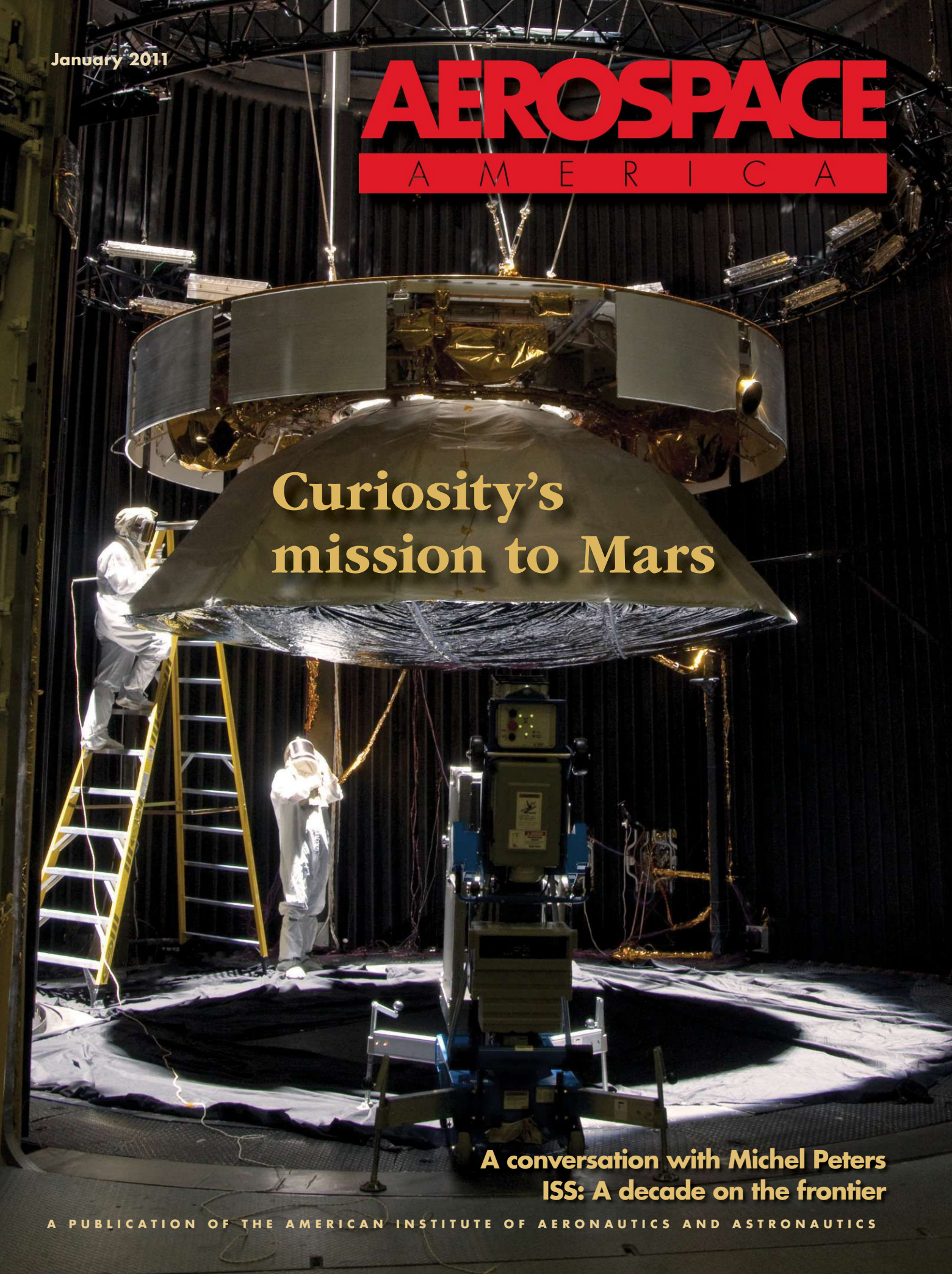
January 2011

AEROSPACE AMERICA



Curiosity's mission to Mars

A conversation with Michel Peters

ISS: A decade on the frontier

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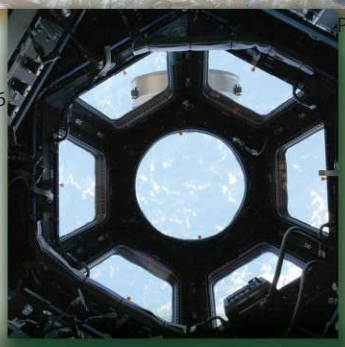

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JPL technicians prepare a space-simulation test of the cruise stage of the Mars Science Laboratory. To learn about the MSL and the Curiosity rover, turn to the story beginning on page 28.

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January 2011, Vol. 49, No. 1

AIAA
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Commentary

The first A in NASA—Lost in the space debate

In the recent debate over NASA's future, its aeronautics program was totally ignored. The research program that enabled U.S. global aviation supremacy for over nine decades has been reduced to near oblivion.

From the 1960s through the 1990s, annual aeronautics funding averaged about $1.4 billion (all amounts inflation adjusted). This period of unprecedented technology progress sustained the nation's global leadership in both civil and military aviation. NASA research led this growth and helped establish our aviation products as the largest positive contributor to our trade balance. Then the axe fell and funding plummeted from $1.8 billion in 1998 to $500 million in 2010. Because of the time lag from research to application, we are only now seeing the results of NASA research during the '90s in the F-22 and F-35 and Boeing's 787 airliner. How did such a dramatic decline happen?

Traditionally, NASA's aero program consisted of basic research coupled with systems technology programs that brought promising technologies to flight demonstration and readiness for low-risk applications. In 1998 NASA began canceling systems technology programs that had produced many enabling technologies for the 787 and NextGen, eliminating $700 million from the aero budget. In 2001 NASA canceled the classified advanced aircraft military technology program, phasing out NASA-funded military aviation research. The NASA-DOD partnership that began in 1915 with establishment of NACA had a profound impact on almost all military aircraft and is now largely eliminated. Four additional systems technology programs were canceled between 2004 and 2007 with another $360-million funding reduction.

The good news is that a $70-million aeronautics increase is budgeted for 2011. Even so, the total aero budget is only 76% of what was allocated for basic research alone in 1995 and only 3.0% of today's total NASA budget. This is insufficient to sustain a world-class U.S. research effort and maintain long-term aviation leadership. Research test facilities are no longer well maintained, and many top researchers have moved on to other programs. Without a major change in priority, there is little hope of sustaining U.S. world leadership in aeronautics.

All this comes as our nation faces huge new technical challenges to the future of civil and military aviation. NASA should be leading efforts to address these issues with systems technology programs focused on "green" aviation and developing technologies to follow NextGen. Further, it makes no sense for NASA's expertise and facilities not to help solve military aviation problems. Aviation's importance to U.S. competi tiveness and defense demands that NASA revitalize its aeronautics program. To meet the challenges, it needs a roughly $1-billion annual budget and a revitalized management structure.

Uncertainty over the direction of the human spaceflight program has overwhelmed all other NASA issues. Federal budget realities and the program's low priority do not bode well for aeronautics. Continuing to marginalize this critical national effort will have serious negative co sequences for our nation's global competitiveness, yet there is no serious discussion of this issue in the debate over NASA's future. Shame on us.

Roy V. Harris Jr.
NASA Langley (ret.)

Anglo-French defense treaty: The changing dynamic

THE U.K.'S "STRATEGIC DEFENCE and Security Review" in October and the November Anglo-French defense accord last year appear to have set the U.K.'s defense/aerospace industrial strategy on a new path. In the future, the country will have a much smaller army, air force, and navy, and much of its equipment will be codeveloped with France, rather than sourced directly from the U.S.

