250 publications and major presentations, often on the future of technology and the impact it will have on our society.

Thus far this is just raw speed. Machine intelligence approaching human levels is being worked via soft computing (neural nets, fuzzy logic, genetic algorithms, and so on), biomimetics, and perhaps emergence. The latter is the probable manner by which human beings developed intelligence: Make something complex enough and it 'wakes up.' At present, biomimetics—nanosectioning the brain and replicating it in silicon—appears to be the principal approach, with IBM's Blue Brain project suggesting human-level, or nearly so, machines roughly 10-15 years out. In the meantime, machine intelligence is becoming increasingly capable.

These massive improvements in IT capability are changing society, enabling more 'tele-everything'—commuting, work, shopping, education, medicine, commerce, politics, socialization, and so on. This rapidly growing capability has produced a decades-long shift in aeronautical testing and product development, from major dependence on wind tunnels toward increasing dependence on modeling and simulation, or mod-sim, and computation. If and when quantum computing is developed, the resulting capability would probably enable ab-initio computation of turbulence in a design mode, yielding further major reductions in wind tunnel requirements.

Virtual and unpiloted flight

It has been projected that within less than a decade, teletravel would lead to a major drop in aircraft business travel. This teletravel would be accomplished via increasingly capable five-senses virtual reality—haptic taste, touch, smell, sight, and sound. Initial versions of this technology have already been demonstrated. Estimates indicate that millions of people worldwide are now spending more time in virtual worlds than in the 'real world.' This is expected to increase greatly, first as virtual reality, then as five-senses virtual reality when serious fidelity is achieved. This might mean fewer airline travelers rather than the large increases previously projected. Ridership is already less than predicted, possibly because of economic conditions combined with these improvements in teletravel.

Evolving information technologies also offer the real possibility of a much more capable and far less expensive air traffic con-

Aerospace engineer Mark Moore's 'Puffin' is one example of a personal air vehicle.

trol (ATC), navigation, and operations system. This would enable unmanned vehicles in controlled airspace for military, DHS, and civilian use. Such a system could be developed and proven piecemeal, in parallel with the existing system, with only experimental studies until the entire new system is fully vetted.

There are emerging technologies potentially capable of providing triply redundant fail safe-safe communications, navigation, sensors, and computing. They include 'atom optics' (inertial navigation systems improved by many orders of magnitude), and passive location/navigation using TV tower signals with signal amplitude that improves enormously on GPS. Physicist Hal Puthoff has a vector/scalar potential approach that could revolutionize communications, and optical free-space communications are developing nicely. There is also an emerging 'global sensor grid,' thanks to low-energy, inexpensive improved nano and quantum sensors. Networking vast numbers of sensors will produce a 'digital air space' in future decades.

This kind of 'beyond-NextGen' ATC system would enable deployment of both civilian robotic delivery vehicles and UAS carrying passengers—PAV, or personal air vehicles. These could be both affordable and safe, allowing aircraft to usurp some or much of the automobile market, and could enable cost avoidance for some of the surface transportation infrastructure. Vehicles are under development; a goodly number are described at www.roadabletimes.com.

The estimated worldwide PAV market, with parts, is in the range of $1 trillion a year, far greater than the current civilian aeronautical market. As PAVs are envisaged to operate autonomously, they could be used by the aged, the young, the infirm, and the inebriated. A PAV is the PC of aeronautics, and has shown great market robustness for nearly a century. We are quite close to achieving the requisite technologies.

With the development of appropriate ATC systems, robotic delivery vehicles, and PAV, the population could expand in terms

The hybrid wing body H-Series is from a research team led by MIT. It features embedded engines using variable-area nozzles with thrust vectoring, noise shielding, and advanced onboard vehicle health monitoring systems. Image credit: NASA/MIT/Aurora Flight Sciences.

One truss-braced wing concept for a CTOL transport from VPI and Stanford University shows a longer wingspan than conventional aircraft.

of land use to a much lower density. About 200,000 homes in the U.S. are off the electric grid, and an increasing number are going off all the grids as teleliving becomes more pervasive, enabling habitation nearly anywhere/everywhere. Autonomous/robotic operation of both vehicles and the ATC system should be both far less expensive and significantly safer, since around 80% of aviation accidents are ascribed to human error.

IT also, via mod-sim, enables design of ultraefficient aero configurations at R&D costs far lower than those of industrial-age methods, which involved significant physical testing. A current transport concept that appears to be a 'near best bet' uses externally truss-braced wings. These enable thinner wings, reduced wing sweep for natural laminar flow, and greatly increased span for decimation of drag due to lift.

If the engines are placed at the rear of the fuselage and thrust vectored for control, then the empennage weight and drag can be obviated.

A Goldschmied cowl around the engine offers the possibility of favorable propulsive/airframe interference and provides internal volume for noise treatments. Then there is fuselage relaminarization. The lift-to-drag ratio of such a transport design is in the 40s or higher, with major—perhaps 80% or more—fuel burn reductions. Mod-sim also would enable channel wings with circulation control, an interesting supershort takeoff and landing concept.

An alternative configuration approach that has 'sky train' and 'modular aircraft' functionality is a double fuselage, mid-(unswept) natural laminar flow wing concept, with wing-tip fuselages optimized for drag-due-to-lift reduction. Engines are positioned at the rear of the fuselages, which are 'interchangeable' for optimized operation tempo and overall system efficiency.

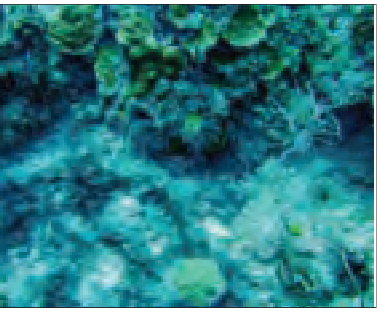
Mod-sim would also allow serious study of a transonic biplane with a tentative performance improvement of more than 25%. For supershort takeoff and landing capability, mod-sim enables synergistic design of a channel wing with circulation control that provides up to a near-theoretical maximum lift coefficient of 12. The massive supersonic transport improvements from the Pfenninger strut-braced extreme arrow wing design, with a lift-drag ratio of about 16 vs. about 9 for conventional configurations, are also now within reach thanks to mod-sim. So too are favorable wave interference supersonic designs (again with around 25% improvements), wave rotors for major overall improvements in gas turbine engines, and ring wings of various flavors.

As applied mathematician and aerodynamicist Sir James Lighthill once told the author, "We build what we can compute." For far too long, Lighthill believed, this constrained us to nearly linear theories and consequent linear thinking and conceptualization. IT-engendered mod-sim has opened up configuration design spaces to include 'open thermodynamic systems,' where the propulsive and aerodynamic functions are synergistically combined. Enabling structural concepts such as external strut/truss bracing are a further gift of mod-sim in terms of minimizing interference drag. Pulse detonation wave engines, with wave dynamics tailored to provide valving and ignition, could, along with antinoise, enable a much less expensive propulsion device.

Nanotechnologies

Projections indicate that nanomaterials will have a major impact on structural weight

The Boeing Sugar is an initial version of a strut/truss braced wing design.



Cyanobacteria may produce up to 20,000 gallons of biofuel per acre-year.

across the board. They include carbon nanotubes and boron nitride nanotubes, graphene, and others. Thus far they have been used in composite materials, but work is under way to produce nanotube structures directly. These efforts might potentially reduce dry weight by *factors* of three to five to eight. Another possibility is carbon nanotube springs, with estimated performance many orders of magnitude better than that of steel springs. Applications include super-short takeoff and landing, which would incorporate regeneration, providing an opportunity to 'spring into the air.'

Then there is 'strong nano,' where mechanical engineering is used to assemble materials 'atom-by-atom,' in contrast to the current largely chemical engineering approach of self-organizing nanosystems. Such superb manufacturing at the atomic level could possibly enable facsimiles of trabecular bird bones and ultralight structural members, as well as 'ageless' materials free of the contaminants, dislocations, and inhomogeneities that degrade the strength and usability of current materials.

For nearly two decades the prevailing opinion was that strong nano, or molecular, manufacturing, was not possible. Recently, however, several groups have made progress, and success is expected in some 15 years. If this comes about, it would enable very localized manufacturing—'fab labs' (fabrication labs) in the home, for example—and the demand for cargo air transport would probably plummet. In the meantime, 'free-form fabrication' by various means, including electron beams, is increasingly prevalent.

Nano also enables a plethora of sensors and instruments for integrated vehicle health management and safety, as well as 'situational awareness' writ large. The latter will enable the all electron/photon ATC-nav/ops systems mentioned previously.

Additional 'gifts' of nano could include very advanced batteries that will enable serious consideration of electric aircraft of various scales, ice- and bug-phobic surfaces for optimizing safety and laminar flow control, and carbon nanotube tethers for harvesting high-altitude wind energy.

The Icon-II future aircraft design concept for supersonic flight over land comes from the team led by Boeing. A design that achieves fuel burn reduction and airport noise goals, it also achieves large reductions in sonic boom noise levels that will meet the target level required to make supersonic flight over land possible.

Energetics

Perhaps the poster child for an energetics revolution is low-energy nuclear reactions. Some 20 years of LENR experiments have now taken place worldwide. Many of these have produced heat in excess (often far in excess) of chemical reactions and various transmutations, with little worrisome radiation—and at low electronvolt energy inputs rather than the huge numbers necessary to surmount the Coulomb barrier.

There are several theories to explain this, and they indicate that weak interactions, not the strong force, are responsible. There are four or five devices producing many watts to kilowatts, and researchers are trying to vet their efficacy. If this energetics technology proves real, scalable, and safe, aeronautics will be changed greatly. We will be able to enter a design space we have never been in before, called 'energy rich.' LENR measurements indicate energy densities much greater than chemical with the Weak Interaction Theory indicating over a million times chemical. Such energy density, with little radiation to worry about, would enable myriad changes:

- Energy focused far ahead of an SST to reduce sonic boom.
- SSTs that make little environmental impact, have ultralow fuel fraction, and are, overall, affordable.
- The ability to reduce disk loading and propulsor efficiency, allowing VTOL/STOL operations so quiet they can be conducted locally. The overall approach also applies to reducing transport and SST noise—reduce loading/efficiency in favor of noise reduction, as there is a surfeit of energy.
- For all craft, greatly reduced fuel fraction and gross weight, and hence reduced dry weight; huge range increases and loiter improvements for climate aircraft, 'sensor craft,' and other 'wholly green' aircraft.
- Energy enabling direct control of wake vortices and vortex hazard, also allowing flow control for bird-like, all-weather flight;

superSTOL for nearly simultaneous takeoffs of several aircraft on the same runway, enabling greater airport 'productivity.'

• Design margins for fail-safe safety engineering, including engine surrounds, effective Faraday cages for EMP protection, and parachutes for large aircraft energy-absorbing structures for 'crashworthy' aircraft. Safety issues associated with fuel explosions and fires disappear.

Estimated costs of energy produced for the grid via LENR are on the order of 25% those of coal. This is a very early estimate but indicates positive cost margins compared to those for petroleum.

In addition, there are emerging sources of biofuels that have massive capacity and low cost (around $50 a barrel). These include Joule biotechnology approaches, genomic cyanobacteria, which allegedly produce some 20,000 gallons per acre-year using CO_2, waste water, and sunlight. Another source is halophytes, or salt plants—there are some 10,000 species extant—which grow on wastelands using seawater irrigation. About 97% of Earth's water is saline, and around 44% of the land mass is wasteland. Seawater contains about 80% of the nutrients needed to grow plants.

Estimates indicate that a goodly portion of the Sahara could, via halophytes and seawater irrigation, produce enough biomass to replace all the fossil carbon fuels; provide the petrochemical feedstock needed to make plastics; and produce sufficient food such that much of the 68% of the freshwater now tied up in conventional agriculture could go to thirsty populations rather than to irrigating freshwater-dependent crops.

These advanced energetics options are both 'green,' with no net CO_2 emissions. The halophyte/cyanobacteria-sourced fuels would emit CO_2 but, in the case of halophytes, at better levels than a closed CO_2 cycle because of root sequestration during growth. In the case of LENR, there are no CO_2 emissions, and estimates based on the efficiency of current devices (yet to be validated) suggest that around 1% of the world's yearly nickel production could fulfill the world's energy requirements.

LENR produces heat, which could be used directly as a combustor replacement or, via means such as pyroelectrics or Stirling cycles, produce electricity for propulsion. As for water—the other major aviation greenhouse efflux—LENR emits none. Biofuels do emit water, so their use generally requires flight below the tropopause (below around 27,000 ft), where water efflux is cooling rather than warming.

Use of ground facilities like Langley's now-shuttered 16-ft transonic wind tunnel will continue to decline as the use of mod-sim increases.

Resulting aero markets and systems

Given serious research, rapidly evolving technology revolutions, and the large number of technology options for achieving success, the following appear to constitute a conceptual laydown of the 'frontiers of the responsibly imaginable' in aeronautics going forward:

• Reduced long-haul passenger traffic (because of teletravel).

• Reduced long-haul cargo traffic (from molecular manufacturing and, in the interim, fab labs).

• An economical, fail-safe, totally robotic ATC/navigation/operations system (digital airspace) to enable UAS in controlled airspace for DOD, DHS, and civilian use.

• Robotic delivery vehicles.

• PAV vehicles that partially replace autos.

• Greatly improved long-haul transport performance (via ideation and mod-sim).

• SSTs, courtesy of LENRs.

• Ultralong loiter sensor craft for climate and other studies and uses.

• Greatly reduced wind tunnel use (via mod-sim-to-quantum computing).

Several other simultaneous, significant, and mostly human-engendered issues will affect the aeronautics industry in various ways in the future. The climate-positive feedback—on methane hydrates, fossil CO_2, reduced ocean CO_2 uptake, increased water vapor—is kicking in, making projections from the Intergovernmental Panel on Climate Change appear conservative.

Declassifying

Recently declassified government documents are revealing a wealth of information on the U.S./Soviet space race from the earliest days of the Cold War. As U.S. surveillance technology advanced in the 1950s and 1960s, it began to uncover closely guarded secrets about the military and space activities of the USSR, bringing details of Soviet assets and achievements into sharper and sharper focus with each improvement in U.S. capabilities.

Part 1: Surveillance systems

by Peter Pesavento
Contributing writer

An extraordinary confluence of disclosures made recently by a number of federal agencies and associated groups reveals highly detailed, formerly classified documents connected to the space race. These materials provide the first glimpses of some major technologies employed by the U.S. intelligence community during the Cold War, as well as information captured and transmitted to policy makers at the highest levels of the U.S. government. Much of the declassified reportage provides an unprecedented opportunity both to correct the record and to reveal previously untold modern history.

The vast majority of the documents highlighted here are new to us. Their release is the culmination of a declassification process that took many years and involved use of the Freedom of Information Act and the Mandatory Declassification Review, a much stronger declassification protocol. A federal grouping called the Interagency Security Classification Appeals Panel, which works "in the name of the President," was instrumental in the process.

Part 1 of this two-part series describes some of the ground-based projects and two photoreconnaissance satellite programs that obtained information about Soviet rocket-launched missions. Part 2, to appear next

the space race

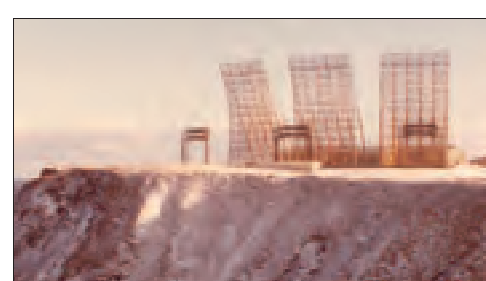
The GAMBIT spacecraft awaits launch atop its Titan IIIB rocket booster at the Vandenberg launch site in California. Courtesy NRO.

month, focuses specifically on non-film satellite imagery, on telemetry captures (and their meaning) from Soviet rockets outbound from Earth as well as probes in selenocentric space, along with additional glimpses of how this technical information was transmitted to the highest-level policy makers in Washington, D.C.

RAGMOP AND THE BLUES

The Anatolian project was the first effort at a systematic gathering of information about Soviet rocketry via technical means. It consisted of the backscatter radars first installed at Diyarbakir, Turkey, and a counterpart placed at Shemya in the Alaskan Aleutians a few years later. Both locations used radars identified as the FPS-17. The effort had all the earmarks of a crash program: The design, construction, and installation of the very large radar system took only nine months, and the steel and structural components needed for the Diyarbakir radar were deployed by the second-largest airlift in USAF history, surpassed only by that of the 1948-1949 Berlin crisis.

The FPS-17 facility in Turkey was given the code name **Ragmop**. It went operational on June 1, 1955, and in its first month successfully mon-



The FPS-17 radar system rests on the island of Shemya, Alaska. This version of the radar was used to detect the final phase of missile tests launched from Tyuratam. With several added antenna elements, this version of the FPS-17 covered four times the area covered by the system installed at Diyarbakir, Turkey. Courtesy James Moss.

Ragmop was instrumental in the detection and monitoring of the launch and initial orbits of Sputnik-1. Courtesy: Chris Hunter/ GE History Museum.

itored and recorded data from 13 Soviet rocket launches from the Kaputsin Yar test center. While the radar was originally intended to be a 'line of sight' detection system, atmospheric conditions during the summer and early autumn over south central Asia allowed the detection of missile launches well beyond the horizon, via atmospheric 'ducting,' which allows radio frequency-based signals to traverse very long distances.

This HEXAGON panoramic image excerpt of the Deep Space Tracking Antenna at Simferopol in the Crimea was taken in September 1982. Courtesy NRO.

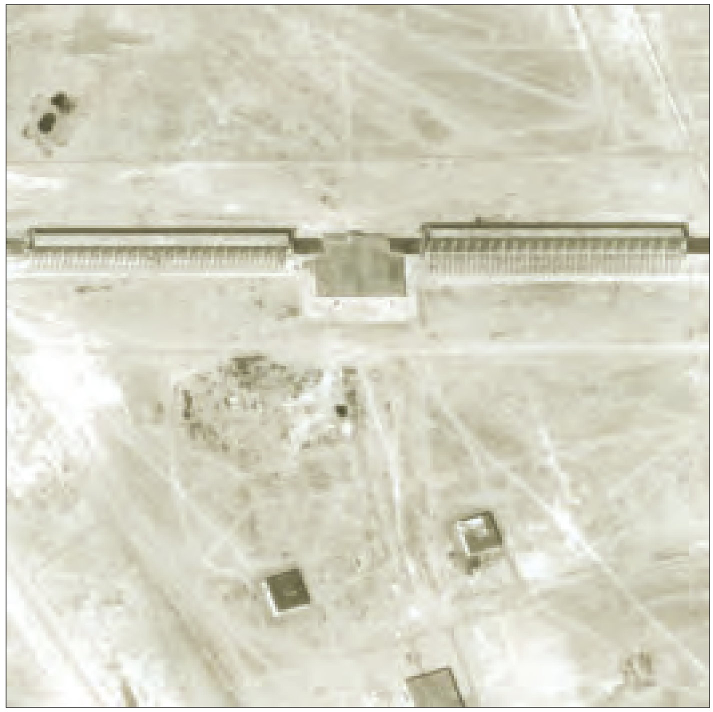
U.S. intelligence community analysts call the data garnered from backscatter radar RADINT—radar intelligence—which works by sending high-frequency radio signals around the world, bouncing between the ground and the charged ionosphere. Gases from a rocket's exhaust, as well as the rocket body itself, reflect back these signals—backscatter—and their detection by a receiver indicates that a rocket has been launched.

Indeed, Ragmop was instrumental in the history-making detection and monitoring of the launch and initial orbits of Sputnik-1, the world's first satellite, from the Tyuratam Missile Test Center (TTMTC), on October 4, 1957. TTMTC is located over 1,300 mi. from the Turkey radar facility. The following year, the FPS-17 facility expanded its coverage of Soviet airspace with additional radar equipment and antennas that were also quickly installed—again aided by an airlift of components to Turkey. These enhancements included a 'Cinerama' reflector that was 300 ft wide and weighed 1,500 tons. Code-named Hurricane Betty, this new reflector made it easier for Diyarbakir to exploit the seasonal atmospheric ducting, and to monitor the launch phases of rockets from Tyuratam.

In 1959, the Shemya Alaska facility (code named Big Alice) was built to monitor the end trajectories of all missile tests from TTMTC. The FPS-17 radar at Shemya eventually became an integral part of the monitoring network for Soviet space shots that included additional, separate equipment on the island for intercepting television transmissions from Earth orbit.

According to one declassified CIA report, during the historic manned mission of Yuri Gagarin on April 12, 1961, "83-MHz transmissions were detected 20 minutes later as the spacecraft passed over Alaska. Only 58 minutes after launch, the National Security Agency (NSA) reported that reliable real-time readout of signals clearly showed a man and showed him moving. Thus, before Gagarin had completed his historic 108-minute flight, intelligence components had technical confirmation that a Soviet cosmonaut was in orbit, and that he was alive."

With Shemya in operation in 1959, new U.S. military and intelligence requirements motivated the building of site-specific radars for tracking space objects, mandating the escalation of operating frequencies and power levels well beyond the standards for radars in the early 1950s. Radars that could detect objects farther into space with higher resolution (to see smaller sized objects) required bigger antenna dishes (60 ft and more), amplified transmitter power (using gridded tubes at frequencies from 300 MHz to 1 GHz), transmitting that power at higher and higher frequencies, using klystrons that operated at L-band (1–2 GHz), S-band (2–4 GHz), and C-band (4–8 GHz). All of these new requirements pushed the state of the art, putting radar systems on the cusp of a revolution in technology development.



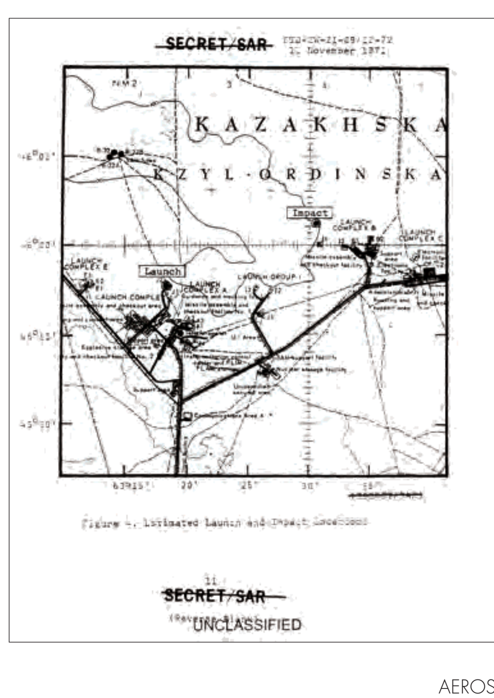
This GAMBIT 1 image of the Sary Shagan space tracking radar facility inside the USSR was taken on May 28, 1967. The facility was also used during a series of on-orbit Soviet antisatellite tests that began in the late 1960s. This is a 25X magnification of the original photo. Courtesy NRO.

Ultimately, WW II-era magnetrons and plasma-tube duplexers that were limited in peak transmitting power (2–3 MW) gave way to systems that married radio pulse compression with gridded tubes and klystrons to achieve peak power values 10 times higher (20–30 MW). The very large dish antennas, coupled with newly designed pulse compression transmitters, allowed increases in power directivity in the range of hundreds of megawatts, and even into the low gigawatt range.

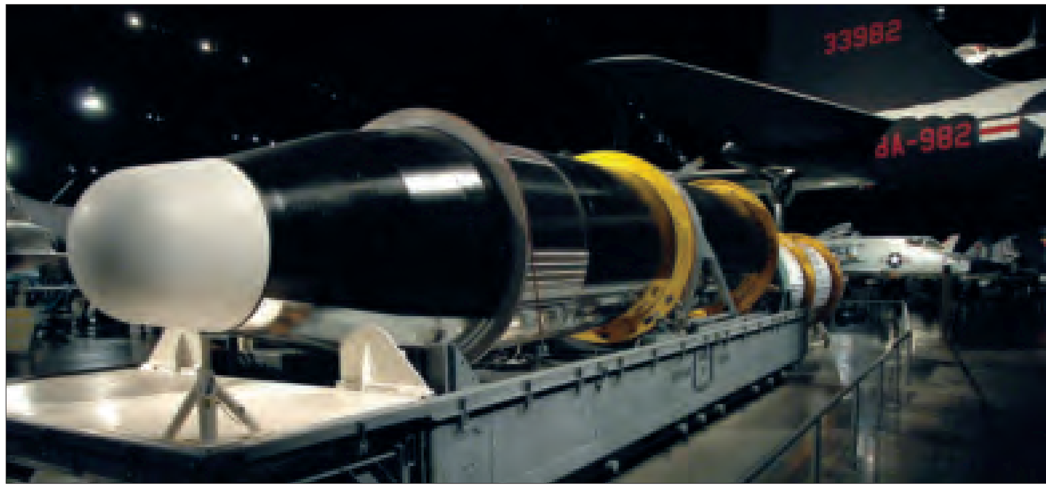
Examples of the new spacecraft tracking radars (each a 60-ft dish on a pedestal) included **Blue Moon**, which went operational at Shemya on April 1, 1962. Labeled the FPS-80, it used a 2.5-deg monopulse pencil beam in the UHF range. A modified version of Blue Moon, code-named **Blue Nine**, was subsequently assembled and went live at Diyarbakir in late 1963, becoming fully operational in May 1964. Designated the FPS-79, it had an 84-ft parabolic dish. This new Turkey-based radar, operating in L-band, was significant in that it operated in real time, using computer-controlled data processors to aid the tracking of Soviet spacecraft in orbit.

Blue Nine yielded highly accurate metric data on both missiles and satellites. Indeed, Diyarbakir's radars provided satellite launch and tracking (including calculation of ephemeris), as well as missile detection and performance evaluation services well into the mid-1990s before its deactivation.

Newly declassified CIA "Daily Missile and Space Summaries" explicitly highlight the importance and centrality of the Diyarbakir facility to the monitoring of Soviet space missions—both manned and unmanned, from launch to return—as well as confirmation of mission benchmarks. For example, the Summary from June 24, 1969, reports that Cosmos 287, a photoreconnaissance satellite, had reached space: "…confirmation that the vehicle successfully achieved orbit was provided by RADINT from the Diyarbakir facility."



Launch and crash sites of SL-X attempt of June 1971 were recorded by the DSP satellite. The accuracy of the DSP's tracking allowed FTD analysts to pinpoint J2 (second launch pad at 'Area J') as the liftoff site, and revealed that the area where the first stage crashed was near another missile launch complex. Courtesy Col. Timothy Traub, NASIC vice commander.



The National Museum of the USAF in Dayton, Ohio, displays the GAMBIT spacecraft. Seen here is the photographic payload section. Courtesy USAF National Museum.

Indeed, Diyarbakir data differed at times from official Soviet announcements, and in some cases corrected them. A case in point is an excerpt from a Summary dated October 17, 1969, which relates that the landing time of a manned spacecraft (garnered by the U.S. radar intercepts) was not in agreement with that announced by the Russians:

"…17 October: Soyuz-7 was deorbited early this morning during its 80th revolution of the Earth… RADINT of the deorbiting vehicle was acquired by Diyarbakir and indicated a landing time of 0928Z [Zulu, or Universal Time]. TASS announced the successful recovery of the cosmonauts at 1018Z and stated that the vehicle had landed at 0926Z in the normal recovery area northwest of Karaganda…."

The HEXAGON system qualification vehicle is lowered into its 'A' frame by handling equipment during assembly at the Lockheed plant in Sunnyvale, California. Courtesy NRO.

Gathering radar intelligence was not the only means the U.S. had for monitoring the USSR's burgeoning space program. Further newly declassified materials show that U.S. imaging satellites orbiting overhead also gathered important and timely data. These included assets whose details were officially disclosed in late 2011: GAMBIT 3 and HEXAGON. Information on another satellite program—also recently disclosed—reveals that infrared sensors aided U.S. analysts' evaluations in ascertaining what was happening inside Russia's *Sov Sekretno* (Top Secret) centers for rocketry development and testing.

GAMBIT and HEXAGON

In September 2011, NRO celebrated its 50th anniversary. As part of this observance, the agency declassified two overhead photoreconnaissance programs, named **GAMBIT 3** and **HEXAGON**. Spacecraft from both series were also put on temporary display at the National Air and Space Museum's Steven F. Udvar-Hazy Center in Chantilly, Virginia. Concurrently, the NRO released a batch of once highly classified documents on both programs, including retrospective histories.

The 54-ft-long, 5-ft-wide GAMBIT 3, with its Agena D/satellite control section attached, weighed about 21,000 lb at liftoff. The system also had, in its final iteration, two film return capsules attached. According to official NRO disclosures, GAMBIT 3 was the U.S.'s best film-based close-look/narrow-range-of-field photographic system. Its ultimate imagery resolution, according to NRO documents, was "better than four inches ground-resolved distance." There were 54 missions attempted, with 50 considered successful. The GAMBIT 3's average mission life was about 31 days.

One of the previously unknown (and undisclosed) capabilities of GAMBIT 3 was its ability to modify the altitude of its orbit significantly. In the NRO-released film *GAMBIT—Eye of the Eagle*, a former GAMBIT program director mentioned that of the several evolutionary changes made to the system, one of the most significant involved beefed-up thermal modifications. This was done so that they "could fly the vehicle lower, using the rule of thumb that for every mile we get closer to the target, we improve the resolution a tenth of an inch…. In one flight, we actually took pictures below 65 nautical miles." The nominal flight mission altitude was usually near 90 n.mi. above the Earth's surface. (Unconfirmed reports indicate that the lowest altitude at which the spacecraft may have operated was an astonishing 50 n.mi.)

The HEXAGON spacecraft was a technological marvel in its own right, and on par with its GAMBIT cousin in pathfinding technological achievements connected to search and surveillance. Its photographic system of twin panoramic stereo cameras garnered broad coverage, high-resolution images of a wide swath of ground area (300 x17 n.mi.) in a single photographic frame—more than three times the capability of the original Corona photographic satellite series initially developed in the late 1950s. To accomplish this, the photographic system used film over 6 in. wide, with the ability to tailor the length of the picture being exposed; that is, when conducting a 120-deg scan of the ground below, the film could take a single image up to 125 in. long.

The spacecraft itself was large: 60 ft long, 10 ft wide, weighing about 30,000 lb at liftoff. Four film-return capsules were also attached. Prior to HEXAGON, no satellite camera system had been able to transport very large quantities of ultrathin base film (155,000 ft) at speeds over 200 in./sec across the exposure plane, and to reverse direction of the film at both the takeup and film supply spools when necessary. Of 20 missions attempted, 19 were deemed successful. Mission lengths ranged between one and nine months.

TARGET OF INTEREST

Despite the declassification of the two spacecraft configurations and their overall programs, in 2011 both GAMBIT 3 and HEXAGON imagery still had remained strictly classified. That all changed in January of this year, when the first images were

A GAMBIT 3 photo shows the SL-X on its launch pad at Area J on September 19, 1968. The blast pit deflectors and the service gantry tower are easily seen. The pointed-tip shadow of the rocket itself is directly behind the launch vehicle. This close-up image was released by the NRO in January 2012. At the time of the release, decision-making on how clear to make the specific GAMBIT 3 images released to the public was still in flux. In this individual case, a decision was made to electronically 'de-focus' the image so that the true capabilities of the imaging system would remain hidden. Courtesy NRO.

disclosed to the public on a set of posters displayed at a ceremony at the USAF National Museum in Dayton, Ohio. This ceremony commemorated the unveiling of both satellite systems for permanent display at the museum. Subsequently, the first series of both GAMBIT 3 and HEXAGON imagery was released by the NRO.

According to the declassified NRO documents, as well as examples in the initial imagery release from both GAMBIT 3 and HEXAGON, the Soviet space program apparently was among the top targets of interest to the U.S. intelligence community. In 1981, the National Photographic Interpretation Center identified key historical events for which the GAMBIT program provided significant intelligence information. Surprisingly, the U.S./Soviet race to the Moon was considered to be among the most significant, second only to the monitoring of Soviet strategic submarine developments. Special emphasis was given to Area J at Tyuratam, where the Soviet SL-X manned lunar landing booster had been tested for the undeclared Russian program undertaken to be competitive with Apollo.

To be continued…

Space solar power

Panacea, or pie in the sky?

The concept of beaming electric power from space to Earth, freeing the planet from dependence on fossil fuels, has intrigued scientists for decades. From the beginning, however, such plans have faced a seemingly insurmountable barrier–the high cost of space transportation. But proponents now say recent technological advances are sufficient to justify investing in the next logical step toward this elusive goal–a demonstration.

by Jerry Grey
Editor-at-Large

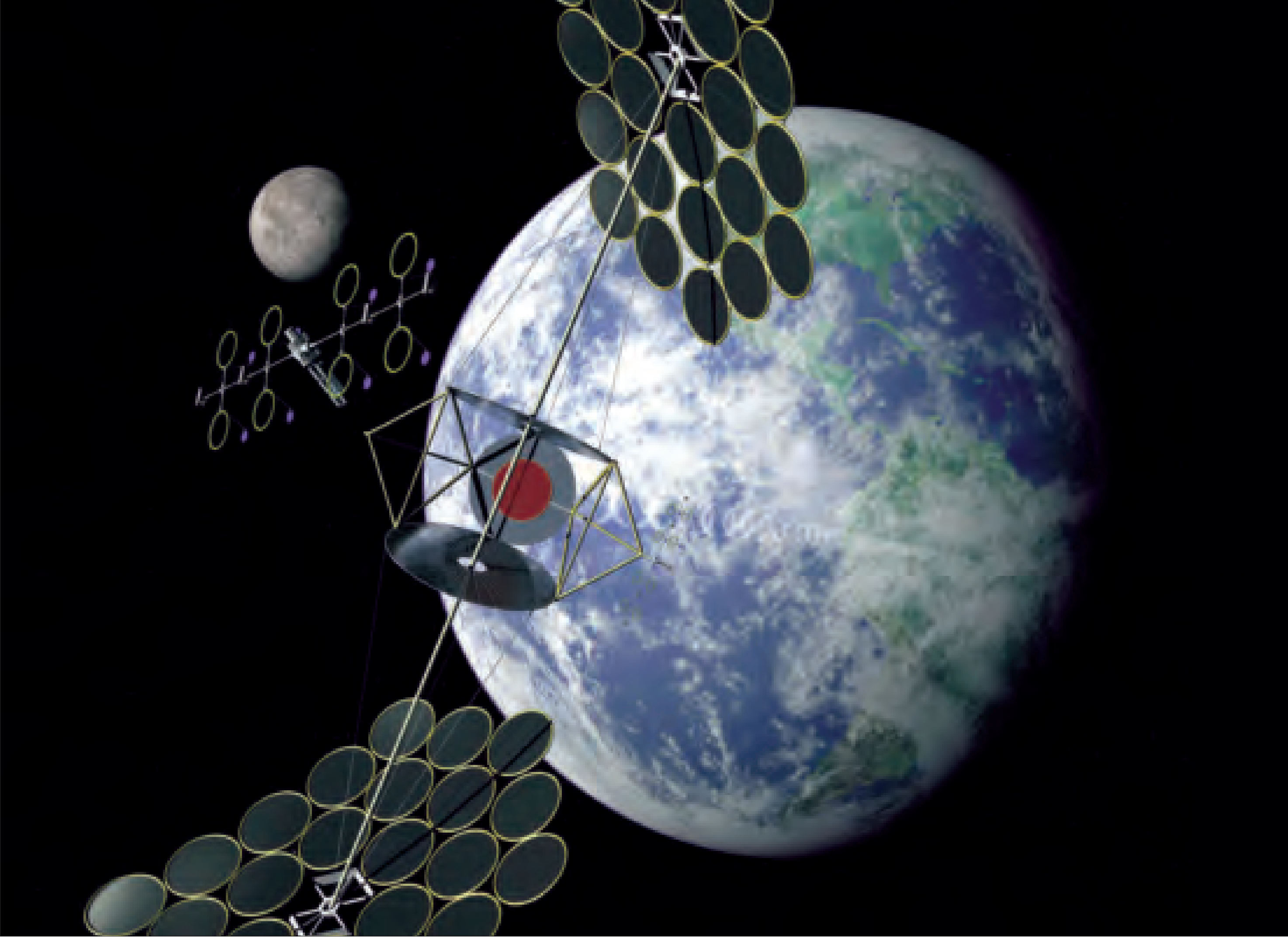
The idea of delivering electricity to Earth from solar collectors in space has been around for over a century. Dozens of studies, analyses, assessments, and proposals for technology development have been generated. But these activities, almost all performed by government agencies or not-for-profit organizations, have not resolved the principal issue: Is the SSPS a good investment?

The key ingredient: Industry interest

Along with the economic barrier imposed by high space transportation cost, the other key factor cited in virtually all the space solar power systems (SSPS) studies and assessments was the need for industry to become actively involved. Government studies and research projects are all well and good, but the driving factor in every successful commercial space effort (and, indeed, in most successful nonmilitary ground-based ones) has been the early and deep involvement of the industrial sector best suited to derive a profit from the endeavor.

A December 1998 NASA workshop on the prospects for future commercialization of space technology, "New Space Industries for the Next Millennium," provided a most interesting revelation. The workshop concluded that by far the largest part of any projected growth in the space industry would not be derived from the current successful commercial enterprises—communications, navigation, and to a lesser degree, remote sensing. Nor would it come from well-recognized potential product development via space processing research and the consequent manufacturing of special products such as crystals and semiconductors. Rather, it would come from wholly new areas of space applications: space tourism and terrestrial energy supply.

Events since the workshop have indicated the potentially explosive growth in



The Integrated Solar Collector, a geostationary-orbit architecture, was examined in NASA's SSPS Concept Development and Evaluation studies of 1998.

space tourism (or whatever euphemisms have been applied to this general area of commerce). But where did this growth originate and find its main support? Not from NASA or other government agencies, but from private-sector investments and corporations. The most promising of these new corporations, The Spacecraft Company, is a joint venture of Scaled Composites, winner of the private-sector X-prize, and Virgin Galactic, a member of U.K. billionaire Richard Branson's Virgin Group, which has already begun to capitalize on the tourism market by accepting several hundred million dollars in deposits from prospective space tourists.

Another promising entrepreneurial company that expects to capitalize on this market (as well as the NASA space transportation needs) is SpaceX, most of whose development and operations funding for its Dragon capsule and Falcon-9 booster comes from the private sector. A third company is Bigelow Aerospace, which has already placed two prototype space stations in orbit with the expectation of deriving profits from the use of their microgravity environment by anyone who can pay for it.

Several other 'newspace' companies have invested substantial private sector funding and effort in developing potential for space tourism and related markets. One legacy space launch company, Boeing, is developing its CT-100 crew capsule as a commercial supplier to the ISS, with plans to promote it for the space tourism market. It is also important to note that the government has assumed its proper regulatory and licensing role in this new industry, as it has done in past new endeavors, by establishing a Commercial Space Transportation Office in the FAA to carry out these essential government functions.

In the case of the SSPS, there *were* a few indications of interest by the electric power industry and the civil engineering profession. The Electric Power Research Institute, the research arm of that industry, had devoted the Spring 2000 issue of its quarterly *EPRI Journal* to the SSPS, and the American Society of Civil Engineers also published a full issue of the *ASCE Journal* on the subject in April 2001.

In 2009 California regulators proposed a plan to approve a 15-year contract for the solar energy firm Solaren to supply space-based solar power to one of the nation's biggest utility companies, Pacific Gas and Electric, by 2016. But that contract was never issued, and no system was ever developed or built.

Another prospective industry venture in the U.K., described in the June issue of the Royal Aeronautical Society's *Aerospace International*, is Orbital Power's visionary project to develop and launch a constellation of 10-tonne satellites, each transmitting 20 MW of microwave power to ground antennas, for a total of up to 5 GW of delivered power during the decade 2030-2040. As yet, however, there is no sign of any actual system elements being designed, developed, or built.

So in the end this minimal recognition of the concept by the industry engendered no real financial or development interest from the industrial energy-supply sector.

Turning point: DOD takes note

This was the situation when the Defense Dept. got into the act. In October 2007 the National Space Security Office (NSSO) issued a preliminary assessment titled "Space-Based Solar Power as an Opportunity for Strategic Security." Further interest resulted from two events that featured discussions of the then-ongoing NSSO study: an August 2007 roundtable sponsored by Washington, D.C.'s George C. Marshall Institute, and a September 2007 USAF workshop at the Air Force Academy.

This unequivocal interest shown for the first time by the military created a potential turning point for SSPS development. A number of published reports in the trade media, including *Space News* and *Aviation Week*, documented the salient points of the military's interest. A commentary by James Vedda (*Space News*, October 29, 2007) cited

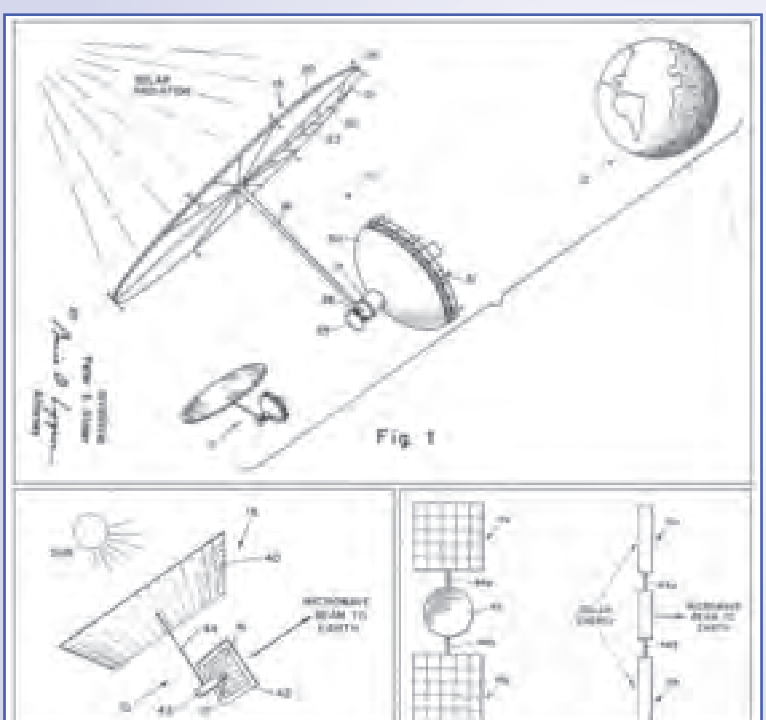
SSPS: A look at its beginnings

In 1890 Nicola Tesla proposed the wireless transmission of electric power, and 10 years later he conducted proof-of-concept experiments. The collection of solar energy in space for transmission to Earth was suggested in 1912 by the grandfather of rocketry, Konstantin Tsiolkowski. The modern version was first published in 1968 by Peter Glaser, vice president of Arthur D. Little, and patented by him in 1973. Glaser's version laid out a specific system design concept that entailed using large orbiting satellites to convert solar energy in space to electricity and beaming the power to Earth for terrestrial use.

Glaser's design concept drew some interest in the ensuing decade, not because of the prevailing hysteria about global warming, but because the price of oil had soared to an unbelievable $12 a barrel. The Dept. of Energy and NASA conducted an extensive study of a so-called 10-GW 'reference design' in 1978-1979. They concluded that although the system was technically feasible, it was nowhere near practical economically. Their conclusion—to shelve the idea for at least a decade to see how the technology and the market would develop—made very good sense at the time.

Since then, much interest has been expressed in the idea of a space solar power system), also known by other names such as satellite power system, solar power satellite, and space-based solar power.

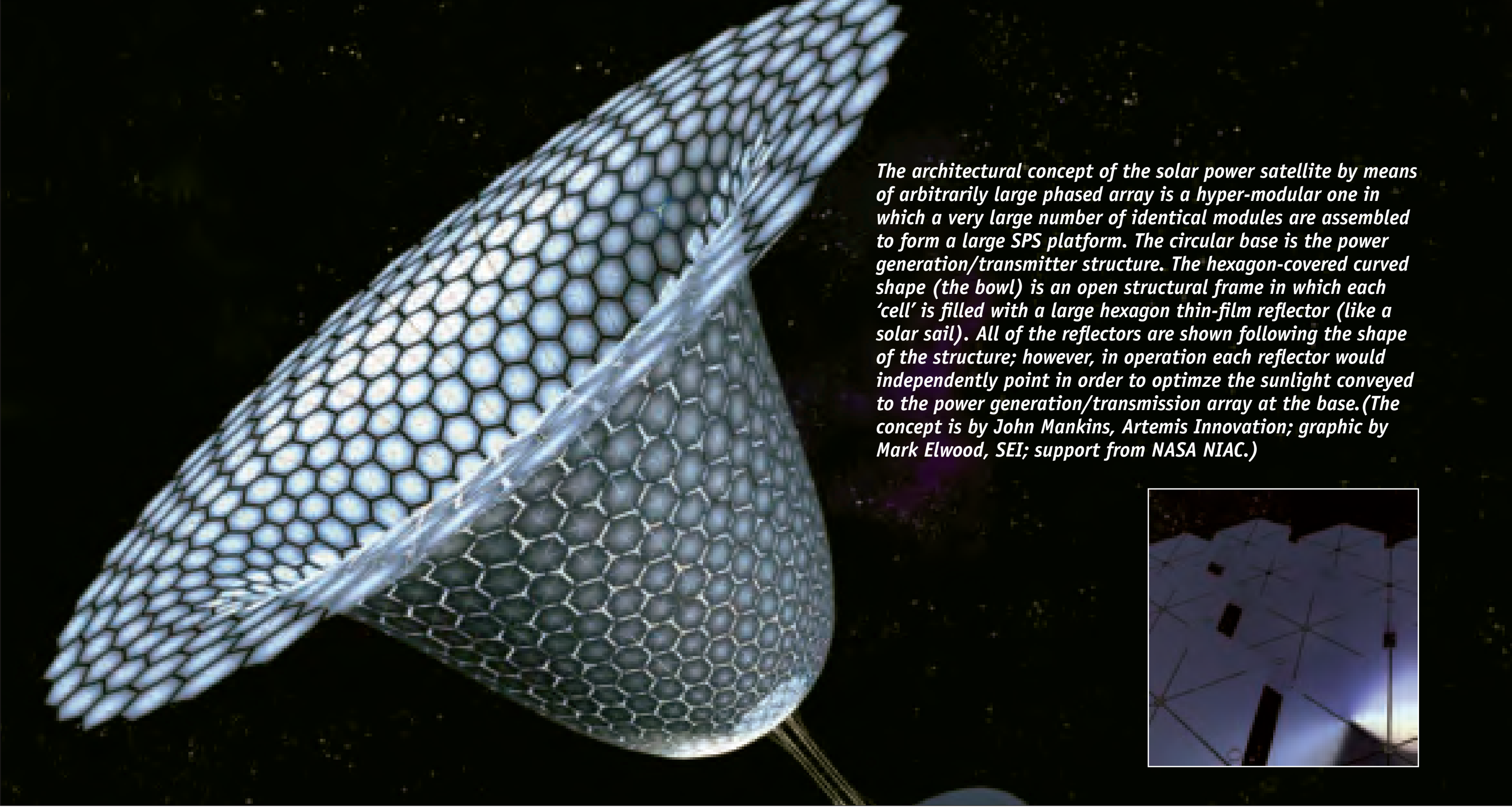
Despite its infeasible economics—and the high 'giggle factor' associated with the idea of launching dozens of thousand-ton spacecraft to geostationary orbit—the fascinating long-term prospect of delivering the world from dependence on fossil fuels (and their environmental impacts) has stirred up considerable interest. Space-based solar collectors also avoid the factors that limit ground-based solar powerplants—clouds, nighttime, the need for energy storage systems, atmospheric absorption, windstorms, precipitation, lightning, earthquakes, and so on—and therefore can offer baseload service rather than just supplementary power to terrestrial grids.