Ian Godden, chairman of the U.K. aerospace, defense, and security trade association ADS, says the defense treaty with France "may well prove crucial to both retaining and developing future capabilities within Europe by ensuring sustained investment in research and technology to deliver the next generation of programs for our armed forces. The alternative, buying off-the-shelf from the U.S., is often not the appropriate solution for our troops, and this development ensures that future governments will retain a choice of suppliers—both U.K.-based and from overseas—that meet the needs of our armed forces."

The MRTT might offer the British Ministry of Defence huge benefits if it can lease spare tanker capacity to a NATO ally.

More, or less?

So do these agreements mark a major shift in defense/aerospace teaming arrangements for U.K. industry away from North America? Over the past few years, all of the U.K.'s major aerospace systems companies—BAE Systems, Rolls-Royce, QinetiQ, Cobham—have invested hugely in their U.S. operations rather than those in continental Europe, and have generated important new revenue streams as a result. But will this now change? Is the U.K.'s treaty with France more, or less, than it seems?

This is an especially major issue for BAE Systems, the U.K.'s largest aerospace and defense manufacturer, which now derives around half of its income from the U.S. In September 2010 the company announced it would be putting the U.S.-based platform solutions division, based in Johnson City, N.Y., up for sale. This is part of a much broader consolidation program the company has initiated in response to tightening defense budgets in most of its key markets.

For BAE Systems and other U.K. majors, the U.S. defense market remains the most lucrative in the world—accounting for around 50% of the global defense market—and their access to U.S. defense contracts is envied by their continental European competitors.

The question remains whether BAE Systems will join the nEUROn initiative.

In contrast, the European continental defense market is a much more complex arena in which to operate—smaller, fragmented, and riddled by national politics. According to figures from the European Defense Agency, Europe spends around €200 billion a year on defense while the U.S. spends €466 billion. Defense (until now) accounts for just 1.63% of European nations' annual gross domestic product, while in the U.S. the figure is 4.7%.

But the new Anglo-French agreement could make BAE Systems think again about Europe. The treaty, after all, offers the prospect of a major share in two programs that are likely to be huge money-spinners at some point in the future: a single European unmanned combat air vehicle (UCAV) and the—probably related—single European replacement for the Eurofighter Typhoon, Dassault Rafale, and Saab Gripen fighters.

Under the agreement, a joint work-

ing party will look at the next generation of unmanned surveillance aircraft that will be needed between 2015 and 2020. Longer term studies will look at prospects for development of a common UCAV system by around 2030. While continental European manufacturers have pooled their UCAV efforts—under Dassault's leadership—in the nEUROn program, BAE has developed its own UCAV prototype, Taranis. So will BAE Systems be joining the nEUROn initiative?

The MANTIS is a contender for the ISTAR UAS.

MALE and UAS opportunities

BAE Systems is treating this issue with some discretion and would only say, "We…note Prime Minister David Cameron and President Nicolas Sarkozy's joint statement regarding their intention to collaborate on a future medium altitude long endurance (MALE) unmanned aircraft system (UAS) program and a potential unmanned combat aircraft system. Not only is this an important milestone in terms of the development of our ongoing unmanned aircraft capability, but it represents a significant investment in the future of our U.K. and French military aerospace capability. We actively support this collaborative approach with the U.K. and French governments. Given the strong research and development investment that has already been made in this area by both BAE Systems and Dassault Aviation, we have entered into discussions with Dassault to explore how we could best deliver this opportunity."

The MALE market is dominated by Israel and the U.S.; the new accord gives France and the U.K. an opportunity to enter this growing sector with a combined product. The U.K.'s Ministry of Defence (MOD) Scavenger program entails the identification of a next-generation ISTAR (intelligence, surveillance, target acquisition, and reconnaissance) UAS by 2012, to follow on from the armed General Atomics MQ-9 Reaper in service with the MOD. Potential candidates include the General Atomics Predator C Avenger and a development of BAE Systems' own Mantis technology demonstrator, though the Anglo-French accord now opens the doors for a new European contender.

The treaty addresses two different levels of cooperation—the sourcing of material by the U.K. and French military (which together account for around 70% of the total European defense market) and the development of strategic partnerships between French and U.K. suppliers to reach domestic and global markets.

In terms of the first area of cooperation—acquisition of new equipment by and combined operations between U.K. and French defense forces—the agreement will take the U.K. and France much further than they have been before.

Benefits of pooling resources

With the U.K. military now rapidly downsizing, the need to pool resources with equally cash-strapped neighbors makes economic sense—and not just in terms of saving money. For example, the U.K.'s RAF has ordered 14 Airbus military MRTT (multirole tanker transports), nine of which will be delivered for RAF service, with five leased out to civil or military operators. There will be huge benefits if the MOD can lease spare tanker capacity to a NATO ally, a potential business area currently being discussed between the French and U.K. governments. France is looking to acquire new air tankers by 2015; any shortfall or delay in capability could be met by the RAF as the nine core aircraft are due to be delivered by 2014, with the five others, available for leasing, thereafter.

The U.K. will fit catapults and ar-

Two new treaties will redefine the U.K.'s defense capabilities

Key components of the November 2010 Anglo-French agreement:

•Coordination of the aircraft carriers to ensure that there is always a British or French vessel available for joint operations.

•Creation of a Combined Joint Expeditionary Force training British and French troops to deploy on operations together.

•Development of a new nuclear testing facility at the Atomic Weapons Establishment at Aldermaston and its French counterpart at Valduc.

•Pooling training, maintenance, and logistics resources for the A400M transport aircraft.

•Increased cooperation on satellite communications, cyber security, and the development of new missile systems, submarine technologies, and unmanned air systems.

Key air elements of the U.K.'s October 2010 Strategic Defence and Security Review:

•Defense budget to be cut by 8% over the next four years.

•Retirement of current Harrier close-support aircraft this year—to be replaced by an unknown number of U.S. F-35s in 10 years' time.

•Cancellation of the BAE Systems Nimrod MRA4 surveillance aircraft program.

•Reduction of the Panavia Tornado GR4 strike aircraft fleet from eight to five squadrons.

•Replacement of the Trident submarine-based nuclear missile, but with £750 million savings to be made by specifying fewer warheads.

•Two aircraft carriers saved, but one will not enter service.

It is likely that the British JSF buy will be the F-35C carrier version.

rester gear to its future aircraft carriers so that both countries' naval fighters can fly from each other's naval vessels. U.K. aircraft (Lockheed Martin F-35 Joint Strike Fighters) will be able to access the French nuclear carrier Charles de Gaulle.

The construction of two U.K. aircraft carriers will proceed; that should allow the creation of a "U.K.-French integrated carrier strike group" by the early 2020s. When the two new carriers, the Queen Elizabeth and Prince of Wales, are finally ready to enter service in 2020, the former is likely to be sold or stored and the latter adapted to take the conventional version of the JSF, which will use catapults to take off.

According to the International Institute for Strategic Studies (IISS), "The number of JSFs purchased will be reduced in line with the aircraft decision, and they will be the conventional F-35C carrier version rather than the advanced short takeoff and vertical landing variant, a change which may please the air force but will require that the deployable new carrier is equipped with catapult systems and arresting gear."

There will be further joint service ventures, most notably the Combined Joint Expeditionary Force available "at notice for bilateral, NATO, European Union, United Nations, or other" operations. Combined land and air exercises will begin this year.

But for the second part of the treaty—the closer alignment of U.K. and French aerospace concerns, and what this might mean for aerospace industries of other European countries and the U.S.—the implications are less clear, though the first indications are that this could lead to a new wave of further defense and aerospace consolidation in northern Europe.