In 1968 Peter Glaser published a modern version of a solar power collector first conceived by Konstantin Tsiolkowski in 1912. It was one of the many SSPS configurations explored in past studies.

Early assessments

The congressional Office of Technology Assessment conducted an in-depth evaluation of the DOE/NASA study in the 1980s. Subsequent assessments of the whole SSPS concept were published by the National Academies' National Research Council, the Battelle Memorial Institute, the National Science Foundation, Resources for the Future, and the AIAA. In Congress, three bills were written (and at least three more drafted) proposing various SSPS programs and goals. Controversy raged, not only over the obvious



The architectural concept of the solar power satellite by means of arbitrarily large phased array is a hyper-modular one in which a very large number of identical modules are assembled to form a large SPS platform. The circular base is the power generation/transmitter structure. The hexagon-covered curved shape (the bowl) is an open structural frame in which each 'cell' is filled with a large hexagon thin-film reflector (like a solar sail). All of the reflectors are shown following the shape of the structure; however, in operation each reflector would independently point in order to optimze the sunlight conveyed to the power generation/transmission array at the base.(The concept is by John Mankins, Artemis Innovation; graphic by Mark Elwood, SEI; support from NASA NIAC.)

concerns—orders-of-magnitude increase in space operations and uncertain long-term economics—but also over a host of political, societal, environmental, military, and international regulatory issues. Every assessment and analysis reaffirmed the high cost of space transportation as the principal barrier, even to subscale demonstration projects.

Among those showing broad interest in the concept were the Japanese, who created several technical approaches to various aspects of the system, published technical journals based on annual Japanese SSPS symposia, and designed a comprehensive orbital demonstration project called SPS 2000. This was followed in 2001 by JAXA's 30-year, $2-billion development effort in cooperation with Japanese industry.

There were several ground-based demonstrations of microwave power transmission (the mode espoused by Glaser's patent). The first was a 1-mi. transmission by JPL in 1975; the most recent, by Discovery Channel in 2008, covered 92 mi. A space demonstration proposed in 2009 called for using traveling wave tube amplifiers (donated by the Air Force Research Laboratory and mounted on the Japanese Experiment Module's Exposed Facility on the international space station) to beam ISS solar array power to Earth, but this never took place.

A fresh look

Outside of these peripheral activities, the SSPS idea languished, drawing little attention until 1995, when NASA conducted a 'Fresh Look' study. As the earlier study had recommended, this new effort explored the technological progress made since the 1979 report and the changes in market dynamics.

The Fresh Look study made important strides in recognizing technology advances applicable to SSPS and in developing cost models for evaluating candidate system design concepts and sensitivities. It clearly identified the benefits of using smaller launch packages, multiple modular units, concentrator arrays, and automated assembly. It was also useful in targeting other major cost drivers and implementation difficulties and identified a range of alternative satellite and system concepts for evaluation.

NASA followed up the Fresh Look effort with a series of comprehensive Concept Development and Evaluation studies that documented major advances in technology, market opportunities, and benefits to both civil and military space programs. These studies revised and updated the concepts developed during the Fresh Look and laid out a series of Technology Roadmaps to guide the efforts needed to achieve SSPS cost and operational goals. Work accomplished in 1998 included further definition of the old and new system concepts, of technology advancement planning, and of the economic, market, environmental, regulatory, and political considerations implicit in SSPS development.

Several AIAA assessments in 1999 and 2000 then confirmed the significant technological progress made since the first study: developments in solar photovoltaics; electric power management and distribution; laser power conversion, transmission, and reconversion; lightweight structures (including inflatables, later demonstrated by Bigelow's Genesis modules, now in orbit); structural dynamics of very large spacecraft; robotic assembly; and high-efficiency orbit-transfer propulsion. Such advances had moved these technologies very close to the point where they could soon be incorporated into an operational demonstration SSP system.

One AIAA assessment also identified a number of dual-use options in NASA and military programs—space exploration and geocentric missions—that would both contribute to and benefit from SSPS technology advancements. However, the principal technical barrier remained: achieving sufficiently low-cost, reliable transportation from Earth to low orbit.

Despite these positive indications, in 2001 NASA decided it had more important fish to fry and closed down all research and evaluation of SSPS systems, technology, and economics. There has been, however, one promising recent development: In August 2010 the NASA Innovative Advanced Concepts (NIAC) office awarded a grant to Artemis Innovative Management Solutions for a year-long study of a new SSPS concept. Called SPS-ALPHA, it uses biomimetic technology for a radical new SSPS architecture. Artemis CEO John Mankins presented the idea this year to the March 27-29 NIAC conference. He had led NASA's Fresh Look and Concept Development studies and had generated and led a 2010 Cosmic Study, Solar Energy from Space, *by the International Academy of Astronautics.*

International activities

Several agencies outside the U.S. have conducted extensive studies and symposia on the SSPS, most notably the International Academy of Astronautics, the International Astronautical Federation, ESA, France's CNES and Électricité de France, the French island of Reunion, the Chinese Academy of Space Technology, the Japan-U.S. Science, Technology and Applications Program, UNESCO's World Energy Program, England's University of Oxford, Russia's Maglev institute, the Ukrainian Design Bureau, the Israeli Space Agency, Canada, and the international Sunsat Energy Council.

SSPS as one of the substantial contributions that would make space much more important to mankind than would sending humans to Mars. That opinion was later reaffirmed in a *Space News* commentary by Edward Hujsak on March 26 of this year. And Britain's Royal Aeronautical Society featured "Power from the Sun" in the April 2012 issue of *Aerospace International*.

Although the NSSO report clearly pointed out that the DOD would not be the appropriate agency to fund the development of SSPS, it also stated that the military would be quite interested in serving as an 'anchor customer.' The cost of furnishing electric power to support advance bases in Iraq, Afghanistan, and other far-flung military posts, including the logistics of fuel supply, was then well over $1/kW-hr, vs. the current price of $0.03-$0.05 cited as the competitive barrier for commercial SSPS power.

In the interest of national security, the NSSO report called on the federal government to create a program that would reduce the technical and economic risks of developing a full-scale SSPS, culminating in the funding of a demonstration powerplant in the 5-10-MW range. The key to future growth in both civil and military space activities, said the report, is the development of a space transportation system and the logistic technologies capable of delivering such a unit, either wholly or in parts to be assembled in orbit.

That was precisely what supporters of SSPS had been advocating for years. Modest investments in continued SSPS technology advancement efforts could lead to a space demonstration at reasonable cost in about a decade. Currently available space launch systems would be used pending the evolution of more powerful low-cost launchers.

The extraterrestrial option

Back in 1974, a whole new concept in space development had drawn major public interest: Princeton physics professor Gerard K. O'Neill's proposition that mankind's future would be in space, in the form of enormous orbiting 'space colonies.' As envisioned by O'Neill, these settlements would support thousands of people and could be made self sufficient, drawing their power from the Sun.

During a series of biennial 'Princeton Conferences' cosponsored by AIAA, this grandiose concept was melded with the SSPS, offering life to both programs—a source of jobs and income for the space colonies' populations, and an off-world manufacturing site and workforce for the SSP system. This also would solve the space transportation issue: The materials needed to build and assemble the SSPS hardware would be mined from the Moon and launched to the required geosynchronous Earth orbit locations from the low-gravity, airless lunar surface via solar-powered electric catapults. Additional detailed studies conducted by David Criswell in the 1980s explored the prospects for placing SSPS powerplants on the Moon to deliver power to Earth.

The sizable investment needed to take the next step in SSPS evolution would still be far less than the several trillion dollars now invested annually in the world's terrestrial electric power systems. Indeed, it would be nowhere near a trillion. Yet despite this, and despite the optimistic visions outlined above, today's constrained global economy does not seem to offer any encouragement for investing in that next step: a demonstration, as espoused by the NSSO report and, repeatedly, by SSPS proponents. The NSSO report recommended that, to foster such a demonstration, the U.S. government should:

- Organize effectively to allow for the development of SSPS and conclude analyses to resolve remaining unknowns.
- Retire a major portion of the technical risk for business development.
- Create a facilitating policy, regulatory, and legal environment for the development of SSPS.
- Become an early demonstrator, adopter, and/or customer of SSPS and incentivize its development.

Complying with the first three of these recommendations might have an acceptable budgetary impact and could conceivably be implemented. However, it is likely that in the present budget environment the government would not undertake the more costly 'early demonstrator' role cited in the fourth recommendation.

But unless and until industry commits to that next step—the design, approval, development, construction, launch, testing, and operation of a suitable prototype demonstration in orbit—the half-century-long conundrum will remain: Is the SSPS a potential saviour of our home planet, or just a giant piece of pie in the sky?

(Continued from page 21)

different models of the Long March vehicle and different launch sites, including Jiuquan, Taiyuan, and Xichang.

New players and other factors

That relative drop in the number of commercial payloads being launched lately is related not only to China, but also to the fact that there are new players in the launch market, such as Iran, with its Safir rocket, and Arianespace with its Vega, as well as North Korea with its Unha. Initially, at least, none of these vehicles is going to be launching many, if any, commercial payloads.

The Iranians and North Koreans will stick to small scientific, imaging, and technology development satellites for their respective governments. Meanwhile, Vega will be used primarily to launch small satellites for ESA, European national space agencies, and universities. First launched on February 13, Vega is reportedly going to be priced at $40 million-$45 million per mission. Thus Vega would be much more expensive than Russian smaller launchers such as Dnepr and Start and the Russian/German Rockot, making it difficult for the Arianespace vehicle to compete for commercial payloads.

Judging from its maiden launch customers, however, Vega may end up fueling demand for launch services by universities and research institutes throughout Europe. The rocket carried a total of 10 satellites—seven were picosatellites (1 kg) for universities, including the Technical University of Budapest; Torino Polytechnic University; Universities of Bucharest, Montpellier II, Rome, and Vigo; and Warsaw University of Technology. One was a nanosatellite (12.5 kg) for the University of Bologna.

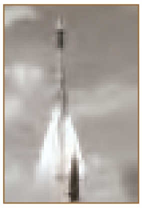

Safir

Vega

With the continuing demand for basic telecommunications and advanced broadband and direct TV broadcast communications around the world, we do not anticipate any significant decline in commercial payloads anytime soon. Replenishment spacecraft for LEO mobile communications satellite constellations such as Globalstar, Iridium, and Orbcomm will also keep the number of commercial payloads stable. But in relative terms, the commercial numbers may well continue to drop, for several reasons: the growing emphasis on other types of satellites because of the strength of China's national space program; evolving space programs such as that of Iran; and better access to space for dozens of universities as a result of new government-subsidized launch vehicles like Vega.

Marco Cáceres
Teal Group
mcaceres@tealgroup.com

Out of the



25 Years Ago, September 1987

Sept. 15 After a 16-month hiatus, ESA launches two communications satellites into orbit from an Ariane 3 booster at Kourou, French Guiana. I. Gawdiak, *Astronautics and Aeronautics, 1986-1990*, p. 130.

50 Years Ago, September 1962

Sept. 4 Vladimir Ilyushin, son of famed Russian aircraft designer Sergei Ilyushin, sets a new world's record for a sustained altitude flight, piloting a T-431 aircraft at 69,885 ft at a speed of 1,304.94 mph. *Aviation Week*, Sept. 17, 1962, p. 36.

Sept. 9 The de Havilland Trident British short/medium-range three-engined jet airliner makes its first overseas flight, carrying delegates from London to Dublin for an International Air Transport Association meeting. The plane, which has sophisticated avionics, later achieves fame as the first airliner to make a fully automatic approach and landing and to conduct automatic landings in regular service. *Flight International*, Sept. 20, 1962, p. 474.

Sept. 9 A Lockheed U-2 spy plane flown by Nationalist Chinese pilot Huai-Sheng Chen from Taiwan is shot down over Nanchang, People's Republic of China, by an SA-2 surface-to-air missile of the same type that brought down Francis Gary Powers in 1960 and created the 'U-2 incident.' Chen is alive when he is found but later dies from his injuries. Few know that this is one of several U-2s shot down by SA-2s over the years. *Flight International*, Sept. 13, 1962, p. 428, and Sept 20, 1962, p. 474.

Sept. 9 Maj. Gen. Vladimir Klimov, noted airplane engine designer from the Soviet Corps of Engineers, dies. Klimov began research work in 1924 and by 1934 was appointed director of the Soviet government's Experimental Engine Design Bureau. There, in 1948, he was responsible for the VK-1 turbojet engine used in the MiG-15. He was also responsible for the VK-7 engine, which powers the Tu-104, and a turbojet also called VK-7. *Flight International*, Sept. 29, 1962, p. 474; *New York Times*, Sept. 11, 1962, p. 33.

Sept. 9 NASA announces that a three-man crew 'survives' a week-long virtual round trip to the Moon in a simulation chamber resembling the Apollo spacecraft, in the Martin plant near Baltimore, Md. The men are Donald L. Mallick, Harold E. Ream, and Glenn W. Stinnett. *Washington Star*, Sept. 9, 1962, p. A2.

Sept. 11-12 President John F. Kennedy tours NASA Marshall in Huntsville, Ala., and the Launch Operations Center at Cape Canaveral, Fla. At Marshall he inspects a mockup of the F-1 engine and a Saturn C-1 launch vehicle. At Cape Canaveral he inspects the launch complexes for the Mercury-Atlas, Titan, and C-1, then flies to the Manned Space Center at Houston. NASA Historical Staff, *Aerospace Chronology 1962*, p. 277.

Sept. 17 NASA names nine more astronauts for Projects Gemini and Apollo: Neil Armstrong, Frank Borman, Charles Conrad Jr., James A. Lovell Jr., James A. McDivitt, Elliot M. See Jr., Thomas P. Stafford, Edward H. White Jr., and John W. Young. *Aviation Week*, Sept. 17, 1962, p. 31, and Sept. 24, 1962, p. 28.

Sept. 18 A Thor-Delta launches the TIROS 6 satellite from Cape Canaveral, Fla., into Earth orbit. The satellite has the dual mission of locating and tracking tropical storms and transmitting weather data in preparation for astronaut Walter Schirrra's upcoming six-orbit Project Mercury flight. It was also designed to further demonstrate the capability of a satellite to observe, record, and transmit TV cloud cover images for use in operational weather analysis and forecasting. *Aviation Week*, Sept. 24, 1962, p. 4.

Thor-Delta

Sept. 19 The 100th Atlas launched from Cape Canaveral is successfully fired 5,000 mi. downrange. The missile, an F model, ejects two cameras from a capsule 5 sec after takeoff and also carries a capsule with scientific instruments and a nose cone cassette for flight recording. *Missiles and Rockets*, Sept. 24, 1962, p. 10.

Sept. 21 The Navy's Q-2C Firebee drone is successfully test launched from the ground for the first time, at Point Mugu, Calif. It reaches an altitude of 45,000 ft and is recovered from the Pacific

Past

An Aerospace Chronology
by **Frank H. Winter**
and **Robert van der Linden**

Ocean. *Missiles and Rockets*, Oct. 8, 1962, p. 11.

Sept. 24 The six-clustered RL-10 engines for the S-IV stage of the Saturn C-1 vehicle, a predecessor of the Saturn V, are successfully fired for 60 sec at the Douglas Missile and Space Systems test installation near Sacramento, Calif. *Missiles and Rockets*, Oct. 1, 1962, p. 13.

Sept. 28 A Thor-Agena rocket launches the joint Canadian-U.S. Alouette (lark) scientific satellite from Point Argello, Vandenberg AFB. Alouette is designed to measure the electron density of the ionosphere. It is Canada's first satellite as well as the first constructed by a country other than the U.S. or USSR. De Havilland Canada built the spacecraft mainly in its Downsview, Ont., factory. *Aviation Week*, Oct. 6, 1962, p. 34.

75 Years Ago, September 1937

Sept. 1 The Post Office's air express service begins its 11th year of operation by flying 1,666 express shipments over 30,160 mi. of domestic airline routes. The service began September 1, 1927, and averaged 43 shipments daily. *Aero Digest*, October 1937, p. 74.

Sept. 1 The new five-place multiengined Bell XFM-1 fighter makes its maiden flight at the Buffalo Municipal Airport in New York. Designed to down heavy bombers similar to the new Boeing B-17 Flying Fortress, the twin-engine fighter features two massive 37-mm automatic cannon. The aircraft is not a success. Lt. Benjamin F. Kelsey pilots the new plane. *Aero Digest*, October 1937, p. 94.

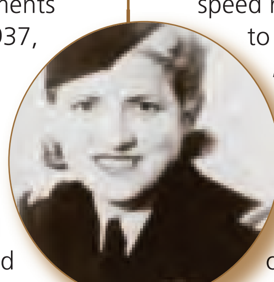
Sept. 2 Soviet aviator Michel Alekseev sets a new world altitude record with a payload of 1,000 kg when he takes his ANT-40 up to 40,187 ft at Moscow-Podlipki. *Aircraft Year Book, 1938*, p. 411.

Sept. 3-6 The 17th annual National Air Races are held at Cleveland, Ohio. Frank W. Fuller wins the coveted Bendix Trophy Race for the fastest flight from Los Angeles to Cleveland. His Seversky P-35 pursuit plane, powered by a single 1,200-hp Pratt & Whitney Twin Wasp Jr., makes it in 7 hr 54 min 26 sec, then continues on to New York, setting a new U.S. transcontinental record of 9 hr 44 min 43 sec. Fuller wins $13,000. A. van Hoorebeeck, *La Conquete de L'Air*, p. 303.

Sept. 12 Air Chief Marshal Sir John M. Steel retires after serving in the British military for 45 years. Steel entered the Royal Navy in 1892 and in 1917 began his aviation career as commander of the Royal Naval Air Service station at Eastchurch. When the RAF was created in April 1918, he was transferred to the new branch with the temporary rank of brigadier general. Following "valuable and distinguished services" during WW I, he became air marshal in 1932 and air chief marshal in July 1936. *The Aeroplane*, Sept. 22, 1937, p. 352.

Roscoe Turner

Sept. 19 Colorful aviator Roscoe Turner sets a new national speed record for 100 km, flying his Laird-Turner Racer to 289.9 mph in Detroit, Mich. *Aircraft Year Book, 1938*, p. 411.



Sept. 21 Jacqueline Cochran breaks the international women's 3-km flight record, piloting her civil version of the Seversky P-35 pursuit plane at an average of 293.05 mph at Wayne County Airport, Detroit. Her fastest of six dashes is 304.7 mph. The previous 3-km record was held by Helene Boucher of France. *Aero Digest*, Oct. 1937, p. 98.

100 Years Ago, September 1912

Sept. 11 Italian army Capt. Riccardo Moizo becomes the first airman to be captured in war when he lands near Zanzur, Libya, in his Nieuport monoplane to adjust his engine during the Italian-Turkish War. He is captured by Arabs and taken to Turkish headquarters at Azizia in Libya. *Flight*, Sept. 21, 1912, p. 861.

MISSOURI S&T

University of Science and Technology

MECHANICAL AND AEROSPACE ENGINEERING DEPARTMENT

Assistant/Associate/Full Professor Positions

(Ref # 000031104/00055726)

The Department of Mechanical and Aerospace Engineering at the Missouri University of Science and Technology (formerly the University of Missouri - Rolla) invites applications for two full-time tenure-track Assistant/Associate/Full Professor positions in the general areas of experimental or computational fluid dynamics. Specific areas of current interest within the Department include gas dynamics, hydrodynamics, flow control, and/or viscoelastic fluids, and applications in energy conversion systems such as internal combustion engines, renewable energy, and/or manufacturing. The level is commensurate with experience and accomplishments.

Applications are invited from candidates who possess an earned Ph.D. in Mechanical Engineering, Aerospace Engineering or closely related fields. The successful candidates will demonstrate the potential to establish and grow a strong research program and will participate in all aspects of the Department's mission, which includes research, teaching and service.

The department currently has 33 full-time faculty members, over 800 undergraduate and approximately 200 graduate students. The Department offers the B.S., M.S., and Ph.D. degrees in Mechanical and Aerospace Engineering. The Department seeks to significantly increase the national visibility of its research and graduate program while maintaining its high standards of teaching. A recently completed $29 million renovation project has produced a state-of-the-art Mechanical and Aerospace Engineering complex with 144,000 square feet of teaching and research laboratory space. Details regarding the department can be found at http://mae.mst.edu/. In addition, details of research centers on campus can be found at http://www.mst.edu/research/.

Candidates should include the following with their letter of application: current curriculum vitae, a list of graduate courses taken, statement of research plans including areas in which the candidate has an interest in collaborating with other faculty, statement of teaching philosophy, and names and contact information for at least three references. Review of applications will begin on November 1, 2012 and applications will be accepted and reviewed until the position is filled. All application materials must be electronically submitted to the Missouri University of Science and Technology's Human Resource Office using the following address: hrsinfo@mst.edu. Acceptable electronic formats that can be used include PDF and Word.

The final candidates are required to provide an official transcript showing completion of the terminal degree listed in the application materials submitted. Copies of transcript(s) must be provided prior to the start of employment. In addition, the final candidates may be required to verify other credentials listed in application materials. Failure to provide the official transcript(s) or other required verification may result in the withdrawal of the job offer.

Missouri S&T is an AA/EO Employer and does not discriminate based on race, color, religion, sex, sexual orientation, national origin, age, disability, or status as Vietnam-era veteran. Females, minorities, and persons with disabilities are encouraged to apply. Missouri University of Science and Technology participates in E-Verify. For more information on E-Verify, please contact DHS at: 1-800-464-3218.

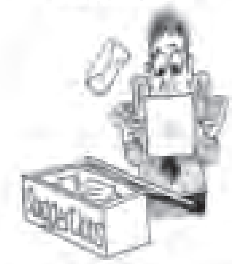
NOTE: All application materials must have position reference number (R00031104/00055726) in order to be processed.

TENURED FACULTY POSITION WITH ENDOWED PROFESSORSHIP

The Henry Samueli School of Engineering and Applied Science (HSSEAS) at the University of California, Los Angeles (UCLA) invites applications for the endowed Ronald and Valerie Sugar Chair in Engineering. The Chair's position will be in any department within HSSEAS at UCLA, but the Chair is dedicated to flight systems and control. The holder of this Chair will be a distinguished scholar with a proven record of professional and academic leadership, a distinguished national and international reputation in research, a strong track record in obtaining extramural funding, and demonstrated excellence in graduate and undergraduate education. Candidates are required to have a Ph.D. in a closely related discipline, and qualifications for appointment as a tenured full professor. For consideration, nominators or applicants should submit a curriculum vitae and names of three references to: Search Committee, Ronald and Valerie Sugar Chair (Tracking No: 0115-1213-01), sugar.chair@seas.ucla.edu, by September 30, 2012.

UCLA is an Equal Opportunity/Affirmative Action Employer. The Henry Samueli School of Engineering and Applied Science at UCLA, has a strong commitment to achievement of excellence and diversity among its faculty and students. Women and minorities are encouraged to apply.

THE AIAA SUGGESTION PROGRAM



AIAA welcomes suggestions from members on how we can better serve you.
All comments will be acknowledged. We will do our best to address issues that are important to our membership.
Please send your comments to:

Merri Sanchez
VP Member Services
AIAA
1801 Alexander Bell Drive
Suite 500
Reston, VA 20191–4344

AIAA

Introducing

AIAA Webinars

Sharpen your skills with our 90-minute webinars taught by some of our most popular instructors.

12–13 September 2012 • 1300–1430 hrs EDT
Fundamentals of Communicating by Satellite
Edward Ashford

AIAA Members	$199
Nonmembers	$239
Full-time students	$100

18–20 September 2012 • 1300–1430 hrs EDT
Deciding on the Form of Missile Defense
Peter J. Mantle

AIAA Members	$299
Nonmembers	$339
Full-time students	$140

26 September 2012 • 1300–1430 hrs EDT
UAV Conceptual Design Using Computer Simulations
Peter Zipfel, PhD

AIAA Members	$99
Nonmembers	$139
Full-time students	$50

3 October 2012 • 1300–1430 hrs EDT
Space Radiation Environment
Vincent L. Pisacane, PhD

AIAA Members	$99
Nonmembers	$139
Full-time students	$50

10–11 October 2012 • 1300–1430 hrs EDT
Introduction to Communication Satellites and their Subsystems
Edward Ashford

AIAA Members	$199
Nonmembers	$239
Full-time students	$100

17 October 2012 • 1300–1430 hrs EDT
Overview of Missile Design and System Engineering
Eugene L. Fleeman

AIAA Members	$99
Nonmembers	$139
Full-time students	$50

Register Today!
www.aiaa.org/webinars

AIAA
The World's Forum for Aerospace Leadership

AIAA Bulletin

Michael Mackowski receives the AIAA Sustained Service Award during the AIAA Phoenix Section Dinner Meeting on 17 May 2012.

SEPTEMBER 2012

AIAA Meeting Schedule B2

AIAA Courses & Training Program Schedule B4

AIAA News B5

AIAA Meetings Programs B13

18th AIAA/3AF International Space Planes and Hypersonic Systems and Technologies Conference

AIAA Calls for Papers B18

AIAA SPACE 2013 Conference & Exposition

AIAA Publications B24

AIAA Courses and Training Program B25

Standard Conference Information B28

AIAA Directory

AIAA HEADQUARTERS
1801 Alexander Bell Drive, Suite 500
Reston, VA 20191-4344
www.aiaa.org

To join AIAA; to submit address changes, member inquiries, or renewals; to request journal fulfillment; or to register for an AIAA conference. **Customer Service: 800/639-AIAA†**

Other Important Numbers: ***Aerospace America*** / Greg Wilson, ext. **7596*** • ***AIAA Bulletin*** / Christine Williams, ext. **7500*** • **AIAA Foundation** / Suzanne Musgrave, ext. **7518*** • **Book Sales** / **800.682.AIAA** or **703.661.1595**, Dept. 415 • **Corporate Members** / Merrie Scott, ext. **7530*** • **International Affairs** / Megan Scheidt, ext. **3842***; Emily Springer, ext. **7533*** • **Editorial, Books and Journals** / Heather Brennan, ext. **7568*** • **Education** / Lisa Bacon, ext. **7527*** • **Honors and Awards** / Carol Stewart, ext. **7623*** • **Journal Subscriptions, Member** / **800.639.AIAA** • **Exhibits / Journal Subscriptions, Institutional / Online Archive Subscriptions** / Chris Grady, ext. **7509*** • **Professional Development** / Patricia Carr, ext. **7523*** • **Public Policy** / Steve Howell, ext. **7625*** • **Section Activities** / Chris Jessee, ext. **3848*** • **Standards, Domestic** / Amy Barrett, ext. **7546*** • **Standards, International** / Nick Tongson, ext. **7515*** • **Student Programs** / Stephen Brock, ext. **7536*** • **Technical Committees** / Betty Guillie, ext. **7573***

* Also accessible via Internet. Use the formula first name last initial@aiaa.org. Example: megans@aiaa.org.

† U.S. only. International callers should use 703/264-7500.

Addresses for Technical Committees and Section Chairs can be found on the AIAA Web site at **http://www.aiaa.org**.

We are frequently asked how to submit articles about section events, member awards, and other special interest items in the *AIAA Bulletin*. Please contact the staff liaison listed above with Section, Committee, Honors and Awards, Event, or Education information. They will review and forward the information to the *AIAA Bulletin* Editor.

Meeting Schedule

DATE	MEETING (Issue of *AIAA Bulletin* in which program appears)	LOCATION	CALL FOR PAPERS (*Bulletin* in which Call for Papers appears)	ABSTRACT DEADLINE
2012				
11–13 Sep	**AIAA SPACE 2012 Conference & Exposition** (Jun)	Pasadena, CA	*Sep 11*	**26 Jan 12**
11–13 Sep	**AIAA Complex Aerospace Systems Exchange Event** (Jun)	Pasadena, CA		
17–19 Sep	**12th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference** (Jul/Aug) **14th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference**	Indianapolis, IN	*Oct 11*	**7 Feb 12**
23–28 Sep†	**28th Congress of the International Council of the Aeronautical Sciences**	Brisbane, Australia Contact: http://www.icas2012.com		**15 Jul 11**
24–27 Sep†	**30th AIAA International Communications Satellite Systems Conference (ICSSC) and** **18th Ka and Broadband Communications, Navigation and Earth Observation Conference** (Jul/Aug)	Ottawa, Ontario, Canada Contact: Frank Gargione, frankgargione3@msn.com; www.kaconf.org	*Nov 11*	**31 Mar 12**
24–28 Sep	**18th AIAA International Space Planes and Hypersonic Systems and Technologies Conference** (Sep)	Tours, France	*Mar 12*	**12 Apr 12**
24–28 Sep	~~**7th AIAA Biennial National Forum on Weapon System Effectiveness** (Jul/Aug)~~ Event Cancelled	Ft. Walton Beach, FL	*Nov 11*	**15 Mar 12**
1–5 Oct	**63rd International Astronautical Congress**	Naples, Italy (Contact: www. iafastro.org)		
11–12 Oct†	**Aeroacoustic Installation Effects and Novel Aircraft Architectures**	Braunschweig, Germany (Contact: Cornelia Delfs, +49 531 295 2320, cornelia.delfs@dlr.de, www.win.tue.nl/ceas-asc)		
14–18 Oct†	**31st Digital Avionics Systems Conference**	Williamsburg, VA (Contact: Denise Ponchak, 216.433.3465, denise.s.ponchak@nasa.gov, www.dasconline.org)		
22–25 Oct†	**International Telemetering Conference**	San Diego, CA (Contact: Lena Moran, information@telemetry.org, 575.415.5172, www.telemetry.org)		
5–8 Nov†	**27th Space Simulation Conference**	Annapolis, MD Contact: Harold Fox, 847.981.0100, info@spacesimcon.org, www.spacesimcon.org		
6–8 Nov†	**7th International Conference Supply on the Wings**	Frankfurt, Germany (Contact: Richard Degenhardt, +49 531 295 2232, Richard.degenhardt@dlr.de, www.airtec.aero)		
2013				
7–10 Jan	**51st AIAA Aerospace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition**	Dallas/Ft. Worth, TX	*Jan 12*	**5 Jun 12**
21–25 Jan†	**Annual Reliability and Maintainability Symposium (RAMS)**	Orlando, FL Contact: Patrick M. Dallosta, 703.805.3119, Patrick.dallosta@dau.mil, www.rams.org		
10–14 Feb†	**23rd AAS/AIAA Space Flight Mechanics Meeting**	Kauai, HI	*May 12*	**1 Oct 12**
2–9 Mar†	**2013 IEEE Aerospace Conference**	Big Sky, MT Contact: David Woerner, 626.497.8451; dwoerner@ieee.org; www.aeroconf.org		
19–20 Mar	**Congressional Visits Day**	Washington, DC Contact Duane Hyland, duaneh@aiaa.org; 703.264.7558		
25–28 Mar	**22nd AIAA Aerodynamic Decelerator Systems Technology Conference and Seminar** **AIAA Balloon Systems Conference** **20th AIAA Lighter-Than-Air Systems Technology Conference**	Daytona Beach, FL	*May 12*	**5 Sep 12**
8–11 Apr	**54th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference** **21st AIAA/ASME/AHS Adaptive Structures Conference** **15th AIAA Non-Deterministic Approaches Conference** **14th AIAA Dynamic Specialist Conference** **14th AIAA Gossamer Systems Forum** **9th AIAA Multidisciplinary Design Optimization Conference**	Boston, MA	*Apr 12*	**5 Sep 12**
12–14 Apr†	**EuroGNC 2013, 2nd CEAS Specialist Conference on Guidance, Navigation and Control**	Delft, The Netherlands (Contact: Daniel Choukroun, d.choukroun@tudelft.nl, www.lr.tudelft.nl/EuroGNC2013)		

DATE	MEETING (Issue of *AIAA Bulletin* in which program appears)	LOCATION	CALL FOR PAPERS (*Bulletin* in which Call for Papers appears)	ABSTRACT DEADLINE
23–25 Apr†	**Integrated Communications Navigation and Surveillance 2013**	Herndon, VA (Contact: Denise Ponchak, 216.433.3465, denise.s.ponchak@nasa.gov, www.i-cns.org)		
27–29 May	**19th AIAA/CEAS Aeroacoustics Conference (34th AIAA Aeroacoustics Conference)**	Berlin, Germany	*Jul/Aug 12*	**31 Oct 12**
27–29 May†	**20th St. Petersburg International Conference on Integrated Navigation Systems**	St. Petersburg, Russia Contact: Prof. V. Peshekhonov, +7 812 238 8210, icins@eprib.ru, www.elektropribor.spb.ru		
29–31 May†	**Requirements for UTC and Civil Timekeeping on Earth: A Colloquium Addressing a Continuous Time Standard**	Charlottesville, VA (Contact: Rob Seaman, 520.318.8248, info@futureofutc.org, http://futureofutc.org)		
6 Jun	**Aerospace Today ... and Tomorrow: Disruptive Innovation, A Value Proposition**	Williamsburg, VA (Contact: Merrie Scott: merries@aiaa.org)		
17–19 Jun†	**2013 American Control Conference**	Washington, DC (Contact: Santosh Devasia,devasia@u.washington.edu,http://a2c2.org/conferences/acc2013)		
24–27 Jun	**43rd AIAA Fluid Dynamics Conference and Exhibit** **44th AIAA Plasmadynamics and Lasers Conference** **44th AIAA Thermophysics Conference** **31st AIAA Applied Aerodynamics Conference** **21st AIAA Computational Fluid Dynamics Conference** **5th AIAA Atmospheric and Space Environments Conference** **AIAA Ground Testing Conference**	San Diego, CA	*Jun 12*	**20 Nov 12**
14–17 Jul	**49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit** **11th International Energy Conversion Engineering Conference (IECEC)**	San Jose, CA	*Jul/Aug 12*	**21 Nov 12**
14–18 Jul	**43rd International Conference on Environmental Systems (ICES)**	Vail, CO	*Jul/Aug 12*	**1 Nov 12**
11–15 Aug†	**AAS/AIAA Astrodynamics Specialist Conference**	Hilton Head Island, SC (Contact: Kathleen Howell, 765.494.5786, howell@purdue.edu, www.space-flight.org/docs/2013_astro/2013_astro.html)		
12–14 Aug	**Aviation 2013**	Los Angeles, CA		
19–22 Aug	**AIAA Guidance, Navigation, and Control Conference** **AIAA Atmospheric Flight Mechanics Conference** **AIAA Modeling and Simulation Technologies Conference** **AIAA Infotech@Aerospace Conference**	Boston, MA	*Jul/Aug 12*	**31 Jan 13**
10–12 Sep	**AIAA SPACE 2013 Conference & Exposition**	San Diego, CA	*Sep 12*	**31 Jan 13**
6–10 Oct†	**32nd Digital Avionics Systems Conference**	Syracuse, NY (Contact: Denise Ponchak, 216.433.3465, denise.s.ponchak@nasa.gov, www.dasconline.org)		

To receive information on meetings listed above, write or call AIAA Customer Service, 1801 Alexander Bell Drive, Suite 500, Reston, VA 20191-4344; 800.639.AIAA or 703.264.7500 (outside U.S.). Also accessible via Internet at www.aiaa.org/calendar.

†Meetings cosponsored by AIAA. Cosponsorship forms can be found at https://www.aiaa.org/Co-SponsorshipOpportunities/.

AIAA Courses and Training Program

DATE	COURSE	VENUE	LOCATION
2012			
9–10 Sep	**Systems Engineering Verification and Validation**	SPACE Conference	Pasadena, CA
9–10 Sep	**Introduction to Space Systems**	SPACE Conference	Pasadena, CA
11–12 Sep	**Robust Aeroservoelastic Stability Analysis**	National Institute of Aerospace	Hampton, VA
12–13 Sep	**Fundamentals of Communicating by Satellite**	Webinar	
15–16 Sep	**Optimal Design in Multidisciplinary Systems**	ATIO/MAO Conference	Indianapolis, IN
18–20 Sep	**Deciding on the Form of Missile Defense**	Webinar	
26 Sep	**UAV Conceptual Design Using Computational Simulations**	Webinar	
3 Oct	**Space Radiation Environment**	Webinar	
10–11 Oct	**Introduction to Communication Satellite and their Subsystems**	Webinar	
17 Oct	**Overview of Missile Design and System Engineering**	Webinar	
7 Nov	**Flight Dynamics and Einstein's Covariance Principle**	Webinar	
14 Nov	**Risk Analysis and Management**	Webinar	
6 Dec	**Advanced Composite Materials and Structures**	Webinar	

**Courses subject to change*

To receive information on courses listed above, write or call AIAA Customer Service, 1801 Alexander Bell Drive, Suite 500, Reston, VA 20191-4344; 800.639.2422 or 703.264.7500 (outside the U.S.). Also accessible via the internet at www.aiaa.org/courses or www.aiaa.org/SharpenYourSkills.

From the Corner Office

CHANGE MISSION IMPOSSIBLE? OR MISSION ACCOMPLISHED?

Klaus Dannenberg, Deputy Executive Director and Chief Strategy Officer

Quite a lot has been written in this column over the past year about coming changes in AIAA's future—by Bob Dickman, Mike Griffin, and myself. Each article has addressed one or more different aspects of changes needed or in progress for the Institute to become more relevant—to the public, to policymakers, to our members, to our organizational sponsors, and to the profession. If you only read these editorials sporadically every two or three months, all the diverse topics discussed may seem disconnected to you and you may wonder why we continue to talk about it and not much is evident yet. Great question! I'm glad you asked. But progress IS being made and action IS in progress. And you will start to notice the changes in 2013, for sure. So let me address this and give you some insights into where we are in this evolutionary process as well as where we are headed.

The business of AIAA largely focuses on two elements: events and publications. There are other activities of great importance to our membership, our future, and our brand. Two prime examples are public policy and education. However, a big difference is that these are services we provide and are not revenue generating activities. To enable us to provide those non-revenue generating services, we must generate enough business in other areas to support them. We've been doing that for decades and will continue to do so, although we may well decide to provide them in a different mix and with a changed frequency. But let me address the two revenue generating areas since these are where you will see the greatest changes.

Publications and events are much more than outlets for various types of technical exchanges of papers. Each is also a platform for membership interaction and an outlet for visibility of aerospace organizations. Each has a constituency and a legacy of products, advertisers, and buyers whose continuing support is vital. As we change each of the products encompassed by these product areas, we need to ensure that we are reaching additional constituencies without losing the legacy ones. The main challenges in each are the long lead times involved, especially for our events, where contracts are usually negotiated years in advance. As we evolve our products, both their content and their format need to evolve simultaneously. But this gives a new look to old constituencies and a new product to new constituencies. Will they both like it?—we don't know. Will we reach the new constituencies desired?—again, we don't know. No matter how much market research we do, it still involves a lot of trial and error. With the multi-year processes involved, we are taking a deliberate approach to these changes. But they are coming to fruition during Mike Griffin's tenure as AIAA president, i.e., this year and next.

We've written about our new events strategy. The transition will be initiated in 2013 with our new AVIATION conference. We've spent a lot of effort getting the consensus of the TAC constituencies as well as the corporate members and government agencies involved in aviation. We seem to have all of that in place with the call for papers now imminent. AVIATION will be followed with an evolution in AEROSPACE SCIENCES and SPACE in 2014. Since these were established events over a longer time period, the coordination was more complex, but it has been accomplished and we are moving forward.

Our publications changes are a little different since they are more focused on format and delivery methods than on content. But we have established new formats, have invested in a digital library capability, and are actively migrating to greater and greater digital formats for publications delivery and archiving. We are positioned for growth and think we will minimize any impacts from shrinking budgets for these purposes.

A third element of change is our model for new business and outreach. Our founders intended for that to be guided by the Institute Development Committee (IDC). But for decades the IDC has been comprised of people responsible for current activities. And since these people are all volunteers (with their respective day jobs), there simply were not enough hours in the month to manage our current activities and also think about change and growth. So the IDC composition and structure have been revised to enable a serious focus on our future. The needed Bylaws changes have been made, willing and energetic visionary leaders have been appointed to the IDC, and the kickoff meetings have happened to put the revised process and team to work.

Have we got it right? Only time will tell. But I do think we are looking ahead and are positioned to survive the expected austerity, growing budget scrutiny, and rapid market shifts that are all playing out simultaneously in the larger operating environment. If you have other ideas that can make a difference, I encourage you to contact any of your Board members, or IDC members, or myself (klausd@aiaa.org). We are eager to hear from you and discuss these issues important to our future with you.

CALL FOR MEMBERSHIP: AEROSPACE SYSTEMS INTEGRATION WORKING GROUP (ASI-WG)

The recently formed Aerospace Systems Integration-Working Group (ASI-WG) under AIAA Technical Activities Committee/Program Committee (TAC/PC) Group is seeking active members. The ASI-WG is a forum to promote and contribute to aerospace systems integration across the spectrum of applications ranging from traditional systems to complex systems and systems of systems. ASI-WG will be actively developing AIAA standard, guide, and/or handbooks while participating/organizing conferences or sessions relating to this field. Please send your brief resume and areas of interest to Mat French, mat.french@liberty.rolls-royce.com, Hernando Jimenez, hernando.jimenez@asdl.gatech.edu, or Satoshi Nagano, Satoshi.Nagano@aero.org if you are interested in becoming a member of ASI-WG.

INTERNATIONAL COUNCIL OF THE AERONAUTICAL SCIENCES (ICAS) MEETS IN AUSTRALIA

As a member of the International Council of the Aeronautical Sciences (ICAS), AIAA is pleased to support the 28th Congress of ICAS, occurring 23–28 September 2012 in Brisbane, Australia. Hosted by the Royal Aeronautical Society Australian Division and co-hosted by Engineers Australia, ICAS 2012 covers a wide range of topics including structures and materials, aircraft systems integration, system engineering and supply chain, air transport system efficiency, safety and security, challenge of the environment, and operations and sustainment. The Congress attracts delegates from all over the world, including company CEOs, technology officers, managers, government officials, scientists, researchers, and students.

For more information, please visit **www.icas2012.com**.

LAUNCH OF TIAS WILL ADD TO VIBRANT COMMUNITY OF SCHOLARS AT TEXAS A&M

This summer the Texas A&M University Institute for Advanced Study (TIAS) will invite up to ten top researchers and scholars from sister institutions from around the world to collaborate as TIAS Faculty Fellows with faculty and student scholars at Texas A&M. Funding is in place to support ten Faculty Fellows for the first year of operation beginning in September 2012. Dr, John L. Junkins has been named the founding Director of TIAS. The TIAS Faculty Fellows will hold full-time visiting appointments for up to a year and will be selected through a faculty-led nomination process designed to attract preeminent thinkers from throughout the nation and abroad. During their stay at Texas A&M, the Faculty Fellows will engage Texas A&M faculty and students in ways intended to enhance the University's intellectual climate and to deepen educational experiences for students, as well as provide the Faculty Fellows extremely attractive opportunities for advancement of their scholarship.

TIAS directly relates to Texas A&M's 20-year roadmap, Vision 2020, for attaining status as one of the nation's top 10 public universities. It is anticipated that when TIAS is fully funded, 25 TIAS Faculty Fellows will be appointed each year, joining the University's current cadre of Nobel Laureates, Wolf Laureates, National Academy members, and internationally recognized intellectual leaders across a wide range of disciplines. Endowments are also in place for 20 Ph.D. researchers who will team with the Faculty Fellows.

TIAS was launched with the appointment of Distinguished Professor John L. Junkins as the founding Director. An AIAA Honorary Fellow, Junkins is also a member of the National Academy of Engineering and holds the Royce E. Wisenbaker '39 Innovation Chair in the Dwight Look College of Engineering at Texas A&M.

"... based upon the early response of nominees, I believe TIAS can become the premiere advanced study institute among public universities," said Junkins. He further noted that "TIAS is structured to recognize excellence in all of her guises and to provide opportunities for the 'mother of all sabbaticals' for distinguished scholars."

The wide-ranging areas of advanced study in TIAS include, but are not limited to, architecture; arts, humanities, and social sciences; business; education; engineering; physical, geophysical, agricultural, and life sciences; public and foreign policy; and across multiple disciplines. The actual areas of emphasis will evolve annually, driven by the excellence of the nominations and their correlation to our strategic plans.

NEW PUBLICATION AVAILABLE FROM AIAA

AIAA is pleased to announce the newest American National Standard, the revised Guide for the Preparation of Operational Concept Documents (ANSI/AIAA G-043A-2012). It is a cooperative effort between AIAA's Systems Engineering Committee on Standards and the INCOSE Requirements Working Group, providing a systems-level viewpoint and inclusion of international knowledge, information, and experiences that have been recognized since the Guide's original publication.

This edition has been broadened to encompass the development of all system types, including software-intensive systems, and to reflect technological advances of the last two decades. It describes which types of information are most relevant, their purpose, and who should participate in the operational concept development effort. It also provides advice regarding effective procedures for generation of the information and how to document it.

This document is free to AIAA members. Download a copy at https://www.aiaa.org/PubLandingList.aspx?id=3261&taxIDs=705.

Important Announcement
New Editor-in-Chief Sought for the Progress in Astronautics and Aeronautics Series

AIAA is seeking an outstanding candidate with an international reputation for this position to assume the responsibilities of Editor-in-Chief of the Progress in Astronautics and Aeronautics series. The chosen candidate will assume the editorship at an exciting time as AIAA expands its ability to support e-books and other electronic content, and continues to address many emerging issues in aerospace science and technology.