The high-level agreement calls for the development of a common defense industry and research policy that aims to cut 30% of the cost of complex weapons systems through a 10-year strategic plan, including the emergence of a single European prime contractor. A combined €100-million minimum annual research and technology budget has been agreed on, to look at critical future areas such as electronic warfare.

A single prime contractor?

The reference to a "single European prime contractor" for complex weapons systems most probably refers to the further consolidation of Europe's missile business around MBDA, which was created in December 2001 after the merger of the main missile producers in France, Italy, and the U.K. The company has three major aeronautical and defense shareholders—BAE Systems (37.5%), EADS (37.5%), and Finmeccanica (25%).

Many in the industry now expect the missile interests of Thales to merge with MBDA. The two are already partners in ventures such as an up-rated version of the Storm Shadow air-to-surface missile fitted to the RAF's GR4 strike aircraft. This would complete the consolidation, for the first time, of virtually an entire aerospace sector into a single European company. MBDA acquired the German subsidiary EADS/LFK in March 2006 and in November 2010 announced an agreement with CIRA (the Italian Center for Aerospace Research) to work on a series of "flying test beds" for next-generation missile technologies.

Further synergies will be sought lower down the supply chain. "There has been for a while an attempt to bring the U.K. and France's aerospace and defense trade associations closer together," according to Derek Marshall, director of policy and public affairs at ADS. "We are now looking to build on this, making the process more systematic. It will also mean looking at how companies further down the supply chain can come closer together.

There have been attempts at this in the past, and we shouldn't underestimate the difficulties—but we need to be more persistent."

Prospects for U.S. business

Marshall does not, however, believe this rapprochement with France will mean the U.K. is seeking to realign its military and industrial links with the U.S. "This is a question of opening up new bilateral activity. What you are seeing is the identification of specific opportunities for cooperation with France. We've been attempting to work together for some time, through a high-level working group, and now this is a step up from that. The U.S. market remains the premier global market and I can't see the attitude of BAE Systems or any U.K. defense company changing directly as a result of this agreement."

The Anglo-French agreement was signed as the final touches were being made to a new Defense Trade Cooperation Treaty between the U.K. and the U.S.—which should reduce the bureaucracy associated with the movement of equipment and information between the two nations.

According to U.K. Defence Secretary Liam Fox in October 2010, "By simplifying export licensing arrangements, the treaty will allow for the better sharing of information and technology." Over the next year new administrative arrangements underpinning the treaty will be trialled on both sides of the Atlantic, opening the door to increasing the number of joint defense and aerospace projects, currently numbering around 140, between both countries.

Given the cutbacks announced in the U.K.'s October strategic defense review, it is likely that, despite the French treaty, there will be more, not less, U.K. defense business for U.S. contractors.

According to the ISS, "The U.K.'s key ally, the U.S., has indicated that it understands the Cameron government's predicament, and seems content that the U.K. will maintain its military commitment to Afghanistan, keep its defense spending above 2%

of GDP (thus setting an example to other European NATO partners), maintain 'full-spectrum' armed forces (including special forces), continue its wide-ranging intelligence collaboration with Washington, and press ahead with modernizing its nuclear deterrent (which is important to Washington because of the U.K.'s financial contribution to its Trident missile program). For its part, the U.K. will become rather less able to conduct independent military operations and more dependent on cooperation with allies. In the first place, this means the U.S."

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It is likely that the countries most at risk from the Anglo-French accord will be Germany, Sweden, Italy, and Spain. If the U.K. and France do cooperate on military aerospace programs to the extent envisaged by the recent treaty, U.K. firms will probably replace the leading aerospace contenders from these countries, working with French companies on common European UCAV, weapons systems, and satellite programs.

Philip Butterworth-Hayes
Brighton, U.K.
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Correspondence

I appreciated your roundtable discussion, **Human rating for future spaceflight** (July-August, page 26), but I was concerned that the moderator, Robert Dickman, seemed to want to focus on a set number for the Probability Risk Assessment (PRA). It should be recognized that even a PRA requirement with a specific number should not be taken as a line in the sand. Failure rates and percentages are easy to manipulate and highly inaccurate.

Panel members Bryan O'Connor and Michael Bloomfield touch upon the real benefit of PRA; that is, to produce the sorted list of failures upon which you can decide where to allocate resources.

Too often both contractors and procuring agencies draw that line in the sand at the requirement number and work on fixing failures above it and accepting failures below it. But often there are failures below the line that raise concerns due to the inaccuracies in the numbers and failures above the line that people are willing to accept.

A PRA is very valuable and should always be performed so that each failure mode and effect can be reviewed to determine which ones should be fixed. Deciding which ones to fix should be the function of an experienced board of reviewers and not based on an arbitrary requirement number. Instead of a PRA requirement, a fail-safe/fail-op requirement or a baseline set of safety design guidelines should be used.

In addition to hardware failures, a good PRA should include software errors (such as initialization), manufacturing errors (such as incorrect torque), operational errors (human error), maintenance errors (incorrect calibration), and errors in training material.

William P. Branch
Fort Worth, Texas

Reply by Bob Dickman I agree with the comment. My intent, as moderator, was to promote discussion—in part by suggesting that setting a PRA "too high" could drive solutions that are either unachievable or unaffordable.

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In the feature **Air Force technology: Changes on the horizon** (November, page 28) it is stated on page 30 that "precise navigation and timing in GPS-denied environments" was deemed particularly important.

In 2009 I posted two documents at www.setterholm.com that solve the problem of coupling a stereo-pair image to WGS-84 (GPS) X,Y,Z coordinates using a fixed 4x4 homogeneous matrix. I conjecture that the mathematics is simple enough to teach to bright 9th graders taking linear algebra 1 after having had algebra 1 in 8th grade.

I call the concept "quantitative Visual Presence" (qVP); Google that phrase and my introductory pdf document is the No. 1 hit. The mathematical derivation is provided in the other pdf document in that subdirectory. Under that subdirectory you'll find sample qVPs of different areas. Once a qVP has been formed, GPS is no longer needed in order to have "coordinated Stereovision."

The whole world has access to qVP spatial mathematics. I predict that, by 50 years from now, qVPs will be in ubiquitous use in many disciplines because of the simplicity, robustness, and connectivity the algorithm provides to both human stereo perception and autocorrelation algorithms. Consider bringing the qVP/coordinated stereovision concept to the attention of your readers.

Jeff Setterholm
Lakeville, Minnesota

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Arianespace: Thirty years and growing (September, page 18) provided very important information about the Ariane launch vehicle. But it failed to mention that the reason the Ariane was created was because European satellite builders were competing directly with U.S. satellite builders, who were the main customers of the existing launch vehicle suppliers such as the U.S. Atlas and Titan.

Since European satellite builders were competing directly with U.S. satellite suppliers, U.S. satellite builders/owners leverage their importance to the companies that launched the Atlas and Titan and have priority in receiving launch dates over European satellite launches.

Len Losik
Failure Analysis

✈✈✈

Correction Authorship of "Futuristic aircraft: Old-fashioned look is only skin deep" (November, page 14) was incorrectly attributed. It was written by Jim Banke, NASA Aeronautics Research Mission Directorate.

A time of transition

WASHINGTON IS IN TRANSITION—ringing in a new Congress with Republicans controlling the House of Representatives and enjoying a larger presence in the Senate. Rep. John Boehner (R-Ohio), speaker-elect of the House, says Washington will be "doing things differently." President Barack Obama says he can work with the changing faces on the Hill.