Progress in Astronautics and Aeronautics is AIAA's oldest book series, with over 240 volumes published. The series Editor-in-Chief works closely with AIAA Headquarters staff and the Editorial Advisory Board to identify new topics and potential authors, maintain high-quality print and electronic content, and promote the series and AIAA's publishing program as a whole. He or she evaluates book proposals and manuscript submissions, assigns them for review and evaluation by the series Editorial Advisory Board members or outside reviewers, and works with AIAA staff to ensure that all proposals are processed in a fair and timely manner. A small honorarium is offered to cover clerical and other minor expenses. AIAA provides all appropriate editorial and production resources, including a web-based manuscript-tracking system.

Interested candidates are invited to send letters of application describing their reasons for applying, summarizing their relevant experience and qualifications, and initial priorities for the book series; full résumés; and complete lists of publications, to:

Heather Brennan
Manager, Content Development and Editorial Policy
American Institute of Aeronautics and Astronautics
1801 Alexander Bell Drive, Suite 500
Reston, VA 20191-4344
Email: heatherb@aiaa.org

A minimum of two letters of recommendation are required. The recommendations should be sent by the parties writing the letters directly to Ms. Brennan at the above address or e-mail. **To receive full consideration, applications and all required materials must be received at AIAA Headquarters by 15 October 2012, but applications will be accepted until the position is filled.**

A search committee appointed by the AIAA Vice President–Publications Vigor Yang will seek candidates and review all applications received. The search committee will recommend qualified candidates to the AIAA Vice President–Publications, who in turn will present a recommendation to the AIAA Board of Directors for approval. This is an open process, and the final selection will be made only on the basis of the applicants' merits. All candidates will be notified of the final decision.

AIAA UTILIZES MEMORANDUM OF UNDERSTANDING WITH INTERNATIONAL PROFESSIONAL SOCIETIES TO PROMOTE PROFESSIONAL EXCHANGES

The steady growth of AIAA international membership over the past decade reflects the increasing globalization of air and space technology and its commercial applications. AIAA has proactively sought to create and develop working partnerships with aerospace professional societies around the globe that will benefit both its U.S. and overseas members.

The Institute is now pleased to announce several Memorandum of Understandings (MOU) put in place over the past decade that are co-signed between AIAA and its international counterparts in America, Europe, and Asia. In all cases, the leadership of both AIAA and their counterpart agree to promote technical exchanges among aerospace professionals in areas of mutual interest, and often including young professionals and students. Currently the bilateral MOUs include those with aerospace professional societies of Canada, China, France, India, Japan, South Korea, and the United Kingdom.

AIAA's international activities are conducted under the auspices of its International Activities Committee, with its international member participants, and led by the elected Vice President for International Activities. For further information about the Institute's international engagement, please visit the International Community page under "Membership & Communities" on the AIAA website (**www.aiaa.org**). In addition, you can learn about AIAA's international strategies in the latest AIAA 5-Year Strategic Plan, which is accessible through the "My AIAA" member portal on the AIAA website.

MATTSON RECEIVES PRESIDENTIAL EARLY CAREER AWARD FOR SCIENTISTS AND ENGINEERS

AIAA congratulates **Christopher A. Mattson**, AIAA Senior Member, and associate professor, mechanical engineering, Brigham Young University (BYU), Provo, UT, on receiving a Presidential Early Career Award for Scientists and Engineers. The award is the highest honor that the U.S. government bestows on science and engineering professionals in the early stages of their independent research careers.

Mattson was nominated for the award by the National Science Foundation in recognition of his "innovative research to enable product design for sustainable poverty alleviation, and for dedication towards establishing third-world outreach and learning experiences for engineering students." His research work is funded in part by the National Science Foundation.

Mattson, the co-director of BYU's Mechanical Engineering Capstone program, is a member of AIAA's Multidisciplinary Design Optimization Technical Committee, and is the technical program chair of the 2012 AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference. Mattson is a past recipient of a Faculty Early Career Development (CAREER) award from the National Science Foundation.

Established in 1996, the Presidential Early Career Awards for Scientists and Engineers are coordinated by the Office of Science and Technology Policy within the Executive Office of the President. Honorees are selected for their pursuit of innovative research at the frontiers of science and technology and for their commitment to community service as demonstrated through scientific leadership, public education, or community outreach.

MEMBERSHIP ANNIVERSARIES

AIAA would like to acknowledge the following members on their continuing membership with the organization.

25-Year Anniversaries (continued)

Abdollah Khodadoust	Los Angeles
John F Love	San Francisco
Douglas G MacMynowski	San Gabriel Valley
Kevin E Mahaffy	Arrowhead
James D Maul	Utah
Vincent G McDonell	Orange County
Robert E Meyerson	Pacific Northwest
John M Morgenstern	Antelope Valley
Douglas H Nelson	Point Lobos
Mark A Potsdam	San Francisco
Charles C Rankin	San Francisco
Larry G Redekopp	Los Angeles
Michael J Rendine	Phoenix
David L Rodriguez	San Francisco
Susan M Schoenung	San Francisco
Brent Sherwood	San Gabriel Valley
Arvin Shmilovich	Orange County
Stephen C Smith	San Francisco
Thomas E Stevens	Vandenberg
Michael J Todaro, Jr.	Los Angeles
Venkat Venkatakrishnan	Pacific Northwest
Robin E Vermeland	Antelope Valley
Douglas A Wardwell	San Francisco
Scott D Williams	San Francisco
Sungyul Yoo	Pacific Northwest
Shigeru Aso	International
Pablo A Chini	International
Sergio A Emili	International
Peter G Hamel	International
Atef Khalil, I	International
Horst Koerner	International
Domenico LaForgia	International
Gerard S Leng	International
Gerard B Mersch	International
Yoichi Nakazono	International
Nobuo Niwa	International
Patrick Norris	International
Nobuo Tsujikado	International
Nicholas S Vlachos	International
JieZhi Wu	International
Gregg L Abate	International
Anant KS Grewal	International
Hans E Hoffmann	International
Philippe Kletzkine	International
Susumu Kobayashi	International
Walter Kroell	International
Francesco Marulo	International
Jiro Nakamichi	International
Phil R Nuytten	International
Yaakov Oshman	International
John R Page	Sydney
Andre J Preumont	International
Keisuke Sawada	International
Minoru Shibata	International
Lorenz W Sigurdson	International
Fatih Tezok	International
Asko T Vilenius	Adelaide
Hendrikus G Visser	International
Elmar U Wilczek	International
Hadi Winarto	International
James R Youdale	International

40-Year Anniversaries

Maurice E Bridge	Connecticut
Douglas M Carlson	National Capital
Ronald F Drzewiecki	Niagara Frontier
Joseph R Fragola	Long Island
Charles R Gallaway	National Capital
Darryl W Hall	Greater Philadelphia
George Y Jumper	New England
William O Keksz	Mid-Atlantic
Gilbert E Lavean	Mid-Atlantic
Ronald A Luzier	National Capital
Paul V Marrone	Niagara Frontier
Michael (Tony) McVeigh	Greater Philadelphia
James W Mehring	National Capital
Michael W Miller	National Capital
Thomas K Moore	National Capital
Thomas S Moseley	National Capital
James L Nevins	New England
Luat T Nguyen	Hampton Roads
Robert A Oliveri	Mid-Atlantic
Leonard J Otten	Hampton Roads
Peter P Pandolfini	Mid-Atlantic
Peter Plostins	Long Island
Sidney G Reed	National Capital
William L Sellers	Hampton Roads
Jag J Singh	Hampton Roads
Stephen F Sousk	National Capital
Jerry C South	Hampton Roads
Norman Starkey	Mid-Atlantic
Joseph M Verdon	Connecticut
Jerry M Ward	Mid-Atlantic
Arthur W Banister	Cape Canaveral
William A Bell	Atlanta
John T Best	Tennessee
Donald J Bouws	Central Florida
Edward R Dytko	Cape Canaveral
Gopal H Gaonkar	Palm Beach
Harmon L Hale	Tennessee
James E Hellums	Greater Huntsville
J Jeffrey Irons	Greater Huntsville
Edward M Kraft	Tennessee
Thomas P Sapp	Greater Huntsville
James E Viney	Atlanta
David L Whitfield	Tennessee
Chester A Winsor	Central Florida
Robert H Wynne	Carolina
Theo G Keith	Northern Ohio
Edward A Kudzia	Michigan
Eric R McFarland	Northern Ohio
Eric E Rice	Wisconsin
James R Stone	Northern Ohio
Lawrence P Timko	Dayton/Cincinnati
Joseph L Weingarten	Indiana
David S Bodden	North Texas
Michael C Cline	Albuquerque
Thomas E Diegelman	Houston
Anita E Gale	Houston
John S Gibson	North Texas
Bradley C Hosmer	Albuquerque
Larry R Rollstin	Albuquerque
John H Russell	North Texas
John H Watson	North Texas
William W Bower	St. Louis
Richard G Brasket	Twin Cities
Dale M Pitt	St. Louis
Prabhakara P Rao	Rocky Mountain
David K Schmidt	Rocky Mountain
Michael J Wendl	St. Louis
Robert J Wheeler	St. Louis
William F Ballhaus	Los Angeles
Henry L Beaufrere	Pacific Northwest
Melvin R Brashears	San Francisco
Thomas E Chamberlain	Los Angeles
Robert L Collins	Pacific Northwest
John P Danell	Pacific Northwest
Richard E Duncan	Pacific Northwest
James E Eninger	Los Angeles
Louis D Friedman	San Gabriel Valley
Alex Gimarc	Pacific Northwest
Bruce T Goodwin	San Francisco
David B Grange	Orange County
John O Hallquist	San Francisco
Glenn L Havskjold	San Fernando Pacific
David P Helgevold	Los Angeles
Jack F Juraco	Tucson
Philip A Kessel	Sacramento
Dietrich K Lezius	San Francisco
Craig A Lyon	Phoenix
Robert W MacCormack	San Francisco
Robert Marcellini	Point Lobos
Lowell D Mc Millen	Orange County
Unmeel B Mehta	San Francisco
Andrew H Milstead	Los Angeles
David G Mitchell	Los Angeles
Robin M Orans	San Francisco
George A Paulikas	Los Angeles
Joseph P Provenzano	Los Angeles
Pradeep Raj	Antelope Valley
Stanley G Rajtora	China Lake
Donald B Reid	San Francisco
Hugh M Reynolds	San Francisco
Subbarao B Ryali	San Gabriel Valley
Robert J Sherwood	San Francisco
Brenton N Smith	Pacific Northwest
Jay F Strange	Los Angeles
Ronald D Sugar	Los Angeles
Lawrence Trupo	Arrowhead
Joseph Vadyak	Antelope Valley
Henry H Woo	Orange County
Lincoln J Wood	San Gabriel Valley
Robert A Woodward	Pacific Northwest
Hironori A Fujii	International
Alwar Parthasarathy	International
Robert H Schmucker	International
Richard J Smyth	International

50-Year Anniversaries

Geary Andrews	Sacramento
Dale B Atkinson	Carolina
James S Barrowman	Mid-Atlantic
Bernard R Bornhorst	Sacramento
Adam P Bruckner	Pacific Northwest
Leonard H Caveny	National Capital
M. J Cork	Phoenix
James L Current	Carolina
Duane F Dipprey	San Gabriel Valley
Raynor L Duncombe	Southwest Texas
John W Edwards	Utah
Dale AFester	Rocky Mountain
Robert EFeucht	Northern New Jersey
William M Fisher	National Capital
Philip F Fote	New England
Jerome T Foughner Jr.	Hampton Roads
Stanton T Friedman	International
Michael K Gauthier	Los Angeles
Gordon L Hamilton	Los Angeles
Ronald E Hart	Pacific Northwest
William Hathaway	New England
Philip J Hengen	Oklahoma
Robert W Hermsen	San Francisco
Stephan F Hooker	National Capital
William A Horne	Phoenix
John C Houbolt	New England
James D Howe	Greater Huntsville
Alan J Hugo	China Lake
Richard Jamron	Michigan
Albin D Kazanowski	San Fernando Pacific
Robert A Kilgore	Hampton Roads
Charles R Kilmer	Los Angeles
Richard L Kline	Greater Philadelphia
Ronald C Knechtli	San Fernando Pacific
Douglas C Krueger	Orange County
Robert B Kruse	Palm Beach
Samuel C Laden Jr.	North Texas
Albert C Lee	Carolina
Robert W Leko	Greater Philadelphia
Walter E Leser	Orange County
Anna Longobardo	Long Island
John M Mallard	San Fernando Pacific
Scott AManatt	San Fernando Pacific
Roy W Meinke	Houston
Michael R Mendenhall	San Francisco
Arthur F Messiter	Michigan
Charles A Mitchell	Sacramento
L David Montague	San Francisco
Stanley W Moore	Albuquerque
Nicholas V Mumford Jr.	Michigan
Blake Myers	San Francisco
Ali H Nayfeh	Hampton Roads
Lawrence Newman	San Francisco
John L Norton	Los Angeles
William L Oberkampf	Southwest Texas
Edward C Painter	Delaware
Lionel Pasiuk	National Capital
Walter B Peterson	San Fernando Pacific
Max F Platzer	Point Lobos
James W Plummer	Pacific Northwest
J. P Reding	San Francisco
Patrick J Roache	Albuquerque
John W Robinson	Orange County
David A Sagerser	Northern Ohio
Carl G Sauer Jr.	San Gabriel Valley
Arthur J Schiewe	Los Angeles
Lewis B Schiff	San Francisco
Norman H Schroeder	Point Lobos
Barrett L Shrout	Hampton Roads
William Sollfrey	Los Angeles
Ronald J Steinke	Northern Ohio
Leo W Stockham	Albuquerque
Leon D Strand	San Gabriel Valley
John R Straton Jr.	San Diego
J Kenneth Thompson	Columbus
Noel A Thyson	New England
John H Tinley	Los Angeles
Gary R Van Sant	Vandenberg
William W Vaughan	Greater Huntsville
Jesco Von Puttkamer	National Capital
Richard A Wallace	San Francisco
Dallas C Wicke	Orange County
Raymond M Wille	San Francisco
Clarence A Wingate Jr	Mid-Atlantic

60-Year Anniversaries

Hilary W Allen	North Texas
James B Beach	San Fernando Pacific
Rex G Bloom	Utah
Frederick G Blottner	Albuquerque
John R Bollard	Pacific Northwest
James A Browning	New England
Mario W Cardullo	National Capital
Lawrence J Cervellino	Long Island
Harvey R Chaplin	National Capital
John W Converse	Vandenberg
Robert (Bob) E Covey	San Gabriel Valley
Robert E Donham	San Fernando Pacific
Morton R Fleishman	Palm Beach
Daniel Frederick	Hampton Roads
Maurice P Gionfriddo	New England
Isaac Greber	Northern Ohio
James T Harker	International
William D Harkins	National Capital
Ernest L Hartman	Connecticut
James F Heavner	Sacramento
Frank R Herud	Niagara Frontier
Claiborne P Hollis	Greater New Orleans
Rodney D Hugelman	Central Florida
Lloyd H Johnson	National Capital
John S Kanno	Los Angeles
Raymond J Kazyaka	Northeastern New York
Vernon A Lee	North Texas
Andrew Z Lemnios	Connecticut
Thomas L Lindsay	National Capital
William H Lowe	San Diego
Carl A Loy	Greater Huntsville
H. H Luetjen	St. Louis
Gerald E Lutz	Central Florida
William L Marcy	Albuquerque
Gene J Matranga	Antelope Valley
Angelo Miele	Houston
James G Mitchell	Tennessee
Charles H Murphy	Mid-Atlantic
John A Murphy	Northern Ohio
Stanley J Nanevicz	Pacific Northwest
J. R Nelson	Mid-Atlantic
Paul M Nichols	Atlanta
Adrian J Pallone	New England
Jack S Parker	Phoenix
Thomas M Perkins	Tennessee
Raymond A Petty	Orange County
Edward T Pitkin	Connecticut
Robin K Ransone	Hampton Roads
Harold W Ritchey	Utah
Wallace M Ritchey	Dayton/Cincinnati
L. E Rittenhouse	Tennessee
William A Robba	Rocky Mountain
Maido Saarlas	Mid-Atlantic
William T Schleich	Orange County
Louis V Schmidt	Point Lobos
John L Sheport	San Francisco
Robert D Sherrill	Dayton/Cincinnati
Thomas B Shoebotham	Los Angeles
John E Shuter	Columbus
Milton A Silveira	National Capital
Stephen R Smith	Los Angeles
William M Spreitzer	Michigan
Lu Ting	Long Island
Adelbert O Tischler	National Capital
Irwin E Vas	Greater Huntsville
Michael I Yarymovych	Central Florida

70-Year Anniversaries

Gerald J Bibeault	Connecticut
Tom B Carvey	Vandenberg

Roy S Cornwell	San Francisco	James W Mar	Pacific Northwest
Wilbur H Day	Northeastern New York	Robert V Meghreblian	Vandenberg
Hubert M Drake	San Francisco	Dale D Myers	San Diego
Jack B Gearhart	San Diego	Robert J Patton	North Texas
Wayne E Harding	Rocky Mountain	Robert D Richmond	International
Hartmann J Kircher	Northern New Jersey	Don H Ross	New England
Reuben G Klammer	Los Angeles	Richard A Schmidt	National Capital
Edwin H Krug	Tucson	Arthur Schnitt	Los Angeles
John V Landry	Los Angeles	Robert B Short	St. Louis
Bernard M Leadon	Central Florida	Melvin Stone	San Diego
Bernard Maggin	National Capital		

AIAA NORTHERN OHIO SECTION SPONSORS YOUNG PROFESSIONALS LUNCHEON WITH DR. GRIFFIN

Kevin Melcher, NOS Vice Chair

On 24 April, the AIAA Northern Ohio Section (NOS) sponsored a Young Professionals (YP) Luncheon with Dr. Michael Griffin, then AIAA President-Elect. The luncheon was held at the Ohio Aerospace Institute (OAI) in conjunction with Dr. Griffin's OAI Distinguished Lecture "Balancing Governmental and Commercial Roles in 21st Century Space Exploration." The AIAA NOS co-sponsored Dr. Griffin's lecture.

The YP Luncheon was attended by fifteen AIAA NOS young professionals. Chris Jessee from AIAA Headquarters also attended. During the luncheon, Dr. Griffin fielded questions from the participants and engaged them in a lively dialogue covering a variety of relevant topics. Dr. Griffin pleasantly surprised the group when he suggested extending the session an extra 30 minutes. In addition to being a great experience for AIAA NOS Young Professionals, interest in the event resulted in several YPs applying for or renewing membership in the AIAA.

Below: AIAA Northern Iowa Section Young Professional luncheon participants (L to R): Stephen Berkebile, Stephanie Hirt, Jonathan Burt, Ashlie McVetta, Karin Bodnar, Robert Sills, Ryan May, Dr. Michael Griffin, Jeffrey Csank (rear), Hans Hansen, Stacey Bagg, Daniel Hauser, Jerry Vera, Lucas Staab, Ana De La Ree, Stephen Barsi.

AIAA FELLOW SIMPSON MADE PROFESSOR EMERITUS BY VIRGINIA TECH

Roger Simpson, the Jack E. Cowling Professor of Aerospace and Ocean Engineering in the College of Engineering (http://www.engineering.vt.edu) has been conferred the "professor emeritus" title by the Virginia Tech Board of Visitors. The title of emeritus may be conferred on retired professors and associate professors, administrative officers, librarians, and exceptional staff members who are specially recommended to the board of visitors by Virginia Tech President Charles W. Steger. Nominated individuals who are approved by the board of visitors receive an emeritus certificate from the university.

A member of the university community for 29 years, Dr. Simpson is widely known for his work in experimental fluid mechanics and state-of-the-art instrumentation development. He brought international visibility to the university with his many complete data sets and information on unsteady and 3-D turbulent flows, which were the first of their kind to determine models for practical cases and are used as test cases by turbulence modelers.

Dr. Simpson is a Fellow of AIAA, the American Society of Mechanical Engineers, and the Institute of Diagnostic Engineers. Additionally, he authored or co-authored more than 250 peer-reviewed journal articles, conference papers, book chapters, and reviews. He also obtained more than $15 million in research funding.

During his tenure, Dr. Simpson directed 40 master's degree and more than 20 doctoral students and served on more than 100 graduate degree committees. He also served on science advisory panels and proposal review panels for the U.S. Office of Naval Research and the National Science Foundation.

Among Dr. Simpson's many professional honors and awards are Dean's Awards for both Research Excellence and Service Excellence, and the AIAA Sustained Service Award.

He received his bachelor's degree from the University of Virginia and his master's degree and doctoral degree from Stanford University.

CALL FOR NOMINATIONS

Recognize the achievements of your colleagues by nominating them for an award! Nominations are now being accepted for the following awards, and must be received at AIAA Headquarters no later than **1 October**. Awards are presented annually, unless otherwise indicated.

Any AIAA member in good standing may be a nominator. It is important that nominators carefully read the award guidelines to view nominee eligibility, page limits, letters of endorsement, etc., and are reminded that quality of information is most important.

Nominators may submit a nomination online after logging into **www.aiaa.org** with their user name and password, and will be guided step-by-step through nomination entry.

If preferred, a nominator may submit a nomination by completing the AIAA nomination form, which can be downloaded from www.aiaa.org.

Premier Awards & Lectureships

Distinguished Service Award gives unique recognition to an individual member of AIAA who has distinguished himself or herself over a period of years by service to the Institute.

Goddard Astronautics Award, named to honor Robert H. Goddard—rocket visionary, pioneer, bold experimentalist, and superb engineer—is the highest honor AIAA bestows for notable achievement in the field of astronautics.

International Cooperation Award recognizes individuals who have made significant contributions to the initiation, organization, implementation, and/or management of activities with significant U.S. involvement that includes extensive international cooperative activities in space, aeronautics, or both.

Reed Aeronautics Award is the highest award an individual can receive for achievements in the field of aeronautical science and engineering. The award is named after Dr. Sylvanus A. Reed, the aeronautical engineer, designer, and founding member of the Institute of Aeronautical Sciences in 1932.

Dryden Lectureship in Research was named in honor of Dr. Hugh L. Dryden in 1967, succeeding the Research Award established in 1960. The lecture emphasizes the great importance of basic research to the advancement in aeronautics and astronautics and is a salute to research scientists and engineers.

Durand Lectureship for Public Service is presented for notable achievements by a scientific or technical leader whose contributions have led directly to the understanding and application of the science and technology of aeronautics and astronautics for the betterment of mankind.

von Kármán Lectureship in Astronautics honors Theodore von Kármán, world-famous authority on aerospace sciences. The award recognizes an individual who has performed notably and distinguished himself technically in the field of astronautics.

Wright Brothers Lectureship in Aeronautics commemorates the first powered flights made by Orville and Wilbur Wright at Kitty Hawk in 1903. The lectureship emphasizes significant advances in aeronautics by recognizing major leaders and contributors.

Technical Excellence Awards

Aeroacoustics Award is presented for an outstanding technical or scientific achievement resulting from an individual's contribution to the field of aircraft community noise reduction.

Aerodynamics Award is presented for meritorious achievement in the field of applied aerodynamics, recognizing notable contributions in the development, application, and evaluation of aerodynamic concepts and methods.

Aerodynamic Measurement Technology Award is presented for continued contributions and achievements toward the advancement of advanced aerodynamic flowfield and surface measurement techniques for research in flight and ground test applications.

Aerospace Communications Award is presented for an outstanding contribution in the field of aerospace communications.

Aerospace Design Engineering Award recognizes design engineers who have made outstanding technical, educational or creative achievements that exemplifies the quality and elements of design engineering.

Aerospace Software Engineering Award is presented for outstanding technical and/or management contributions to aeronautical or astronautical software engineering.

Air Breathing Propulsion Award is presented for meritorious accomplishment in the science of air breathing propulsion, including turbomachinery or any other technical approach dependent on atmospheric air to develop thrust, or other aerodynamic forces for propulsion, or other purposes for aircraft or other vehicles in the atmosphere or on land or sea.

Chanute Flight Test Award recognizes significant lifetime achievements in the advancement of the art, science, and technology of flight test engineering. (Presented even years)

Engineer of the Year is presented to an individual member of AIAA who has made a recent significant contribution that is worthy of national recognition. Nominations should be submitted to your AIAA Regional Director.

Fluid Dynamics Award is presented for outstanding contributions to the understanding of the behavior of liquids and gases in motion as related to need in aeronautics and astronautics.

Ground Testing Award recognizes outstanding achievement in the development or effective utilization of technology, procedures, facilities, or modeling techniques or flight simulation, space simulation, propulsion testing, aerodynamic testing, or other ground testing associated with aeronautics and astronautics.

Information Systems Award is presented for technical and/or management contributions in space and aeronautics computer and sensing aspects of information technology and science.

Intelligent Systems Award recognizes important fundamental contributions to intelligent systems technologies and applications that advance the capabilities of aerospace systems. (Presented odd years)

Jeffries Aerospace Medicine & Life Sciences Research Award is presented for outstanding research accomplishments in aerospace medicine and space life sciences.

Theodor W. Knacke Aerodynamic Decelerator Systems Award recognizes significant contributions to the effectiveness and/or safety of aeronautical or aerospace systems through development or application of the art and science of aerodynamic decelerator technology.

Plasmadynamics and Lasers Award is presented for outstanding contributions to the understanding of the physical properties and dynamical behavior of matter in the plasma state and lasers as related to need in aeronautics and astronautics.

Propellants and Combustion Award is presented for outstanding technical contributions to aeronautical or astronautical combustion engineering.

Jay Hollingsworth Speas Airport Award, established in 1983, is cosponsored by AIAA, the American Association of Airport Executives, and the Airport Consultants Council. It is presented to the person or persons judged to have contributed most outstandingly during the recent past toward achieving compatible relationships between airports and/or heliports and adjacent environments. The award consists of a certificate and a $10,000 honorarium.

Structures, Structural Dynamics, and Materials Award is presented for an outstanding sustained technical or scientific contribution in aerospace structures, structural dynamics, or materials. (Presented even years)

Survivability Award is presented to recognize outstanding achievement or contribution in design, analysis implementation, and/or education of survivability in an aerospace system. (Presented even years)

Thermophysics Award is presented for an outstanding singular or sustained technical or scientific contribution by an individual in thermophysics, specifically as related to the study and application of the properties and mechanisms involved in thermal energy transfer and the study of environmental effects on such properties and mechanisms.

Wyld Propulsion Award is presented for outstanding achievement in the development or application of rocket propulsion systems.

Service Award

Public Service Award honors a person outside the aerospace community who has shown consistent and visible support for national aviation and space goals.

For further information on AIAA's awards program, please contact Carol Stewart, Manager, AIAA Honors and Awards, at carols@aiaa.org or 703.264.7623.

To submit articles to the *AIAA Bulletin*, contact your Section, Committee, Honors and Awards, Events, Precollege, or Student staff liaison. They will review and forward the information to the *AIAA Bulletin* Editor. See the AIAA Directory on page **B1** for contact information.

OBITUARIES

AIAA Senior Member Lawrence Died in March

William H. "Bill" Lawrence, 84, passed away on 14 March 2012. Mr. Lawrence earned his Bachelor of Science in Mechanical Engineering from Purdue University in 1950 and his Masters of Business Administration from the University of Chicago in 1953. He served his nation during World War II in the U.S. Navy, and again during the Korean Conflict with the U.S. Army.

Mr. Lawrence moved to the Antelope Valley in 1955, to work at growing America's rocketry foundations at Edwards 'Rocket Site', known today as the Air Force Research Laboratory's Propulsion Directorate. He was instrumental in transforming its 65 square miles of desert terrain that overlooks the Edwards dry lakebed, into the nation's premier rocket research and test facility. During his federal career spanning from 1955 to 1981, he was chief or manager of the Lab's Technical Support Division, Liquid Rocket Division, Operations Office and finally Special Projects and Advanced Plans Office.

Retiring in 1981, he established Lawrence Associates to provide engineering and management services to major aerospace companies for their multi-million dollar projects. Those efforts increased when he joined WYLE Laboratories in 1986 and served as their Program Manager for their Large Engine Operations Program dealing with some of the world's largest and complex rocket engines. Taking his expertise in propulsion testing and facility development, Mr. Lawrence helped establish a new generation of capabilities at the Rocket Site. As these capabilities became a reality, he moved in 1995 to the beginnings of an innovative resource for the aerospace community, the Aerospace Office, encouraging and enabling the retention and growth of aerospace business in the Antelope Valley and California.

Mr. Lawrence was an AIAA Senior Member, joining in 1955 when it was known as the American Rocket Society. He was a key player in establishing the Lancaster University Center's Engineering Campus at the former Antelope Valley Fairgrounds, working the agreements that enabled California State University Fresno and now CSU-Long Beach to provide classroom and distance learning education so the Antelope Valley can grow its own engineers.

Former AIAA President Died in June

Daniel J. Fink died on 1 June 2012 at the age of 85. He devoted a lifetime of service in both management and advisory capacities to the Department of Defense and to other organizations, public and private, involved in national security.

A graduate of MIT, he served in the Pentagon in the Office of the Secretary of Defense from 1963 to 1967, ultimately holding the position of Deputy Director of Defense Research and Engineering. He returned to private industry in 1967, joining General Electric Company as Vice President and General Manager of the Space Division, later becoming Vice President and Group Executive of the Aerospace Group and then Senior Vice President of Corporate Planning and Development. Along with NASA's Dr. John Clark, Fink was awarded the 1974 Collier Trophy for Leadership of the NASA/Industry team responsible for the Earth Resources Satellite Program, LANDSAT. In 1982 he retired from GE to form a strategic management consulting firm, D.J. Fink Associates, Inc.

Mr. Fink served on the board of directors of the Orbital Sciences Corporation for 25 years beginning in 1983, including a term as the firm's first Lead Director. He was a member of the Defense Intelligence Agency Scientific Advisory Board, the Army Scientific Advisory Panel, and the Defense Science Board for which he chaired numerous committees over the years.

A strong and effective advocate for strengthened Department of Defense and NASA cooperation, Mr. Fink served from 1983 to 1988 as chairman of the NASA Advisory Council during which time he is credited with refocusing the Council's activities to address strategic issues rather than day-to-day matters. He also served as president of AIAA and was elected an AIAA Honorary Fellow. He was elected to the National Academy of Engineering and served as Chairman of the Space Applications Board and the Board on Telecommunications and Computer Applications. He was a member of the NASA/White House Committee on the future of the U.S. Space Program that was established after the *Challenger* accident and served on the Vice President's Space Policy Advisory Board, for which he chaired a committee on the future of the U.S. Space Industrial Base.

In addition to his service as an advisor to the Department of Defense, Mr. Fink served on the Board of Directors of the Armed Forces Communications and Electronics Association and the Board of Governors of the National Space Club. He was a member of the M.I.T. Corporate Visiting Committees for the Department of Aeronautics and Astronautics and for the Sloan School of Management and was also Chairman of the Rensselaer Polytechnic Institute's Departmental Advisory Board for Mechanical Engineering, Aeronautical Engineering and Mechanics.

Mr. Fink was awarded the Department of Defense's highest civilian decoration, the Distinguished Public Service Medal, and the NASA Medal for Outstanding Leadership and was chosen to be the von Karman Lecturer for AIAA. In October 2010 he was presented with the Eugene G. Fubini Award for his significant contributions to national security.

AIAA Fellow Rustan Died in June

Pedro "Pete" Rustan, a former senior manager at the U.S. National Reconnaissance Office (NRO) and a fixture in space technology circles, died on 28 June. He was 65. In addition to his reputation as a technical innovator and advocate of nontraditional acquisition approaches in space programs, Dr. Rustan was known for having defected from Cuba to the United States by swimming across Guantanamo Bay to the U.S. naval base.

Dr. Rustan most recently served as director of the NRO's Mission Support Directorate before his official retirement in October 2011. Previous NRO positions included director of the Ground Enterprise Directorate, director of the Advanced Systems and Technology Directorate and director of small satellite development.

He received bachelor's and master's degrees in electrical engineering from the Illinois Institute of Technology in Chicago in 1970 and 1971, respectively. Dr. Rustan earned his doctorate in electrical engineering from the University of Florida in 1979. During a 26-year career with the U.S. Air Force, he ran several advanced technology space programs and served as mission manager for the Ballistic Missile Defense Organization's Clementine mission. When he retired from the Air Force with the rank of colonel, he consulted for companies pioneering low-Earth orbit satellite communications. After 9/11, he returned to the NRO, where he served in various positions.

One of his many incredible achievements was technology that improved the accuracy of measuring the location of ground-based radio frequency signals from space and aircraft. Dr. Rustan authored more than 60 public technical papers and articles, was an AIAA Fellow, and was honored by *Aviation Week & Space Technology* with the Philip J. Klass Lifetime Achievement Award.

18th AIAA/3AF International Space Planes and Hypersonic Systems and Technologies Conference

24–28 September 2012
Vinci International Congress Centre of Tours
Tours, France

Dear Colleague,

The AIAA and 3AF warmly invite professionals from industry and research institutions, as well as students working in the field of aeronautics and astronautics to come to Tours to attend the 18th AIAA/3AF International Space Planes and Hypersonic Systems and Technologies Conference. This event will bring together delegates from some twenty nations, demonstrating the strength of hypersonics internationally and the significant extent of international cooperation that underpins the research and activities presented. Future vehicle concepts will be described, supported by the rapidly advancing science and technology required to realize those concepts. The event will reflect the increasing synergy among experimental, numerical, and flight test approaches, and the rapid evolution in experimental and numerical tools. A highly multidisciplinary event, it brings together essentially all relevant aspects of spaceplane and hypersonics R&D in the same forum, providing an unparalleled opportunity to gain insight across the full spectrum of activities in the field.

A stellar program is planned and conference attendees will gain valuable insight into the current state of spaceplane and hypersonic programs, learn about leading-edge research advancements and flight test programs, and better understand evolving international collaborations. Confirmed speakers for the event include:

Yann Barbaux, CEO of EADS Innovation Works
Phillippe Cazin, Former Director for Military Applications at ONERA
Christer Fureby, Swedish Defense Research Agency
Herman Hald, DLR
Roger Longstaff, Reaction Engines, Ltd.
Sannu Molder, Ryerson Polytechnic University
Jean-Pierre Taran, ONERA

Attending this conference will provide attendees the opportunity to meet and interact with many of the world's premier technical experts in the field of spaceplanes and hypersonics. We hope you'll join us this Fall in Tours, France!

Sincerely,
David Stallings
Conference General Chair

Special Thanks to Our Organizing Committee

David Stallings, General Chair

David Van Wie, Technical Committee Chair
Johns Hopkins University Applied Physics Laboratory

Australia
Russell Boyce
University of Queensland

China
Jin Fan
Institute of Mechanics, Chinese Academy of Sciences

France
François Falempin
MBDA France

Germany
Klaus Hannemann
German Aerospace Center, DLR

Italy
Gennaro Russo
Italian Aerospace Research Center, CIRA

Japan
Masataka Maita
Japan Aerospace Exploration Agency, JAXA

United Kingdom
Richard Brown
University of Strathclyde

	Monday	Tuesday	Wednesday	Thursday	Friday
0730 hrs	Speaker's Meeting	Speaker's Meeting	Speaker's Meeting	Speaker's Meeting	Technical Tours
0800 hrs					
0830 hrs	Plenary Session Descartes Auditorium	Distinguished Lecture 1 Descartes Auditorium	Distinguished Lecture 2 Descartes Auditorium	Distinguished Lecture 4 Descartes Auditorium	
0900 hrs					
0930 hrs		Networking Break	Networking Break	Networking Break	
1000 hrs	Networking Break	Technical Sessions III (4 papers)	Technical Sessions VI (4 papers)	Technical Sessions IX (5 papers)	
1030 hrs	Plenary Session Descartes Auditorium				
1100 hrs					
1130 hrs					
1200 hrs		Lunch Break	Lunch Break		
1230 hrs	Lunch Break			Awards Luncheon Agnès Sorel Lounge	
1300 hrs					
1330 hrs		Culpepper Lecture Descartes Auditorium	Distinguished Lectures 3 Descartes Auditorium & Rene Lorin Room	Technical Sessions X (3 papers)	
	Technical Sessions I (3 papers)				
1400 hrs					
1430 hrs		Technical Sessions IV (2 papers)	Technical Sessions VII (2 papers)		
1500 hrs					
1530 hrs	Networking Break	Networking Break	Networking Break	Networking Break	
1600 hrs	Technical Sessions II (4 papers)	Technical Sessions V (4 papers)	Technical Sessions VIII (3 papers)	Technical Sessions XI (4 papers)	
1630 hrs					
1700 hrs					
1730 hrs			Conference Dinner Chateau de le Bourdaisiere		
1800 hrs					
1830 hrs					
1900 hrs	Welcoming Cocktail Tours City Hall				
1930 hrs					
2000 hrs					

Benefits of Attendance

This is the 18th in the International Spaceplanes and Hypersonic Systems and Technologies Conference series, which began in the days of spaceplane programs such as NASP, HERMES, SÄNGER, HOTOL, PREPHA, and HOPE, and will reflect the exciting evolution of the field. Concrete projects for hypersonic flight date back to the 1950s, with vehicles such as the Dynasoar, based on studies in earlier decades by René Lorin on ramjets, Eugen Sanger on rocketed flight, Antonio Ferri and Frederick Billig on scramjets, and Adolf Busemann on supersonic aerodynamics. This 18th conference will provide a forum for reviewing the latest advancements in these fields together with other technologies relevant to space plane and hypersonic system development.

What to Expect?

Technical Program Highlights:

- Distinguished Lectures
- Close to 200 Technical Paper Presentations
- Technical Poster Presentations
- Technical Tours (Tentative)

Networking

- Welcoming Cocktail Reception
- Awards Luncheon
- Off-Site Conference Dinner at Château de le Bourdaisière
- Daily Networking Coffee Breaks

Who Should Attend?

- Engineering managers and industry executives
- Young aerospace professionals
- Engineers, researchers, and scientists
- Educators and students
- Media representatives

Special Events

Monday, 24 September 2012

Welcoming Cocktail Reception

The Mayor of Tours is inviting the participants to a welcoming cocktail reception at the Tours city hall from 1900–2000 hrs.

Wednesday, 26 September 2012

Conference Dinner at Château de le Bourdaisière

The Château de la Bourdaisière is a magnificent fifteenth-century castle located in the heart of the Loire Valley, a UNESCO world heritage site. Near the biggest Castles of the Loire, it is situated between the vineyards of Montlouis and Vouvray, in an

	Registration Type	Conference Rate Before 27 August 2012	AIAA/3AF Member Before August 2012	Conference Rate 27 August 27 - 22 September 2012	AIAA/3AF Member 27 August - 22 September 2012	Conference Sessions	Online Proceedings	Wednesday Conference Dinner	Thursday Awards Luncheon
Option 1	**Full Conference with Online Proceedings**	**$1,215**	**$1,080**	**$1,350**	**$1,200**	●	●	●	●
Option 2	**Full-Time Undergraduate Student**	**$160**	**$135**	**$175**	**$150**	●			
Option 3	**Full-Time Undergraduate Student with Networking**	**$330**	**$305**	**$345**	**$320**	●		●	●
Option 4	**Full-Time Graduate or Ph.D. Student**	**$330**	**$270**	**$360**	**$300**	●			
Option 5	**Full-Time Graduate or Ph.D. Student with Networking**	**$500**	**$440**	**$530**	**$470**	●		●	●
Option 6	**Full-Time AIAA/3AF Retired Member**	**N/A**	**$225**	**N/A**	**$250**	●			
Option 7	**Full Time AIAA/3AF Retired Member with Networking**	**N/A**	**$395**	**N/A**	**$420**	●		●	●
Option 7	**Group Discount***	**N/A**	**$972**	**N/A**	**$972**	●		●	●
	Extra Tickets						**$170**	**$110**	**$60**

Pricing subject to change.

*10% discount off AIAA/IAF member rate for 10 or more persons from the same organization who register and pay at the same time with a single form of payment. Includes sessions and all catered events. A complete typed list of registrants, along with completed individual registration forms and a single payment, must be received by the preregistration deadline of 22 September 2012.

Cancellations must be received in writing no later than 10 September 2012. There is a $100 cancellation fee. Registrants who cancel beyond this date or fail to attend will forfeit the entire fee. For questions, please contact Lynne David, AIAA conference registrar, at 703.264.7503 or lynned@aiaa.org.

enclosed park of 55 hectares (135 acres). The park and gardens of the Château de la Bourdaisière bring the art of living to its fullest potential, with gardens full of a rare variety of aromas, tastes, and colors, from the herb and dahlia gardens to the National Tomato Conservatory with more than 400 heirloom varieties.

The beautiful evening will start with a cocktail reception on the sixteenth-century terrace, overlooking one of the estate's many gardens, which guests will have the opportunity to visit. Dinner will be served in François the First's "vaulted banquet hall" whose impressive "Tuscan architecture" is unique in the Loire Valley.

Thursday, 27 September 2012

Awards Luncheon with Distinguished Speaker
Yann Barbaux, CEO of EADS Innovation Works

Join fellow attendees at the AIAA Awards Luncheon, being held in the Agnès Sorel Lounge at the Vinci International Congress Centre of Tours. The Hypersonics Systems and Technologies Award and Certificate of Merit for the Hypersonics Best Paper are scheduled to be presented. The luncheon is included in the registration fee where indicated. Additional tickets may be purchased for $60 on site at the AIAA registration desk, based on availability.

Registration Information

The French government requires AIAA to register for and to assess a Value Added Tax for goods and services sold in France. A 19.6% VAT tax assessment will be added to your Hypersonics Conference registration fee (fees listed above do not include the tax). The French government also provides a refund mechanism for Value Added Taxes paid by individuals or corporations who are eligible to claim exemption from the tax with valid documentation. The documentation and claims must be submitted to the French VAT Authority. For more information, please visit the conference website at **www.aiaa.org/hypersonics2012**.

Please note that AIAA is responsible for the registration process for this conference, and as a consequence, all registration currencies listed are in USD and must be paid with USD. Nonmember rates *DO NOT* include a membership to AIAA or 3AF. Should you be interested in obtaining a membership, please call the corresponding customer service department (AIAA: 703.264.7500; 3AF: Sophie Videment +33 1 56 64 12 38) or visit www.aiaa.org or www.aaaf.asso.fr.

Hotel Information

A block of rooms has been reserved through Vinci Conventions for various 3-star and 4-star hotel accommodations. Room rates vary from €89 to €183 per night. The total amount to pay consists of administration fees of €10 plus a deposit equal to the average price for one night in the hotel category whatever the duration of your stay. Three-star hotels are divided into two categories (A & B), according to their rates. The deposit will be deducted from the hotel bill when checking out.

Room reservations will be held until **24 August 2012** or until the room block is filled. To make your hotel reservation please visit **www.aiaa.org/hypersonics2012** and click the Plan Your Trip link on the right-hand side of the page, then click Travel and Accommodations.

Transportation

By car: Tours is connected to Paris and Bordeaux by the A10 motorway. Modern motorways link Tours to the other major centers of France. [Paris: 240 km (150 miles—2 h 10 min); Bordeaux: 330 km (205 miles—3 h 15 min); Nantes: 196 km (122 miles—1 h 45 min); Lyon: 432 km (268 miles—4 h)]

By train: The main railway station, Gare de Tours, is located in the center of the city, just in front of the Vinci International Congress Centre of Tours, where the symposium takes place. It is served by the TGV (high-speed train) from the Charles de Gaulle Airport in approximately two hours or from downtown Paris (Gare Montparnasse) in approximately 55 minutes. It also has connections to Bordeaux and Nantes. (Paris: 55 min; Bordeaux: 2 h 30 min; Nantes: 1 h 30 min; Lyon: 3 h 30 min)

By plane: The Tours Val de Loire Airport at the city gates serves destinations in France and elsewhere in Europe. (London: 1 h 15 min; Dublin: 1 h 30 min; Marseille: 1h 20 min; Porto: 2 h)

WHAT MAKES AVIATION 2013 DIFFERENT?

AVIATION engages those involved in the entire product life-cycle from disciplinary research to product development to system operation and maintenance.

AVIATION eliminates barriers by addressing the global nature of aviation requirements, opportunities, regulatory limitations, research activities, development programs, and operations.

AVIATION provides the breadth and depth of content and audience participation that is necessary for tackling the issues critical to safeguarding and shaping the future of aviation.

WHY ATTEND?

- Hear from industry and government leaders who are shaping the future direction of aviation.
- Share your views on issues and insights related to life-cycle management of complex aviation systems.
- Engage in dialogue with world-class researchers, engineers, developers, manufacturers, operators, economists, and policymakers.
- Learn ideas and solutions that have practical implications for your work.
- Establish or enhance personal and professional connections.

LOS ANGELES — THE CITY OF ANGELS

Los Angeles is a world center of business, science, technology, international trade, entertainment, culture, media, fashion, sports, and education. It is home to renowned institutions covering a broad range of professional fields, and is one of the most substantial economic engines within the United States. As the home base of Hollywood, it is known as the "Entertainment Capital of the World," leading the world in the creation of motion pictures, television shows, video games, and recorded music.

KEY TOPICS

- Global Outlook, Opportunities, and Challenges for Commercial, General, and Military Aviation
- The Energy Imperative – The Impact of Energy Futures on Aviation
- Shaping the Conversation – Policy
- Air Traffic Management
- Developing an Orderly Market for UAVs
- Connectivity and Cyber Threats
- Designing the Commercial Fleet to Meet Market Requirements
- U.S. Role in (Global) Peacekeeping/Homeland Security

CALL FOR PAPERS

If you've presented papers at

- The AIAA Aviation Technology Integration, and Operations Conference, or
- The International Powered Lift Conference

in the past, you'll want to make sure that you submit your research to AVIATION 2013.

AIAA is the world's largest technical society dedicated to the global aerospace profession. When you join AIAA, you gain countless opportunities to connect with more than 35,000 others in the field of aerospace science, engineering, systems, technology, management, and policy; achieve your educational and career goals; and inspire the next generation of explorers. Become an AIAA member today. www.aiaa.org/join

Organized by

AIAA

The World's Forum for Aerospace Leadership

AIAA SPACE 2013 Conference & Exposition

10–12 September 2013
San Diego Convention Center
San Diego, California

Abstract Deadline: 31 January 2013

Event Overview

The AIAA SPACE Conference & Exposition is AIAA's premier event on space technology, policy, programs, management, and education. At this three-day event, attendees can expect lively discussions with government and industry leadership in plenary panel and keynote sessions; interactive exhibits, demonstrations, presentations, and poster sessions in the exposition hall; and networking activities for all participants, including students and young professionals. Participation in the event is beneficial for industry executives, government and military officials, program managers, business developers, engineers and scientists, government affairs staff, consultants, professors, and students.