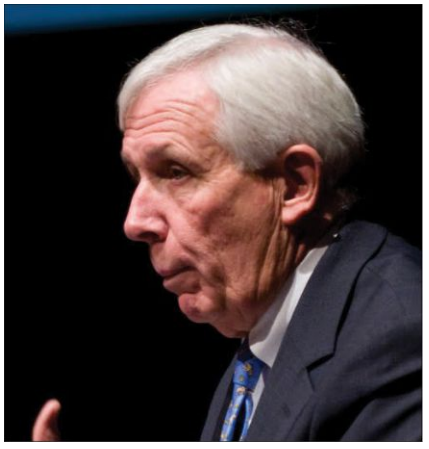
At the turn of the year, many in the nation's capital want cooperation on both sides of the aisle but are concerned over the possibility of legislative gridlock.

NASA's 'interesting times'

The changed mood in Washington could affect NASA's human spaceflight program, which is also in transition. Obama signed the NASA authorization bill in October, fixing policies that will require $19 billion for the agency in the current fiscal year. But Congress must still pass an appropriations measure.

The authorization directs NASA to work with private companies to develop commercial rockets for ferrying people to the ISS. It also directs the agency to develop a heavy-lift rocket to launch astronauts to the asteroids and ultimately to Mars.

Rep. Frank Wolf



NASA Administrator Charles Bolden

Rep. Frank Wolf (R-Va.) will become chairman of the House subcommittee that funds NASA. Wolf, a critic of Chinese human rights policy, criticized NASA Administrator Charles Bolden for attempts to improve ties with China on human spaceflight issues. A long-time incumbent with a constituency in the Washington area, Wolf may come under pressure from a new wave of freshman Republicans who were elected in part on a promise to trim government spending.

One potential target for cost-cutting is the extra STS-135 shuttle flight included in the authorizing legislation and scheduled for next summer. NASA argues that before it can finally retire the shuttle fleet, the flight is needed to support the ISS.

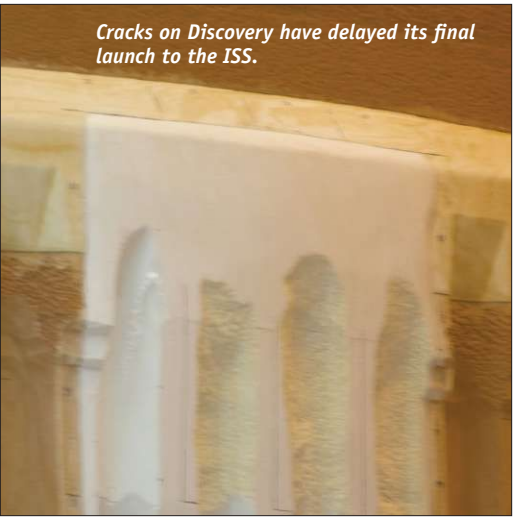
Bolden made a very public appearance at the Orbital Sciences "Mission Control Center–Dulles" event in Virginia on November 12. Bolden said he will push for $300 million in augmented funding for NASA's Commercial Orbital Transportation Center. That funding would in part support Orbital's Taurus II launch vehicle. Bolden told reporters he can see a day when human spaceflight is controlled from the Dulles facility.

In contrast, when Bolden appeared for an all-hands meeting at NASA Marshall, the gathering was off limits to reporters. Workers in Huntsville are uncertain whether their new task of managing the design of a new rocket, rather than simply building one, will keep their jobs secure. NASA and contract employees at the other space centers around the country are evincing similar anxieties.

Observers in Washington say the administration's human spaceflight program lacks focus and could benefit from being branded. "Until now we had what was called the Vision, and it had a name, Constellation," says one NASA insider, referring to the now-defunct plan for a shuttle replacement. Although engineers are still working on components of the abandoned program, the word Constellation is no longer used at NASA. "Just when we need real vision, we no longer have a term to describe the program we're trying to see in our future," says the insider.

Cracked support beams on the external tanks and a hydrogen leak halted the scheduled November STS-133 launch by the shuttle Discovery. As NASA engineers replaced a misaligned seal to plug the leak and contractors sprayed insulating foam over a section of the tank where the cracks were spotted, managers decided the analysis and tests required to launch safely were not complete. Launch has now been postponed to no earlier than February 3.

Six astronauts, led by Air Force Col. Steven W. Lindsey, are preparing for a belated journey to the ISS. Discovery will deliver a storage room for the station as well as a humanoid robot designed to help astronauts with work in space. The NASA authorization bill provides for two further missions—with the final flight next summer—before the shuttle program ends.



Cracks on Discovery have delayed its final launch to the ISS.

Plans for Discovery to become a display artifact at the Smithsonian Institution's Air and Space Museum may be killed by the $28.8-million cost. Neither the Smithsonian nor NASA can afford to move the shuttle to the museum. No announcement has been made as to which museums will acquire the other two shuttles, Atlantis and Endeavour.

[A correction: In the November issue this column reported that the FY11 NASA authorization bill eliminates the Moon as a destination in the postshuttle human spaceflight program. As a reader pointed out, although the administration's program does not include returning astronauts to the Moon, the NASA authorization bill does not preclude it.]

Deficit discussion

Cochairing an 18-member, bipartisan presidential commission on the debt and the deficit are Erskine Bowles, former chief of staff to President Bill Clinton, and Alan Simpson, former Republican senator from Wyoming. Bowles and Simpson want to address the nation's fiscal ills by trimming $100 billion from the Defense Dept., freezing federal salaries, extending the Social Security retirement age, and taking dozens of smaller steps—all the way down to having the Smithsonian charge a $7.50 admission fee. The cochairmen's scheme, available in draft form in early December, would wipe away the popular mortgage interest deduction for taxpayers.

Alice Rivlin, former budget director, and Pete Domenici, former Republican senator from New Mexico, are offering a different deficit-reduction plan that would include a 6.5% value added tax on consumer purchases. Both plans would reduce federal agricultural subsidies.

The proposals generated a lot of discussion in Washington and a little support from Congress, the press, and the public. But both plans appear unlikely to receive serious consideration in Congress or from the administration. Because of their austerity, Rep. Nancy Pelosi (D-Calif.) found the proposals to be "simply unacceptable."

Erskine Bowles and Alan Simpson

The News Herald of Panama City, Florida, editorialized that in the view of some, the draft report from the Bowles-Simpson commission arrived with a "toe tag" attached to it. A CBS News poll shows that 56% of Americans want Congress to concentrate on jobs and the economy. A mere 4% cite the budget deficit and the national debt as important.

The Marine Corps and Italy are the only remaining purchasers of the F-35B.

Greater costs and delays for JSF

The F-35 Lightning II Joint Strike Fighter program is undergoing its third restructuring in two years. Already behind schedule and above cost projections, the F-35 will now be delayed many months more than previously expected. The program is also reeling from drastic cost-cutting measures by Great Britain, including cancellation of the short takeoff vertical landing version. This leaves only the Marine Corps and Italy as purchasers of the STOVL fighter, known as the F-35B. Many in Washington wonder whether the STOVL variant is still viable.

More than any other program, JSF

stands as a symbol of U.S. military prowess and technology. A "fifth-generation" stealth fighter with completely new instruments, avionics, and helmet-mounted cueing, the JSF is a boon to industry. Some 2,443 of the high-performance fighters are slated for the Air Force, Navy, and Marine Corps, with many more going to eight international partners.

In test flights, the JSF "has a lot of power, handles well, is crisp in all axes, and is well behaved," said Lockheed Martin test pilot Bill "Gigs" Gigliotti in an October telephone interview. Compared to the present-day F-16 Fighting Falcon, which pilots find difficult to land, the JSF is "a dream during operations in and around an airfield," Gigliotti said.

But program delays and cost increases are being viewed with increasing seriousness in Washington.