About San Diego

California's second largest city, San Diego boasts a citywide population of nearly 1.3 million residents and more than 3 million residents countywide. San Diego is renowned for its idyllic climate, 70 miles of pristine beaches, and an array of world-class attractions. Popular attractions include the world-famous San Diego Zoo, Old Town San Diego, and the Gaslamp Quarter. For more information, visit www.sandiego.org.

Technical Program and Tracks

The technical program will feature technical paper and poster presentations structured around 15 technical tracks. Nowhere else will you get the depth and breadth of sessions and information-sharing on space systems, technologies, and programs!

Commercial Space
Supported by the AIAA Commercial Space Group
The established community of commercial space companies tracing their lineage to the mid-1960s is being joined by an emerging new group of entrepreneurs. These "NewSpace" companies have characteristics very different from their predecessors, and creative partnerships between the old and the new are developing. The Commercial Space track is soliciting papers that document the various aspects of emerging commercial space sectors and their collaboration with the established commercial space community. Discussions of NewSpace successes and challenges encompass a large number of topic areas, including:

- Suborbital and orbital transportation and tourism
- Orbital commercial facilities, propellant depots, and infrastructure
- Orbital transfer vehicles
- Microgravity commerce and research
- Commercial lunar and NEO
- National space policy
- Legal and regulatory
- International markets and cooperation
- Business and financing
- Aerospace technology transfer to other industries

For questions, please contact:

Bruce Pittman
NASA Space Portal/Ames Research Center
Email: robert.b.pittman@nasa.gov

Intelligent Systems
Supported by the AIAA Intelligent Systems Technical Committee (ISTC)
Papers are sought on applications of intelligent systems across the space domain to include spacecraft operations, spacecraft autonomy, space system monitoring, and adaptive response. Topics of interest include, but are not limited to:

- Autonomous payloads
- Autonomous telemetry monitoring systems
- Data fusion and reasoning
- Decision support systems
- Human-machine interaction
- Integrated system health management and intelligent fault management systems
- Intelligent and adaptive control
- Intelligent data/image processing
- Knowledge-based systems and knowledge engineering
- Machine learning
- Planning and scheduling algorithms
- Robust execution and sequencing systems

For questions, please contact:

Paul Zetocha
AIAA Intelligent Systems Technical Committee (ISTC)
Air Force Research Laboratory
Email: paul.zetocha@kirtland.af.mil

Christopher R. Tschan
AIAA Intelligent Systems Technical Committee (ISTC)
The Aerospace Corporation
Email: christopher.r.tschan@aero.org

Nanosats and Smallsats
Supported by the AIAA Space Systems Technical Committee (SSTC)
The Nanosats and Smallsats track seeks to present important findings from recent work on emerging design, development, implementation, and applications of satellites with wet mass between 1–10kg, typically defined as "nanosats," or less than 500kg, typically defined as "smallsats." Papers are sought on technical, operational, and economic feasibility of systems that address the full range of civil scientific, military, and international applications. Papers by students are especially encouraged. Technical topics include:

- Nanosat (Smallsat) architectures and concepts of operation
- New and emerging technologies and applications
- Rapid and responsive Nanosat (Smallsat) systems
- Enabling technologies for distributed or fractionated space
- Space sensor technologies for Nanosats (Smallsats)
- Workforce development for Nanosats (Smallsats)
- Nanosat (Smallsat) lessons learned

For questions, please contact:

Amy Lo
AIAA Space Systems Technical Committee (SSTC)
Northrop Grumman Aerospace Systems
Email: amy.lo@ngc.com

National Security Space
Supported by the U.S. Air Force Space and Missile Systems Center
The National Security Space track invites papers in the following areas:

- Advanced Concepts: Including advanced CONOPS, material solutions, and architectural solutions

Technical Program Co-Chaired by
AIAA Technical Activities Committee (TAC)
Space & Missiles Group
The Aerospace Corporation

Technical Program Co-Chairs
Randy Kendall
The Aerospace Corporation
randolph.l.kendall@aero.org

TBD
The Aerospace Corporation

- Technology Transition: Including updates on existing programs working on technology transition from any partner toward the NSS customer
- Enterprise Architecting Analysis: Including requirements analysis, military utility analysis, multi-mission analysis and one-on-one engagement analysis, acquisition simulation analysis, and procurement
- Emerging Trends: Including descriptions of the latest trends affecting the MIL space applications and development
- Prototypes and Demonstrations: Including updates on existing prototypes in the NSS pipeline
- Science and Technology Efforts: Including those aimed at key science and technologies for revolutionary MIL applications

For questions, please contact:

Joseph Betser
The Aerospace Corporation
Email: joseph.betser@aero.org

Roberta Ewart
U.S. Air Force Space and Missile Systems Center
Email: roberta.ewart@losangeles.af.mil

Kary Miller
U.S. Air Force Space and Missile Systems Center
Email: kary.miller.ctr@losangeles.af.mil

Robotic Technologies and Space Architecture
Supported by the AIAA Space Architecture Technical Committee and the AIAA Space Automation and Robotics Technical Committee

This track will explore robotic technologies for orbital and planetary surface applications and space architectures, including systems supporting robotic construction techniques. Abstracts are being solicited on the following technical topics:

- Advanced technologies for space robotics
- Unique applications of space robotics
- Self-sustaining/self-repairing systems
- Robotic EVA or IVA servicing
- Robot and spacecraft automation
- Crew cabin architecture
- Orbital and planetary surface construction
- Unique space architecture design

For questions, please contact:

Steven E. Fredrickson
AIAA Space Automation and Robotics Technical Committee (SARTC)
NASA Johnson Space Center
Email: steven.fredrickson@nasa.gov

Shahzad Khaligh
AIAA Space Architecture Technical Committee (SATC)
DOD-AF-ENI
Email: Shahzad.khaligh@cox.net

François Lévy
AIAA Space Architecture Technical Committee (SATC)
Synthesis International
Email: francoislevy@synthesis-intl.com

Gregory P. Scott
AIAA Space Automation and Robotics Technical Committee (SARTC)
U.S. Naval Research Laboratory
Email: gregory.scott@nrl.navy.mil

Space and Earth Science
Supported by NASA Jet Propulsion Laboratory

Sessions for the Space and Earth Science track are by invitation only. If interested in participating, please contact:

Virendra Sarohia
NASA Jet Propulsion Laboratory
Email: virendra.sarohia@jpl.nasa.gov

Space Colonization and Space Tethers
Supported by the AIAA Space Colonization Technical Committee and the AIAA Space Tethers Technical Committee

The goal of space colonization is to create permanent human settlements beyond Earth. A logical implementation approach to would be to develop outposts and colonies in key locations in space (e.g., Lagrange points) and on the moon, near-Earth asteroids, and Mars, as technological advances enable progressively more ambitious missions. The Apollo missions demonstrated that humans can land on and explore other bodies in our solar system. The Shuttle and ISS missions demonstrate that humans can live and work in LEO for extended periods of time. Humanity is ready for exciting and challenging exploration missions beyond LEO that will open the door for future expansion into the solar system. The development of advanced science and technologies needed for space settlements will help humanity improve life on Earth and shape a better future. Space tethers show great promise for enabling a variety of future space missions, both as engineering components and as scientific components. Applications of space tethers include propulsion, space structures, remote sensing, and artificial gravity, among others. To date, several tethered missions have flown and many more have been proposed for flight. This track will include missions enabled and the technologies necessary for exploiting the use of space tethers.

Papers are invited that address the following topics related to space colonization:

- Drivers: Desires for exploration, commerce, tourism, and adventure
- Destinations: Space, the moon, asteroids, and Mars, including missions
- Challenges: Environment, distance, isolation, logistics, and financing
- Designs: Concepts for robotic and human vehicles, outposts, and colonies
- Exploitation: Mining, utilization of in situ resources, and terraforming
- Enablers: Needed research and development of key technologies
- Space law: Claims, property rights, extraction of resources, and commerce

Papers are invited that address the following topics related to space tethers:

- Theory: Physics, kinematics, dynamics, and material requirements
- Applications: Advantages gained by using space tethers
- Missions: Unique missions enabled by space tethers
- Enablers: Needed research and development of key technologies

For questions, please contact:

Sven G. Bilén
AIAA Space Tethers Technical Committee (STETC)
The Pennsylvania State University
Email: sbilen@engr.psu.edu

Anita Gale
AIAA Space Colonization Technical Committee (SCTC)
The Boeing Company
Email: anita.e.gale@boeing.com

Space Exploration
Supported by NASA Headquarters and the AIAA Space Exploration Program Committee

The Space Exploration track spans mission architectures, advanced technologies, and flight systems to enable robotic precursor and human exploration missions to the moon, Lagrange points, Near Earth Objects (NEOs), and Mars and its moons. Abstracts are being solicited on the following topics:

- Mission Architectures: Studies, systems analysis, and operational scenarios for human exploration missions beyond Earth orbit
- Enabling Technologies: Development of critical technologies to enable human exploration missions, including advanced propulsion; cryogenic propellant storage and transfer; high-efficiency space power systems; life support and habitation systems; radiation shielding; entry, descent, and landing technology; EVA technology; advanced robotics; autonomous systems and avionics; high-data-rate communications; in situ resource utilization; and lightweight structures and materials
- Robotic Precursor Missions: Mission concepts and plans for robotic precursor missions to characterize space environments and scout potential destinations for future human activity
- Flight Systems: Flight experiments to demonstrate critical capabilities, and development of crew exploration vehicles and in-space transportation systems
- Using ISS for Exploration: Using ISS as an analog for long-duration missions, and as a test bed for demonstrating technologies and operational concepts for exploration.

For questions, please contact:

Chris Moore
Space Exploration Program Committee
NASA Headquarters
Email: christopher.moore@nasa.gov

Surendra P. Sharma
AIAA Space Exploration Program Committee
NASA Ames Research Center
Email: Surendra.P.Sharma@nasa.gov

Space History, Society, and Policy
Supported by the AIAA International Activities Committee, the AIAA History Technical Committee, the AIAA Legal Aspects of Aeronautics and Astronautics Technical Committee, and the AIAA Society and Aerospace Technology Technical Committee

The Space History, Society, and Policy Track examines the history of our time in space, space law and policy, international cooperation, the societal impacts of aerospace technologies and an educated and trained workforce, and the evolution of our space-faring society. Topics addressed include:

- History of Aerospace—Legacy and Lessons Learned: Collection, preservation, and analysis of historical materials related to spaceflight and space technology, manned space programs, launch systems, unmanned programs—with an emphasis on understanding the significance of people and organizations, programs, facilities, and infrastructure
- Space Law and Policy: Current and emerging policy and legal issues affecting space acquisition, operations, sustainment, and the future of space activities; national space policies of the United States, other countries, and the United Nations; the U.S. National Space Strategy; liabilities and legal obligations associated with space debris and end-of-life and orbital operations; space warfare; insurance, contracting, and liability issues; jamming threats and telecommunications regulation, and legal institutions
- International Cooperation: Risks and opportunities of cooperative engagement; recognizing and surmounting legal impediments to cooperation, including ITAR and technology transfer control regimes; successful and unsuccessful international approaches to acquiring, organizing, operating, and sustaining space systems; international institutions
- Space Science, Technology, Engineering, and Mathematics (STEM) perspectives: Shortfalls in the space workforce's STEM education and training and their impact; and policy, programmatic, and economic solutions to education and workforce shortfalls
- Spinoffs and Technology Transfer: Space technologies and discoveries transferred or commercialized outside of the industry; policies enabling technology transfer and technology transfer lessons learned; analyses of the societal impacts of space technology spinoffs
- Interactions with Society: Impact of space systems on communication, trade, and access to information; the impact of space systems and technology on global emergency response to disasters or acts of terrorism; space stakeholder risk tolerance and perceptions; analyses of the intangible benefits of spaceflight and of space themes in media and literature
- Astrosociology: Social, cultural, psychological, ethical dimensions, and the institutional responses associated with space medicine and isolated long-duration space missions; psychological, sociological, and anthropological perspectives on space-based natural disasters

In addition, this track will host a Best Student Paper Competition. Submitted and accepted papers by student authors will be presented within a session of the Space History, Society, and Policy track. Papers will be judged based on merit with the winning paper(s) receiving a certificate and a monetary award. For further information, including the complete rules and guidelines of the competition, please visit the SATTC website at **https://info.aiaa.org/tac/ETMG/SATTC**, or contact the competition administrator, Brad Steinfeldt, at bsteinfeldt@gatech.edu.

For questions, please contact:

Soumyo Dutta
AIAA Society and Aerospace Technology Technical Committee (SATTC)
Georgia Institute of Technology
Email: soumyo.dutta@gatech.edu

Cam Martin
AIAA History Technical Committee (HISTC)
NASA Dryden Flight Research Center
Email: cam.martin-1@nasa.gov

James D. Rendleman
AIAA Legal Aspects of Aeronautics and Astronautics Technical Committee (LAAATC)
AIAA International Activities Committee (IAC)
Rendleman & Associates
Email: napatarheel@hotmail.com

Space Logistics and Supportability
Supported by the AIAA Space Logistics Technical Committee

Space logistics is the theory and practice of driving space system design for operability, and of managing the flow of materiel, services, and information needed throughout a space system lifecycle. It includes management of the logistics supply chain from Earth and on to destinations throughout the solar system. Supportability considers system architecture strategies to minimize both logistics requirements and operational costs of human and robotic operations. Supportability strategies include processes and technologies to minimize maintenance complexity, exploit in situ resources, scavenge and reuse flight hardware, and recycle consumables. Representative areas include the servicing and sustainment of the International Space Station and of lunar and planetary outposts, the optimization of logistics launch vehicles for responsiveness and serviceability, and modeling of the supply chain in space for human and robotic mission campaigns. Technical topics include:

- International Space Station on-orbit resources management
- In-space spacecraft and satellite servicing
- Advanced Supportability Concepts: in situ repair, in situ fabrication, flight hardware scavenging and reuse, resource pre-positioning, consumables recycling
- Advanced Destination Logistics: outpost management and provisioning, in situ resource logistics, EVA logistics
- Advanced Space Logistics Infrastructures: solar power stations, on-orbit fuel depots, refueling in space, planetary or asteroid resource infrastructures
- Logistics of NASA, DoD, and Commercial Programs: space operations affordability, design for commonality, integrated logistics concepts
- Space Logistics Campaign Planning: methods, modeling, simulation, and cost analysis tools
- Automated spaceflight supply chain asset tracking and monitoring
- Spaceport ground processing and launch logistics
- Commercial space logistics opportunities

For questions, please contact:

Kandyce E. Goodliff
AIAA Space Logistics Technical Committee (SLTC)
NASA Langley Research Center
Email: kandyce.e.goodliff@nasa.gov

Richard Oeftering
AIAA Space Logistics Technical Committee (SLTC)
NASA Glenn Research Center
Email: richard.c.oeftering@nasa.gov

Space Operations
Supported by the AIAA Space Operations and Support Technical Committee

This track is calling for papers in a number of areas that are key to the success of spacecraft and launch systems, with an emphasis on the operational aspect. Technical topics include:

- Space operations in the 21st century
- Space operations automation and reducing cost of operations
- Future human and robotics space exploration operations
- Mission operations assurance
- Responsive space operations
- Human factors in space operations
- Advanced technologies for space operations
- Network-centric space operations
- Space operations policy
- Improving space operations
- Spaceport operations
- Future satellite operations

For questions, please contact:

Shirley Tseng
AIAA Space Operations and Support Technical Committee (SOSTC)
MorganFranklin Corporation
Email: shirleytseng@earthlink.net

Space Resources
Supported by the AIAA Space Resources Technical Committee

Utilization of the natural resources found in space offers a uniquely sustainable approach to space exploration. By leveraging available materials on planetary bodies, the constraining supply chain can be broken. The Space Resources Track will examine alternatives to the classic resupply challenge by providing many of the needed commodities for human and robotic sustainment using locally available resources. The current focus on multiple exploration destinations has renewed interest in the resources of Mars and near-Earth objects. Papers are solicited on all aspects of the resource utilization cycle, from prospecting and precursor missions through production, storage, and delivery. Technical topics include:

- Resource prospecting and precursor missions
- Resource collection and transport
- Lunar resource utilization technologies
- Asteroid resource utilization technologies
- Mars resource utilization technologies
- ISRU for fabrication and repair
- ISRU hardware demonstrations and case studies

For questions, please contact:

Leslie Gertsch
AIAA Space Resources Technical Committee (SRETC)
Missouri University of Science and Technology
Email: gertschl@mst.edu

Space Systems and Sensors
Supported by the AIAA Space Systems Technical Committee

The Space Systems and Sensors track seeks to present important findings from recent work on emerging space systems, space science, and sensor technologies. In particular, papers are sought that address technical, operational, and economic feasibility of current and future space systems that address the full range of civil, military, and international applications. Papers by students are especially encouraged. Technical topics include:

- Architectures and concepts of operation
- New and emerging technologies and applications
- Remote sensing for climate and weather
- Space and planetary science missions and technologies
- Rapid and responsive space systems
- Enabling technologies for distributed or fractionated space
- Proximity sensing of space objects and orbital space situational awareness (SSA)
- Space sensor technologies
- Laser communication

- Cubesats
- Workforce development for space systems and sensors engineering (Panel)
- Space systems lessons learned (Panel)

For questions, please contact:

Amy Lo
AIAA Space Systems Technical Committee (SSTC)
Northrop Grumman Aerospace Systems
Email: amy.lo@ngc.com

Jim Baker
AIAA Space Systems Technical Committee (SSTC)
Email: james.baker@meitechinc.com

Space Systems Engineering and Space Economics
Supported by the AIAA Economics Technical Committee and the AIAA Systems Engineering Technical Committee

The role of systems engineering in space programs has become more important as systems have become increasingly complex, architectures have become expansive, and integration across architectures has become commonplace and essential. As the utilization of space increases, driven by technological advances and mission need, the cost and economics of space will remain a formidable challenge. These challenges can be met by analyzing data and developing models to clarify the best value and key economic insights for decision makers. A goal of the systems engineering and space economics community is to develop and apply capabilities to facilitate robust future space systems. Aspects of systems engineering and space economics that may be included in this track are:

- Definition and application of space system architectures
- Advances in systems engineering processes and tools applied to space systems
- Systems engineering lessons learned from current and previous space programs
- Space systems requirements generation, verification, and validation
- Space systems integration and associated tests
- Systems engineering for autonomous space systems
- Space systems risk management
- Evaluating and balancing space systems cost, performance, schedule, and risk
- Space workforce development and industrial base challenges
- New developments in economic analysis and cost models
- Examples of trade studies incorporating economic analysis, affordability, or value engineering
- Space systems engineering efficiencies in a constrained budget environment

For questions, please contact:

Edmund H. Conrow
AIAA Systems Engineering Technical Committee (SETC)
Management and Technology Associates
Email: conrow@risk-services.com

Jairus M. Hihn
AIAA Economics Technical Committee (ECOTC)
Jet Propulsion Laboratory
Email: jairus.m.hihn@jpl.nasa.gov

Space Transportation and Launch Systems
Supported by the AIAA Reusable Launch Vehicle Program Committee and the AIAA Space Transportation Technical Committee

The success of all space endeavors—military, scientific, exploration, and commercial—depends on low-cost, highly reliable access to space. Since the retirement of the Space Shuttle, current worldwide space deployments are achieved through expendable launch vehicles (ELVs). New emerging space companies have offered the promise of low-cost space access, and some of them are proceeding with development and testing efforts. NASA's Commercial Orbital Transportation Services Demonstration Program is designed to demonstrate low-cost, reliable commercial cargo delivery, and potentially crew delivery, to the International Space Station (ISS). NASA has contracted for ISS Commercial Resupply Services for resupply and return of ISS cargo. NASA's human exploration program promises to continue the U.S. civilian human spaceflight effort by developing and operating new vehicle systems for human exploration of the solar system. Within the U.S. DoD, reusable launch vehicle (RLV) activity is gaining momentum with the Air Force's technology development activities for a reusable first stage. Papers are invited that address the issues and challenges associated with space transportation. Papers may be submitted within, but are not limited to, the following categories:

- Space transportation system, technology, design, and integration challenges
- In-space transportation systems and architectures, including propellant depots
- Advanced concept vehicles and systems
- Launch vehicles
- Designs, concepts, and developments (ELVs , RLVs, or partially reusable LVs)
- RLV development, programmatic (including economics), and industry-related strategies
- Lessons learned from previous RLV-related programs and design studies
- Operationally responsive space
- Operations of spaceports and ranges
- Space transportation for space tourism
- Space transportation analytical tools, materials, and technologies
- Suborbital vehicles and systems

For questions, please contact:

Adam Dissel
AIAA Reusable Launch Vehicle Program Committee (RLVPC)
Lockheed Martin Space Systems
Email: adam.f.dissel@lmco.com

Barry Hellman
AIAA Reusable Launch Vehicle Program Committee (RLVPC)
Air Force Research Laboratory
Email: barry.hellman@wpafb.af.mil

Miroslav Sir
AIAA Space Transportation Technical Committee (STTC)
The Aerospace Corporation
Email: miro.sir@aero.org

Proposals for Special Sessions

Individuals who wish to organize special sessions within the technical program (e.g., invited oral presentations, panels, or demonstrations) should submit a short proposal describing the nature of the session as it relates to a specified technical track. Be sure to include the names of the organizers and participants. Please email your proposal by **17 January 2013** to Randy Kendall, SPACE 2013 Technical Program Co-Chair, at randolph.l.kendall@aero.org. Do not upload an abstract for the proposal.

Abstract Submittal Guidelines and Procedures

Abstract submissions will be accepted electronically through the AIAA website at **www.aiaa.org/space2013**. Once you have entered the conference website, click "Submit A Paper" and follow the instructions listed. *Please note*: Abstracts meeting the high standards for inclusion in the conference technical program may be accepted for either poster or podium sessions. Poster presenters will have the opportunity to present their work in two separate poster sessions, while podium presenters will have the opportunity to present in one technical session. All final manuscripts will be published in the conference proceedings if uploaded by the final manuscript deadline. (*Note, however, the "No Podium, No Paper" policy described below.*) The deadline for receipt of abstracts via electronic submittal is **31 January 2013, 2359 hrs Eastern Time Zone, USA**.

The electronic submission process is as follows.

1) Access the AIAA website at **www.aiaa.org/space2013**.
2) On the right-hand side, click the "Submit Paper" button.
3) You will be prompted to log in. If you do not have an AIAA account, you will be asked to create one.
4) After you log in, you will be in the ScholarOne Abstracts submission site.
5) Click the Submission tab at the top of the page to begin your submission.
6) To begin the submission, click the "Create a New Submission" link on the left-hand side. *Note*: If you have previously visited the site and begun a draft submission, click the "View Submissions" link on the left-hand side to resume your submission.

Special Notes

Submitted abstracts and submission metadata may be revised, but only before the abstract submission deadline. To do so, return to the submission site, click Submission > View Submissions and then select "Return to Draft." Once in draft status, click the edit button to open the submission and make the necessary changes. Authors then must resubmit at Step 6 for the submission to be eligible for consideration.