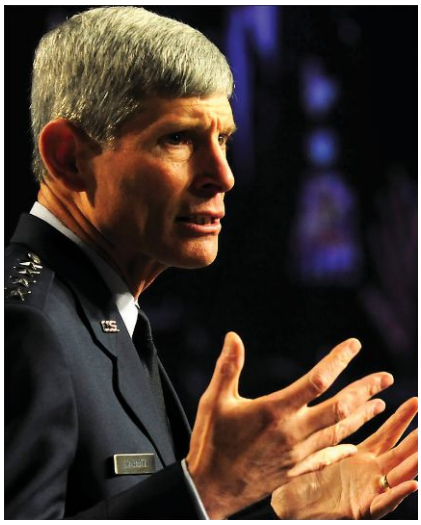
Secretary of Defense Robert Gates received a November 2 briefing telling him that operations and support costs for the F-35 will be rebudgeted at 1.5 times those of the aircraft it replaces, more than twice the original goal, and 50% more than projections that were being made as recently as one month earlier.

The delay is a serious blow to the Marine Corps, which has no alternative to the F-35B. Marines provide the aircraft aboard the Navy's amphibious assault ships. They sacrificed a chance to buy the F/A-18E/F Super Hornet because they wanted to invest aggressively in STOVL.

The latest delay resulted from a need for more time to carry out flight testing and to mature software. Two Air Force JSFs that had been intended for delivery to the 33rd Fighter Wing "Nomads" at Eglin AFB, Florida, in December 2010 will now stay at the factory until April to be instrumented for tests. After that, the two planes will go to Edwards AFB, California, for further evaluation. The wing at Eglin, slated to train JSF pilots and maintainers, is now growing toward full personnel strength but has an empty ramp.

Tanker snafu

An aircraft selection in the Air Force's KC-X air refueling tanker competition, once expected before the end of 2010, is now scheduled for this month.



Air Force Chief of Staff Gen. Norton A. Schwartz

Air Force Chief of Staff Gen. Norton A. Schwartz said on November 23 that he is reassigning two officials who mistakenly sent confidential data to Boeing and EADS about the other's proposal for the 179-plane, $35-billion tanker contract. Schwartz says "just one page" of information was sent. "Instead of receiving information about how the Air Force evaluated the fuel-carrying capabilities of its plane," each competitor "was given similar data on its rival," he adds. The Air Force chief says the mistake will not tarnish the bid process—but others believe the loser in the KC-X competition will now have firm ground for a protest.

Schwartz declined to name the two individuals fired from the tanker program, but he indicated more action would be taken "to hold accountable those responsible for the mistake."

Secretary of State Hillary Clinton

TSA, the public, and the Hill

A backlash by airline passengers was scoring hits on new airline security measures put into effect on the eve of the holiday travel season—but not as many hits as critics had once hoped. On November 14, Secretary of Homeland Security Janet Napolitano appeared at a news conference and defended full-body scanners and a new kind of body pat-down. Napolitano reminded the public, and indirectly lawmakers on Capitol Hill, that just one year has passed since a man attempted to blow up an airliner using a bomb embedded in his underwear. The Transportation Security Administration is part of Napolitano's department.

While many Americans support enhanced security measures, which they see as a necessary shared sacrifice, the measures may come under scrutiny by a new crop of legislators who favor smaller government.

John Pistole, head of the TSA, endured a grilling from the Senate Committee on Commerce, Science and Transportation on November 17. Secretary of State Hillary Clinton, appearing on NBC's *Meet the Press*, said she thought "everyone, including our security experts, are looking for ways to diminish the impact on the traveling public" and that "striking the right balance is what this is about." But Clinton also said that she would not like to submit to a security pat-down. The press attention to the issue brought forth the revelation that members of Congress, cabinet officials, and other Washington bigwigs never undergo security screening.

Outgoing Rep. Pete Hoekstra (R-Mich.) and Rep. Jason Chaffetz (R-Utah) called for profiling as a means for better addressing the threat to air travel. But the issue has not resonated with the public: A planned holiday boycott of scanning machines failed to materialize.

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

JANUARY 28, 1986

AS WE REMEMBER THAT TRAGIC DAY,
AND HONOR THE SEVEN WHO GAVE THEIR LIVES,
WE ALSO REMEMBER THAT EXPLORATION
DOESN'T HAPPEN WITHOUT RISK.

KEEP THE DREAM ALIVE.

AIAA
The World's Forum for Aerospace Leadership

Michel Peters

I guess the pressure is increasing, in the Netherlands as elsewhere, to move increasingly quickly from theoretical research to real applications, to ensure the work you do in the laboratories reaches industry much faster than in the past.

Of course. It is especially important for us in the Netherlands, where we are about fifteenth place in the world on the economic scale. The government ordered a study about four years ago to see how the results of theoretical research could be brought faster to industry. They were quite concerned that fundamental research could be better interfaced with industry, and the vital role for undertaking this work was given to research establishments like NLR.

We are one of the four primary, or major, technology institutes [GTIs in Dutch] in the Netherlands. ECN deals with energy; the second, DELTARES, concerns water management; MARIN undertakes marine and naval research; and then you have NLR, focusing on aerospace research.

One of the specific tasks of these institutes is that we enable fundamental research to move to applied research; we build prototypes to get technology risk out of the research concept and bring it to the Dutch industry. If you look at the turnover of NLR, around 25% is received from the government for high-tech research and the remaining 75% is contracted from industry and government, both national and international.

Because you are tied to industry, how have the economic ups and downs in the market affected your work? Has it changed the products you are interested in or how much money you have available?

About 15 years ago we had the bankruptcy of Fokker, which had a big impact on NLR. But in the end the impact has not been too big. It's a pity that an independent airframe manufacturer was lost, but there are still large parts of Fokker which have remained and they are doing quite well. I think this has something to do with the fact that there is still a very large knowledge cluster in the Netherlands. We have an excellent technical university at Delft, with an important aerospace faculty, and NLR retains its close relationship with industry and small and medium-sized enterprises. A benefit is that the intricate knowledge level of aircraft design is still present.

Among the many aircraft programs you are working on, the Joint Strike Fighter and the Fokker 100 NG [Next Generation] seem to be particularly important to Dutch industry. Would you say they are the two biggest programs for you?

No, but they are important. If you look at the JSF, it's mainly a political decision whether the JSF will be selected—it's a parliamentary decision. In general I can say that when the time comes for the government and air force to choose a fighter aircraft, whatever it may be, Dutch industry should be positioned well to get the revenues out of it, and consequently NLR will support Dutch industry.

What is your biggest program, in terms of financial volume?

There is a variety. The Fokker 100 NG is not yet the biggest program, but we're working very hard on this. The program entails a complete avionics refit, new winglets, new engines, and the integration of the engine with the fuselage. We will also be involved in wind tunnel tests and flight tests during the preparation phase.

The biggest industrial program, indirectly through Dutch industry, would be the work we do for Airbus. This covers a variety of component testing, research into new aircraft materials, and other related work.

The Pplane personal transport is one of the very different programs you are engaged in—a platform you would not normally think of as a logical next step for the industry to take. Why are you doing this?

Despite the economic crisis here, globalization will continue. If that's the case, then mobility and transport demands will grow. When that happens there will be greater demand to improve the quality of travel, and that means multimodal transport options, so when you leave your house there should be a kind of seamless travel experience.

> ***"Despite the economic crisis here, globalization will continue. If that's the case, then mobility and transport demands will grow."***

Do we know when the JSF decision might be made?

In the Netherlands, we have just formed a new government. There is a high-level strategic draft governmental agreement, but a final decision on whether to buy the JSF will not be taken in the period of this government. However, there is an agreement for a second JSF test aircraft to be purchased.

One of the possible means of transport for this may be personal air travel, small personal aircraft, which will allow you to fly directly from your back yard to the airport. These programs will need technical solutions, but the big challenges will be human training and understanding what level of automation you will need in the personal aircraft. It will mean finding the balance between

the capability of the crewmember and the level of automation available. And that's a problem—especially when you want to fly that aircraft in less than benign weather conditions.

The challenge of automation, it appears, is the key to the future for aviation—and not just for Pplane. It seems the real challenge is to map out where we are now to where we need to be, so pilots and controllers are systems managers rather than tactical, hands-on operators. In developing these systems, should we create a grand vision of what it should be like in 50 years and work toward that or introduce automation in a more pragmatic way, as it becomes available?

More automated tools will become available to pilots and controllers on the ground, that's true. But the human will remain in the loop, though more for a monitoring type of task. It's subtle, but important.

A long-term vision, the dot on the horizon as I like to call it, is important, but no one knows what it's going to be, because it's hard to forecast the future. So you look at it and then you make your evolutionary steps. It cannot be any other way. Developing new concepts is one thing, but they need to be integrated into the current system. The concept as such is important, but thinking about the transition is equally if not more important.

So what are the key evolutionary steps toward automation?

The most important, and unexplored, area is a better understanding of human factors. With the personal transport, a relatively unskilled person will have to fly it, which means the balance between the skill level and the level of automation provided by that aircraft needs to be found. This must also be undertaken in combination with the new generation air traffic management systems that will have to cope with all these new small aircraft.

Some of the main challenges are self-separation between two aircraft, how to deal with adverse meteorological conditions, and integrating these vehicles at large airports. Currently, we're looking at airports handling about 36 aircraft per runway per hour, but that won't be nearly enough.

For the challenge of self-separation that's quite close. Given the need to integrate unmanned air systems within civil airspace, we're only a few years away. Do you think we will have the technology available by 2015 or 2016?

The technology is not so much the issue any more. Regulation of the airspace and the role of controllers is more of an issue. I'm not saying the technology is not a problem, but a lot of the technology issues are known. For example, we have conducted a research program called OUTCAST where we equipped one of our research aircraft, a Cessna Citation, as a UAV, with very high resolution electrooptical and infrared sensors. We used them with a high level of automation for target tracking—in this case with air vehicles in the vicinity—to see if it was possible to mimic see-and-avoid operations. The an-

Michel A.G. Peters is currently CEO of the Netherlands National Aerospace Laboratory (NLR). In this role, he leads the primary organization in the Netherlands for aerospace research, technology development, test, and evaluation.

He has held a variety of increasingly responsible positions, both at NLR and at Martinair (now part of KLM). During his career with Martinair, managing the aircraft maintenance department, he was responsible for aircraft maintenance of both Martinair and KLM Cityhopper. At NLR he managed an avionics technical department, then managed NLR's Aerospace Systems and Applications division and NLR's Air Transport division before becoming CEO on January 1, 2010.

Peters is chairman of the Association of European Research Establishments, a member of the Advisory Council for Aeronautical Research in Europe and the DLR-NLR Joint Executive Board, chairman of the German-Dutch Wind Tunnels, and a member of the Netherlands Aerospace Council. He holds various other national positions in government and industry advisory bodies in aerospace, defense, and security.

Born in Rotterdam, Peters is a graduate (BS) of the College of Electrical Engineering, with a specialization in computer science. In addition he earned an MS. in 1987 from the Delft Technical University in electrical engineering with a specialization in avionics engineering.

NLR is an independent, not-for-profit organization that carries out contracts for aerospace customers from government and industry. It owns advanced research, development, testing, and evaluation facilities, including mission simulation and verification facilities, wind tunnels, and a secure networked computing infrastructure. NLR also carries out demand-driven long-term research programs under the auspices of the Netherlands government.

swer was "yes." It's not simple, but real flight testing over four to five years has shown it's possible.

Has that work formulated any new thinking among regulators?

Yes. Our civil and military aviation authorities were part of that experiment, which increased their knowledge of flying aircraft in segregated airspace. When it comes to certifying these UAVs, a lot of the work has focused on the aircraft—but that's not good enough. At NLR we have been very active in the ATM field, with respect to airspace simulation models, where we simulate in real time new airspace concepts, including arrivals like continuous descent approaches (CDAs) and departures.

The demand of the ATM system is not just safety, but overall capacity, coordination with military, flight efficiency, improved environmental performance. We have these huge research programs in place such as U.S. NextGen and SESAR [Single European Sky ATM Research], but I wonder whether we are really going to see the benefits in the next five years from all the billions of euros we are investing in the research.

I think so. SESAR and NextGen are huge programs. If you look at the current European airspace, there are around 600 sectors, so when you fly from southern France to Amsterdam you have to pass through more than 10 of these. Even though the U.S. has a larger volume of traffic than Europe, the costs per flight in the U.S. are around half of that of Europe.

In addition to SESAR are functional airspace blocks [airspace managed by multinational consortia of air navigation service providers]. This will lead to more direct routes and better coordination between military and civil users, and this will certainly benefit safety and capacity and lessen the environmental impact.

But that's changing what's already there. What about the next generation of ATM technology, to allow for large increases in numbers? We will need to increase the number of aircraft a controller can handle at any one time—currently around 20—so what technologies are you working to increase this volume?

"The idea is, in general, that we have one complete real-time system providing all relevant information of all aircraft to all actors in the European ATM network."

With more direct routings, you have another class of airspace. NLR is looking at automation systems assisting the controller to handle more traffic while increasing safety levels. It will take some time, certainly more than five years, before we see a change in the controller's role from controlling to monitoring. Some of that automation has shifted to the aircraft itself, to systems such as airborne separation assurance systems (ASAS), which NLR has flight tested.

A second area for us is improved airport operations. At Schiphol airport, a very large airport lying in a highly populated area, we are working on CDAs where we have done a variety of national programs with our own and KLM aircraft. We've also undertaken work on automating highly accurate departure routes.

What improvements have you seen?

Less noise and higher fuel efficiency. We are looking at a new departure procedure where the aircraft accelerates earlier and at a lower altitude, with earlier retraction of flaps and slats, with the aim of reducing fuel burn and noise.

We are also in discussion about merging civil and military airspace, which is especially important when you're flying through the southeastern part of the Netherlands to Germany, when you have to extend your route by 10-15% to avoid flying into military airspace.

Many of these are changes in procedures rather than core technologies, for example, systems that automate flight plan processing and correlating this with radar data to increase the number of aircraft a controller can handle at one time.

One of the programs we have undertaken has been to provide real-time meteorological information to the flight deck. The aircraft has weather radar, but this has only a limited range. What the pilot would like to see is the actual weather all the way along the route. Around two years ago we undertook a trial with one of our aircraft on a flight from Paris to Amsterdam, using ground stations to provide exact meteorological information on weather along the route, uplinked directly to the flight deck, giving the pilot an excellent overview of what he or she could expect.

This will happen—it will be normal technology in a few years' time. The technology is now available, but it will be up to the operator to purchase it or not. It greatly improves safety, capacity, and, of course, the comfort of passengers..

Hypersonic air travel—is it now off the agenda?

No, but it is long term. I think that progress on this will be evolutionary, perhaps through "recreational aviation" such as space tourism. I think space tourism will be the starter for that type of activity because, from a technological standpoint, there are still things to conquer—propulsion and reusability of the aircraft. I notice there are a lot of private initiatives for spaceports. Some will fail, but some of them will succeed. It will take place in the long term.

But how far away are we from hypersonic travel?