Authors having trouble submitting abstracts electronically should contact ScholarOne Technical Support at ts.acsupport@thomson.com, 434.964.4100, or (toll-free, U.S. only) 888.503.1050. Questions pertaining to the abstract or technical topics, or general inquiries concerning the program format or policies of the conference, should be directed to the appropriate track chair(s).

Authors will be notified of paper acceptance or rejection on or about **10 April 2013**. Instructions for preparation of final manuscripts will be provided for accepted papers.

"No Paper, No Podium" & "No Podium, No Paper" Policies

If a written paper is not submitted by the final manuscript deadline, authors will not be permitted to present the paper at the conference. It is the responsibility of those authors whose papers or presentations are accepted to ensure that a representative attends the conference to present the paper. If a paper is not presented at the conference, it will be withdrawn from the conference proceedings. These policies are intended to eliminate no-shows and to improve the quality of the conference for attendees.

Publication Policy

AIAA will not consider for presentation or publication any paper that has been or will be presented or published elsewhere. Authors will be required to sign a statement to this effect. *Please note*: AIAA policy precludes an abstract or paper from being submitted multiple times to the same conference. Also, once a paper has been published, by AIAA or another organization, AIAA will not republish the paper. Papers being submitted to the Student Paper Competition being held in conjunction with this conference may not be submitted to the general sessions. Author(s) must choose to submit to the Student Paper Competition **OR** to the conference. If your paper is selected for competition it will be published along with the conference proceedings.

Final Manuscript Guidelines

Detailed instructions and guidelines for submitting papers will be made available to authors of accepted papers. Authors must submit their final manuscripts via the conference website no later than **19 August 2013**.

Warning—Technology Transfer Considerations

Prospective authors are reminded that technology transfer guidelines have considerably extended the time required for review of abstracts and completed papers by U.S. government agencies. Internal (company) plus external (government) reviews can consume 16 weeks or more. Government review if required is the responsibility of the author. Authors should determine the extent of approval necessary early in the paper preparation process to preclude paper withdrawals and late submissions. The conference technical committee will assume that all abstracts papers and presentations are appropriately cleared.

International Traffic in Arms Regulations (ITAR)

AIAA speakers and attendees are reminded that some topics discussed in the conference could be controlled by the International Traffic in Arms Regulations (ITAR). U.S. nationals (U.S. citizens and permanent residents) are responsible for ensuring that technical data they present in open sessions to non-U.S. nationals in attendance or in conference proceedings are not export restricted by the ITAR. U.S. nationals are likewise responsible for ensuring that they do not discuss ITAR export-restricted information with non-U.S. nationals in attendance.

Sponsorship and Exhibit Opportunities

There is always something happening at an AIAA conference—plenary sessions addressing critical topics on the future of the space industry; presentations on current state-of-the-art technologies; panel sessions that foster discussion and debate among stakeholders; keynote lectures by renowned speakers addressing relevant topics; special presentations on the exhibit hall stage; a young professional reception or a unique off-site social activity—all of which provide an informal way to interact with industry colleagues and meet new contacts and potential customers.

Sponsorship

If your company is looking for a mechanism to heighten visibility, expand networking capabilities among industry leaders, and demonstrate your unique value to more than 1,000 space professionals who attend this event, AIAA's sponsorship program can help to achieve your objectives.

Merrie Scott, Manager, Industry Partnerships
Office: +1.703.264.7530 • Email: merries@aiaa.org

Exhibits

The AIAA SPACE 2013 Exposition Hall is the center of all networking and business activities at the conference. The 2013 exposition will feature exhibits from industry, government, and academic organizations across the space community. Networking coffee breaks, poster sessions, exhibitor presentations, the opening reception, and other special events are all held in the exposition hall to give attendees and exhibitors the most opportunities to meet and do business. AIAA also offers customized VIP tours of the hall to keynote speakers and other high-level government decision makers, to allow these important customers one-on-one time with the exhibitors.

Christopher M. Grady, Exhibit Sales Manager
Office: +1.703.264.7509 • Email: chrisg@aiaa.org

New and Forthcoming Titles

Visit AIAA's New Electronic Library – Aerospace Research Central at **arc.aiaa.org**

Aircraft Design: A Conceptual Approach, Fifth Edition
Daniel P. Raymer

AIAA Education Series
2012, 800 pages, Hardback
ISBN: 978-1-60086-911-2
Member Price: $84.95
List Price: $109.95

Aircraft and Rotorcraft System Identification, Second Edition
Mark Tischler and Robert K. Remple

AIAA Education Series
2012, 800 pages Hardback
ISBN: 978-1-60086-820-7
Member Price: $89.95
List Price: $119.95

Missile Design and System Engineering
Eugene Fleeman

AIAA Education Series
2012, 800 pages, Hardback
ISBN: 978-1-60086-908-2
Member Price: $84.95
List Price: $114.95

Morphing Aerospace Vehicles and Structures
John Valasek

Progress in Astronautics and Aeronautics Series, 240
2012, 300 pages, Hardback
ISBN: 978-1-60086-903-7
Member Price: $94.95
List Price: $ 134.95

Designing Unmanned Aircraft Systems: A Comprehensive Approach
Jay Gundlach

AIAA Education Series
2011, 805 pages, Hardback
ISBN: 978-1-60086-843-6
Member Price: $84.95
List Price: $109.95

Tactical and Strategic Missile Guidance, Sixth Edition
Paul Zarchan

Progress in Astronautics and Aeronautics Series, 239
2012, 1026 pages, Hardback
ISBN: 978-1-60086-894-8
Member Price: $104.95
List Price: $134.95

Order 24 hours a day at www.aiaa.org/books

Exergy Analysis and Design Optimization for Aerospace Vehicles and Systems
Jose Camberos and David Moorhouse

Progress in Astronautics and Aeronautics Series, 238
2011, 632 pages, Hardback
ISBN: 978-1-60086-839-9
AIAA Member Price: $89.95
List Price: $119.95

Introduction to Flight Testing and Applied Aerodynamics
Barnes W. McCormick

AIAA Education Series
2011, 148 pages, Hardback
ISBN: 978-1-60086-827-6
AIAA Member Price: $49.95
List Price: $64.95

Spacecraft Charging
Shu T. Lai

Progress in Astronautics and Aeronautics Series, 237
2011, 208 pages, Hardback
ISBN: 978-1-60086-836-8
AIAA Member Price: $64.95
List Price: $84.95

Introduction to Theoretical Aerodynamics and Hydrodynamics
William Sears

AIAA Education Series
2011, 220 pages, Hardback
ISBN: 978-1-60086-773-6
AIAA Member Price: $54.95
List Price: $69.95

Basic Helicopter Aerodynamics, Third Edition
John M. Seddon and Simon Newman

AIAA Education Series
2011, 264 pages, Hardback
ISBN: 978-1-60086-861-0
AIAA Member Price: $49.95
List Price: $74.95

Gas Turbine Propulsion Systems
Bernie MacIsaac and Roy Langton

AIAA Education Series
2011, 328 pages, Hardback
ISBN: 978-1-60086-846-7
AIAA Member Price: $84.95
List Price: $119.95

Upcoming AIAA Professional Development Courses

9–10 September 2012
The following Continuing Education courses are being held at the AIAA SPACE 2012 Conference in Pasadena, CA. Registration includes course and course notes; full conference participation: admittance to technical and plenary sessions; receptions, luncheons, and online proceedings.

To register for one of the SPACE courses, go to **www.aiaa.org/space2012.**

	Early Bird by 13 Aug	*Standard (14 Aug–8 Sep)*	*On-site (9–10 Sep)*
AIAA Member	$1338	$1438	$1538
Nonmember	$1443	$1543	$1643

Systems Engineering Verification and Validation

(Instructor: John Hsu, Technical/Project Manager and Principal Investigator, The Boeing Company, Cypress, CA)

This course will focus on the verification and validation process, which plays a key role from the very beginning through the final stages of the systems engineering task for a program or project. It will clarify the distinctions between verification and validation, and discuss validating requirements and generating verification requirements. The course addresses the steps to be followed, beginning with the development of verification and validation plans, and how to choose the best verification method and approach. A test and evaluation master plan then leads to test planning and analysis. Conducting the actual testing involves activities, facilities, equipments, and personnel. The evaluation process analyzes and interprets the data, and acceptance testing assures that the products meet or exceed the original requirements. There are also functional and physical audits and simulation and modeling that can provide virtual duplication of products and processes in operationally valid environments. Verification management organizes verification tasks and provides total traceability from customer requirements to verification report elements.

Introduction to Space Systems **(Instructor: Mike Gruntman, Professor of Astronautics, University of Southern California, Los Angeles, CA)**

This two-day course provides an introduction to the concepts and technologies of modern space systems. Space systems combine engineering, science, and external phenomena. We concentrate on scientific and engineering foundations of spacecraft systems and interactions among various subsystems. These fundamentals of subsystem technologies provide an indispensable basis for system engineering. The basic nomenclature, vocabulary, and concepts will make it possible to converse with understanding with subsystem specialists. This introductory course is designed for engineers and managers—of diverse background and varying levels of experience—who are involved in planning, designing, building, launching, and operating space systems and spacecraft subsystems and components. The course will facilitate integration of engineers and managers new to the space field into space-related projects.

11–12 September 2012
The following standalone course is being held at the National Aerospace Institute in Hampton, Virginia.

To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**

	Early Bird by 7 Aug 2012	*Standard (8 Aug–4 Sep)*	*On-site (5–11 Sep)*
AIAA Member	$885	$1050	$1190
Nonmember	$995	$1155	$1295

Robust Aeroservoelastic Stability Analysis

(Instructor: Richard Lind)

This course will introduce the concept of robustness to the study of flutter and aeroservoelasticity. The models that are traditionally used for stability analysis are augmented with uncertainties to reflect potential errors and unmodeled dynamics. The mu method is developed to account directly for these uncertainties. The resulting robust stability margin is a worst-case measure of the smallest flutter speed for the system as effected by any of the uncertainty values. This course demonstrates the procedure for formulating a model in the mu framework and computing the associated robust stability margin. Furthermore, the course discusses methods to compute uncertainties in the models based on flight data analysis. Several applications from recent flight tests are presented for which the mu method was used to compute robust aeroservoelastic stability margins.

12–13 September 2012
These two 90-minute webinars will take place at 1300–1430 hrs EST

To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**

AIAA Members	Nonmembers	Students
$199	$239	$100

Fundamentals of Communicating by Satellite

(Instructor: Edward (Ed) Ashford)

The two 90-minute (plus Q&A) introductory webinars will present the basic principles involved in satellite communications, starting with a definition of key terms and an explanation of the principles involved in the modulation, coding, and transmission of information. The major elements involved in both satellite communication payloads and Earth terminals will be explained, with emphasis on the antennas and power amplifiers that play such a major role in making satellite communications possible. The course material is intended to allow engineers working in other fields to gain an overall understanding of satellite communications; however its prime purpose is to give a relatively broad overview of the field rather than presenting any rigorous mathematical justification of the concepts covered, so it should also be suitable for a more general audience with a relatively limited technical background.

15–16 September 2012

The following Continuing Education course is being held at the AIAA ATIO/MAO 2012 Conference in Indianapolis, IN. Registration includes course and course notes; full conference participation: admittance to technical and plenary sessions; receptions, luncheons, and online proceedings.

To register for one of the ATIO/MAO courses, go to **www.aiaa.org/atio2012** or **www.aiaa.org/mao2012.**

	Early Bird by 20 Aug	Standard (11 Aug–14 Sep)	On-site (15–16 Sep)
AIAA Member	$1260	$1360	$1460
Nonmember	$1365	$1465	$1565

Optimal Design in Multidisciplinary Systems (Instructors: Prabhat Hajela, Rensselaer Polytechnic Institute, Troy State, NY; Dr. J.E. Sobieski, NASA Langley Research Center, Hampton, VA)

When you are designing or evaluating a complicated engineering system such as an aircraft or a launch vehicle, can you effectively reconcile the multitude of conflicting requirements, interactions, and objectives? This course discusses the underlying challenges in such an environment, and introduces you to methods and tools that have been developed over the years.

You will be presented with a review of the state-of-the-art methods for disciplinary optimization that exploit the modern computer technology for applications with large numbers of variables, design limitations, and many objectives. You will learn how to evaluate sensitivity of the design to variables, initial requirements, and constraints, and how to select the best approach from many currently available. From that disciplinary-level foundation, the course will take you to system-level applications where the primary problem is in harmonizing the local disciplinary requirements and design goals to attain the objectives required of the entire system, and where performance depends on the interactions and synergy of all its parts. In addition to imparting skills immediately applicable, the course will give you a perspective on emerging methods and development trends.

18–20 September 2012

The following is a webinar course that will be broadcast each day at 1300–1430 hrs EDT.

To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**

AIAA Members	Nonmembers	Students
$299	$339	$140

Deciding on the Form of Missile Defense (Peter J. Mantle)

This webinar is an overview of a more extensive 3-day seminar covering all aspects of missile defense. It starts with an understanding of new and evolving forms of missile threat that are emerging in this new world of asymmetric threats, potential terrorism, innovative technology, and global risk. It explores the past missile threats to the United States and develops a new view of possible defense mechanisms. It discusses threats to the United States and to NATO Europe and possible defense architectures. With this background, the webinar reviews the basic theories of ballistic missiles and cruise missiles to establish realistic state-of-the-art performance projections. Simple expressions are developed to establish possible bounds of key parameters. Cost of missile systems (platforms, missiles, radars, support) are examined. Timelines to acquire missile systems are reviewed. Risk expressed in measurable terms of investment and development times are reviewed. Liberal use of historical data is provided to bound the problem. A simple set of evaluation criteria is provided to assess competing missile defense systems including use of "conditional decision making" to help managers decide as less precise data and information is presented. The objective of the webinar is to provide a new approach to determining how best to defend a nation (or group of nations) from missile attack. It is also the objective to provide tools on how to measure "best defense". It integrates technical evaluation with the less precise but all important political and programmatic factors in a controllable and repeatable manner.

26 September 2012

This 90-minute webinar will take place at 1300–1430 hrs EDT.

To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**

AIAA Members	Nonmembers	Students
$99	$139	$50

UAV Conceptual Design Using Computer Simulations (Peter Zipfel, Ph.D.)

Though time does not permit teaching a complete graduate course, you will learn how multiple aerospace disciplines come together for building a UAV.

Airframe, propulsion, guidance, and control are synthesized in a computer simulation to conduct design iterations and performance evaluations. Your laptop is your design bureau, workshop, and test range. For follow-up, you will receive free access to the computer simulation used in this webinar and references of additional study material.

3 October 2012

This 90-minute webinar will take place at 1300–1430 hrs EST.

To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**

AIAA Members	Nonmembers	Students
$99	$139	$50

Space Radiation Environment (V. L. Pisacane, Ph.D.)

This webinar defines the planetary and interplanetary charged particle radiation environment required to assess the effects of radiation on personnel and electronics appropriately. The effects of charged particle radiation are briefly addressed. Equations of motion are presented leading to an understanding of the mechanisms of particle gyration, gyro-frequency, Larmor radius, mirroring, and drift. The trapped radiation, cosmic ray, and solar event environments are then described in detail. Available models for each that are used to simulate the effects on electronics and personnel are presented with references. An understanding of the elements discussed here are important to address the detailed interactions with electronics and personnel that will be covered in a follow on webinar.

10–11 October 2012
This 90-minute webinar will take place at 1300–1430 EDT

To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**		
AIAA Members	Nonmembers	Students
$199	$239	$50

Introduction to Communication Satellites and their Subsystems (Instructor: Edward (Ed) Ashford)

This webinar presents the basic technologies and designs used in communication satellites, and the system considerations that underlie the selection of a particular type of system. A brief history will be given of the field prior to beginning the coverage of system, economic, and technical aspects. An introduction to the environments encountered in space will be given. The various orbits used for satellite communications will be described along with the pros and cons associated with the selection of any specific orbit(s). There will then be a breakdown given of the various subsystems making up typical communication satellites, with an introduction to the types of technologies used in these. The synthesis and analysis techniques on which the subsystem designs are based also will be described. Finally, the typical test program for a communication satellite will be discussed.

17 October 2012
This 90-minute webinar will take place at 1300–1430 EDT

To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**		
AIAA Members	Nonmembers	Students
$99	$139	$100

Overview of Missile Design and System Engineering
(Eugene L. Fleeman)

This webinar presents the fundamentals of missile design, development, and system engineering. It addresses the broad range of alternatives in satisfying missile performance, cost, risk, and launch platform integration requirements. The methods presented are generally simple closed-form analytical expressions that are physics-based, to provide insight into the primary driving parameters. Typical values of missile parameters and the characteristics of current operational missiles are discussed, as well as the enabling subsystems and technologies for missiles. Videos are presented to illustrate missile development activities and performance.

7 November 2012
This 90-minute webinar will take place at 1300–1430 EDT

To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**		
AIAA Members	Nonmembers	Students
$89	$129	$40

Flight Dynamics and Einstein's Covariance Principle
(Peter Zipfel, Ph.D.)

The great divide between Newtonian dynamics and Einstein's Relativity is a chimera. Einstein had great respect for Newton and made sure that his theory would converge to Newton's three laws as conditions approach classical proportions. Flight dynamics, which is based on Newton's laws, is no exception. During a one-hour perambulation, I will acquaint you with Special and General Relativity as it applies to classical dynamics. Modeling of flight dynamics benefits greatly from such a vantage point. The physics of the problem are separated from its computational aspects. Tensors—independent of coordinate systems—model the physics, while matrices, created from these tensors by introducing coordinate systems, are coded for execution.

14 November 2012
This 90-minute webinar will take place at 1300–1430 EDT

To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**		
AIAA Members	Nonmembers	Students
$99	$139	$50

Risk Analysis and Management (Dr. Vincent L. Pisacane)

This course is intended for technical and management personnel who wish to gain an understanding of techniques that can be implemented to minimize premature failure of space systems. It first identifies selected typical space system failures and their causes. Failure analyses includes the Weibull distribution and its failure rate, mean time to failure, hazard function reliability (survival) function, and conditional, reliability function. Mitigation techniques discussed includes burn in and risk management techniques that includes failure identification, fault tree analyses, event tree analyses, failure modes and effects analyses, failure modes and effects analyses, and risk matrices.

6 December 2012
This 90-minute webinar will take place at 1300–1430 EDT

To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**		
AIAA Members	Nonmembers	Students
$99	$139	$50

Advanced Composite Materials and Structures
(Carl Zweben, Ph.D.)

Advanced composites are critical, and in many instances enabling, materials for a large and increasing number of aerospace and commercial applications. Historically considered primarily structural and thermal protection materials, they also have great potential in virtually all subsystems, including propulsion, mechanisms, electronics, power, and thermal management. Physical properties are increasingly important. For example, composites with low densities, low CTEs and thermal conductivities higher than copper are now in production. Materials of interest include not only polymer matrix composites (PMCs), currently the most widely used class of structural materials, and carbon-carbon composites (CCCs), which are well established for thermal protection, but also ceramic matrix composites (CMCs), metal matrix composites (MMCs) and other types of carbon matrix composites (CAMCs). In this presentation we consider key aspects of the four classes of composites, including properties, key manufacturing methods, design considerations, analysis overview, lessons learned and applications. We also consider future directions, including nanocomposites.

Standard Information for all AIAA Conferences

This is general conference information, except as noted in the individual conference preliminary program information to address exceptions.

Photo ID Needed at Registration

All registrants must provide a valid photo ID (driver's license or passport) when they check in. For student registration, valid student ID is also required.

Conference Proceedings

This year's conference proceedings will be available in an online format only. The cost is included in the registration fee where indicated. If you register in advance for the online papers, you will be provided with instructions on how to access the conference technical papers. For those registering on-site, you will be provided with instructions at registration.

Young Professional Guide for Gaining Management Support

Young professionals have the unique opportunity to meet and learn from some of the most important people in the business by attending conferences and participating in AIAA activities. A detailed online guide, published by the AIAA Young Professional Committee, is available to help you gain support and financial backing from your company. The guide explains the benefits of participation, offers recommendations and provides an example letter for seeking management support and funding, and shows you how to get the most out of your participation. The online guide can be found on the AIAA Web site, **www.aiaa.org/YPGuide**.

Journal Publication

Authors of appropriate papers are encouraged to submit them for possible publication in one of the Institute's archival journals: *AIAA Journal*; *Journal of Aircraft*; *Journal of Guidance, Control, and Dynamics*; *Journal of Propulsion and Power*; *Journal of Spacecraft and Rockets*; *Journal of Thermophysics and Heat Transfer*; or *Journal of Aerospace Computing, Information, and Communication*. You may now submit your paper online at **http://mc.manuscriptcentral.com/aiaa**.

Speakers' Briefing

Authors who are presenting papers, session chairs, and co-chairs will meet for a short briefing at 0700 hrs on the mornings of the conference. Continental breakfast will be provided. Please plan to attend only on the day of your session(s). Location will be in final program.

Speakers' Practice

A speaker practice room will be available for speakers wishing to practice their presentations. A sign-up sheet will be posted on the door for half-hour increments.

Timing of Presentations

Each paper will be allotted 30 minutes (including introduction and question-and-answer period) except where noted.

Committee Meetings

Meeting room locations for AIAA committees will be posted on the message board and will be available upon request in the registration area.

Audiovisual

Each session room will be preset with the following: one LCD projector, one screen, and one microphone (if needed). A 1/2" VHS VCR and monitor, an overhead projector, and/or a 35-mm slide projector will only be provided if requested by presenters on their abstract submittal forms. AIAA does not provide computers or technicians to connect LCD projectors to the laptops. Should presenters wish to use the LCD projectors, it is their responsibility to bring or arrange for a computer on their own. Please note that AIAA does not provide security in the session rooms and recommends that items of value, including computers, not be left unattended. Any additional audiovisual requirements, or equipment not requested by the date provided in the preliminary conference information, will be at cost to the presenter.

Employment Opportunities

AIAA is assisting members who are searching for employment by providing a bulletin board at the technical meetings. This bulletin board is solely for "open position" and "available for employment" postings. Employers are encouraged to have personnel who are attending an AIAA technical conference bring "open position" job postings. Individual unemployed members may post "available for employment" notices. AIAA reserves the right to remove inappropriate notices, and cannot assume responsibility for notices forwarded to AIAA Headquarters. AIAA members can post and browse resumes and job listings, and access other online employment resources, by visiting the AIAA Career Center at http://careercenter.aiaa.org.

Messages and Information

Messages will be recorded and posted on a bulletin board in the registration area. It is not possible to page conferees. A telephone number will be provided in the final program.

Membership

Professionals registering at the nonmember rate will receive a one-year AIAA membership. Students who are not members may apply their registration fee toward their first year's student member dues.

Nondiscriminatory Practices

The AIAA accepts registrations irrespective of race, creed, sex, color, physical handicap, and national or ethnic origin.

Smoking Policy

Smoking is not permitted in the technical sessions.

Restrictions

Videotaping or audio recording of sessions or technical exhibits as well as the unauthorized sale of AIAA-copyrighted material is prohibited.

International Traffic in Arms Regulations (ITAR)

AIAA speakers and attendees are reminded that some topics discussed in the conference could be controlled by the International Traffic in Arms Regulations (ITAR). U.S. Nationals (U.S. Citizens and Permanent Residents) are responsible for ensuring that technical data they present in open sessions to non-U.S. Nationals in attendance or in conference proceedings are not export restricted by the ITAR. U.S. Nationals are likewise responsible for ensuring that they do not discuss ITAR export-restricted information with non-U.S. Nationals in attendance.