I think it will take a long time. The U.S. is working on ramjets, but with respect to safety levels, there are major challenges. If you look at the current rate of catastrophic equipment failure it is about 10^{-9}, or one failure per billion flight hours. When the public wants hypersonic flights, they will insist on the same levels of safety.

For many, the focus for aerospace has changed from speed to integrating aviation into a sustainable transport system. With personal transport and hypersonic vehicles you are going against the political demands of society for aviation to be primarily sustainable. How do you merge faster, more personal transport systems and the wider demands of society?

Within air transport there are three core elements—capacity, safety, and environmental impact. Those are the parameters you can play with. Of course you can increase safety levels by grounding all aircraft, but that doesn't help with respect to capacity.

I think with true innovation you can increase both capacity and safety while reducing environmental impact. If you look at the environmental impact—emissions and noise—then in the reduction of perceived noise levels from engines and airframes, there are still large improvements to be made. We're working on this.

But we are also looking at what kind of fuels we will need in the future. If I am correctly informed, in about 50 years fossil fuels will be depleted. One of the biggest challenges now is the development of so-called "drop-in fuels," which we can use on current technology engines, with the same specifications as current fuels but, for instance, based on biomass to extend the period until the fuels will be depleted.

We're looking at new ATM procedures and technologies, faster ascents, engine technology—as part of wider European programs like Clean Sky—and the safety culture of operators.

With respect to safety, we are undertaking more fundamental research into human factors, not merely relating to the man-machine-interface but more to "shared mental models," to understand how teams work together. Shared mental models are the shared knowledge structures, for instance, of pilots that they use during work. This is more than cockpit resource management. In addition, it is also looking in detail at the interaction between air traffic controllers and flight crew. That's really something new. If you really can understand how people's minds work, then you can start to improve training and thereby safety levels.

What have you been able to achieve in Europe through collaborative research rather than working at just a national level?

We face huge challenges. We don't know which are the most promising new propulsion types or new fuels and new materials. It's such a vast terrain, we have to collaborate. No one nation in Europe has the money or resources to do it by itself.

But what areas has NLR decided to specialize in?

Knowledge management is a big issue for us. We have made a taxonomy of 12 knowledge areas that we are pursuing, ranging from ATM research through aircraft safety, aerodynamics and so on. There are, furthermore, three areas we think are extra important—new materials, environmental issues, and aircraft safety.

"If you really can understand how people's minds work, then you can start to improve training and thereby safety levels."

What has been the result of your work in new material research?

This stems from the work we did when Fokker was still building aircraft. The company was one of the pioneers in bonded materials, invented by Fokker in close cooperation with NLR and the technical university of Delft. As a result of this work a new type of material was invented, glass-reinforced fiber metal laminate, or GLARE, which has been quite a success, with a large part of the A380 built from it.

But I haven't seen a GLARE application since the A380.

Boeing decided on a fully composite fuselage [for the 787]; the A350 is still not decided. We are doing additional research into GLARE, a higher strength version, and are planning research programs to develop affordability initiatives for it. But in parallel, we are also looking at composites with respect to the material itself—manufacturing, durability, and reparability—which is really new. The reparability of composites is a particular issue because the material is made of several layers, and if you have damage on the outer layer normally you don't see it on the inside. That's a real problem.

Last but not least, we are also researching life fatigue monitoring. We're currently embedding sensors into the material that continuously measure stress on a specific part of the airframe.

What results have you had?

We have done this mainly for our military customers. All military aircraft are now equipped with small sensors that measure stress on the airframe. Based on that raw data, we provide information to the air force that they use for fleet planning.

With respect to maintenance, this has decreased the cost of maintenance and increased the availability of aircraft. Reduction of maintenance costs is important, but knowing exactly if the aircraft is available is of the utmost importance for a military aircraft.

Do you think in the future we will be able to move the successful results of theoretical research more quickly into the market?

The speed of introduction has something to do with the maturity of the technology, but that's not the only parameter. It's sometimes quite easy to develop in an experimental environment a new concept and to test it relatively quickly in a research aircraft. But when it will be implemented it can only be enforced by ICAO [International Civil Aviation Organization] or by means of government mandates. TCAS [traffic collision avoidance system] was first invented in the mid-1960s but only finally mandated in 2004. Technology is not the only limiting factor.

ISS: A decade on the frontier

THE INTERNATIONAL SPACE STATION is our lone toehold on the frontier of deep space. Sometime after 2020, NASA astronauts may venture again beyond the confines of LEO, perhaps to an asteroid, perhaps to chase other nations to the surface of the Moon. But for the next 10 years and beyond, as it has been since November 2000, the U.S. destination in orbit will be the ISS, humanity's classroom for human spaceflight.

The ISS was born on December 7, 1998, when the first two modules were joined by the STS-88 shuttle crew. The Expedition 1 crew took up residence on Nov. 2, 2000. On October 25, 2010, the ISS surpassed Mir's 3,644 days as history's longest continually inhabited space station. As of last November, more than 196 individuals have visited the ISS, including seven private space travelers.

When I floated aboard in February 2001, the three-person crew already had far more elbow room than the shuttle; today, the station's work and living spaces are the equivalent of a five-bedroom house. Amenities include two bathrooms, a gym, and a seven-pane "bay window" (the cupola) with a breathtaking view of Earth 220 miles below.

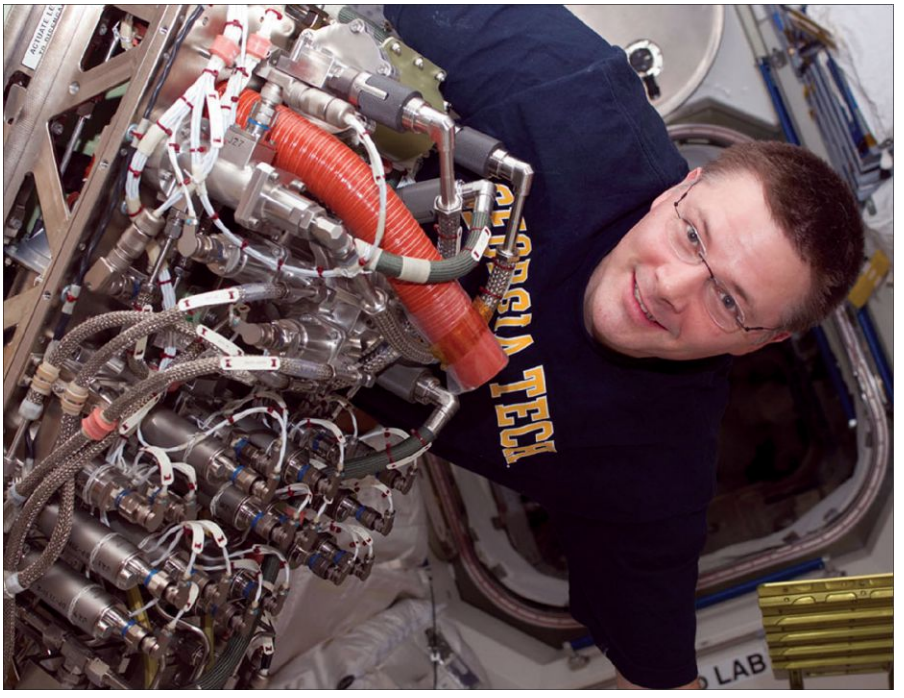
Who's in LEO?

The ISS crew complement expanded from three to six in May 2009. Its current residents (as planned at press time) are the astronauts of Expedition 26: Scott Kelly (commander), Alexander Kaleri, Oleg Skripochka, Catherine Coleman, Dmitry Kondratyev, and Paolo Nespoli. The latter trio was due to arrive on December 15, 2010, and will stay aboard through May 2011. With delivery of the permanent multipurpose module Leonardo on Discovery's final flight, the ISS will expand to 12,000 ft^3 of pressurized living space. The last planned pressurized addition is the Russian Nauka multipurpose laboratory module, scheduled for arrival late this year.

NASA marked the 10-year crew presence milestone with November ceremonies. Peggy Whitson, NASA's chief astronaut and, on Expedition 16, the station's first female commander, noted:

"To have constructed something on orbit greater than a football field in length, with more internal pressurized volume than a 747, with parts and pieces and participation from 15 countries around the world, full-time 24-hour/7-day-a-week operations, and human presence for 10 years, fills me with an incredible sense of pride in what our organization can accomplish."

In the Tranquility node, NASA astronaut Doug Wheelock, Expedition 25 commander, works to install the new Sabatier system that will extract more water out of the ISS atmosphere.



Shift to science

That achievement is visible regularly in the evening or morning sky as a brilliant star traversing the heavens [see http://spaceflight.nasa.gov/realdata/sightings/]. The station's truss—its structural backbone—spans 108.5 m (about 0.75 acre), supporting the four immense but delicate solar arrays that generate most of the outpost's power. Much of that electricity will help the ISS achieve its original purpose, scientific research.

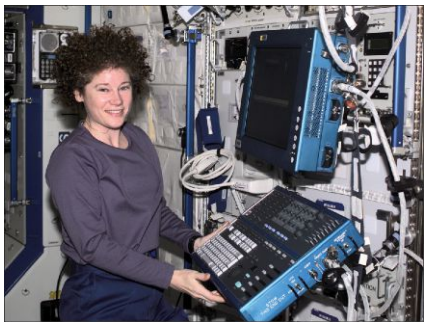
Col. Timothy J. "TJ" Creamer, who worked aboard the station on Expeditions 22 and 23, said in an interview that "It was a privilege and a blessing to have served on the ISS on the cusp of its career. During my tenure there, construction was nearly completed, and ISS was shifting from its assembly phase to utilization."

In its first decade, the orbiting laboratory has supported more than 600 experiments in the unique, nearly zero-gravity environment. ISS communication resources give researchers and engineers continuous access for fine-tuning their investigations. Between now and 2020, the research facilities will support not only fundamental science investigations, but also trials of promising exploration technologies.

NASA and its partners are currently using the research facility for long-planned experiments in the three laboratories: the U.S. Destiny, European Columbus, and Japanese Kibo. In the past decade, 59 countries have been involved in research in disciplines as varied as the physical sciences, life sciences, planetary and Earth science, heliophysics, and astrophysics [see www.Nasa.gov/iss-science/]; for example:

•The smoke aerosol measurement experiment found that burning spacecraft materials in free-fall produced soot particles 50% larger than those in terrestrial cabin fires. Studies of smoke propagation identified inadequacies in current spacecraft smoke detector technology, with a goal of improved astronaut safety.

•The Kibo-mounted MAXI (monitor of all-sky X-ray image) experiment uses highly sensitive X-ray slit cameras to survey for energetic sources like neutron stars and black holes. On September 25, the instrument discovered a new stellar nova whose



Astronaut Susan J. Helms works at the Human Research Facility's ultrasound flat screen display and keyboard module in the Destiny/U.S. Laboratory.

center likely harbors a black hole. Astrophysics research will take a major step up when the massive alpha magnetic spectrometer arrives in early March, searching for energetic atomic particles linked to the cosmos' dark matter and energy.

•Astronauts were trained in orbit to use the advanced diagnostic ultrasound in microgravity (ADUM) experiment, testing new guiding methods to obtain rapid, accurate diagnostic ultrasound images. The space proven techniques have found application on Earth in remote diagnoses everywhere from Mt. Everest to Inuit maternity clinics.

•The nutritional status assessment study has demonstrated that ISS astronauts, living indoors under artificial lighting for months at a time, are deficient in vitamin D. Resulting vulnerabilities may include depression, chronic fatigue, weight loss, diabetes, heart disease, stroke and osteoporosis. The study also showed that adding omega-3 fatty acids to space food counteracted bone loss, a finding since confirmed by ground-based cellular studies and bed-rest results.

If on-orbit diet supplements can protect against bone loss, they may eliminate one of the major challenges of extended deep space voyages, as well as aiding osteoporosis patients back on Earth.

•ISS investigations since 2008 into microbial gene expression and virulence have revealed that pathogens like the common salmonella bacterium become more virulent in free fall. The resulting insight into the genetic trigger of this effect has led Astrogenetix to investigate a candidate antimicrobial drug.

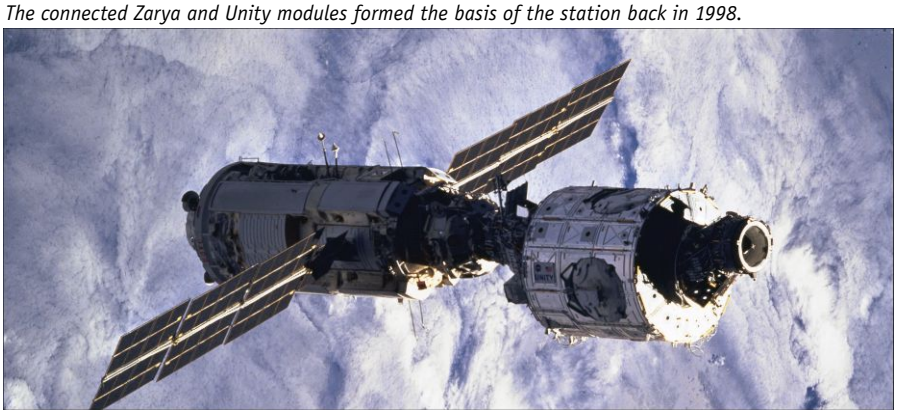
•AiroCide TiO_2, an air purification technique developed for the station's onboard mini-greenhouse, has demonstrated the ability to remove anthrax spores and similar pathogens from indoor spaces like mail handling facilities.

The space station is now engaging the imaginations of future explorers. Already, over 31 million students have viewed educational demonstrations conducted by ISS crewmembers, with 900,000 participating directly in research projects aboard. The careers of some of these aspiring scientists, engineers, and astronauts might one day take flight thanks to the ISS. In the Apollo era, students like me were captivated but passive observers of events unfolding on the Moon. Today, young experimenters can interact with crewmembers and researchers on Earth and aboard the station, participating in the process of scientific discovery.

During Expeditions 25 through 30, astronauts working in the three labs of the U.S. orbital segment will conduct 333 scientific investigations; Russian cosmonauts will operate experiments in the Poisk and Rassvet research modules farther aft. About a thousand scientists have been involved to date in ISS research.

An international panel of research

The connected Zarya and Unity modules formed the basis of the station back in 1998.



advisors recently cited the ISS characteristics attracting potential users: continuous access to microgravity, with gravity as a controlled experimental variable; high vacuum and conditions to create ultra-high vacuum; continuous presence in space for long experimental runs and cumulative results; and significant power and instrument support for geophysical and environmental observations from LEO, with an orbit covering over 90% of Earth's populated surface.

An STS-132 crewmember aboard Atlantis captured this view after the station and shuttle began their post-undocking separation.

Exploration testbed

"We're now looking ahead to using the ISS as a platform for teaching us how to get to Mars," says Creamer. "We must extend this platform's original purpose from pure research to help us take on the challenges of deep space exploration. We can use the ISS as a testbed, incorporating challenges like communications delays, onboard autonomy, and new technologies like life support."

Other technology areas include crew health systems for exercise and radiation protection, advanced solar power systems, propulsion innovations, new spacesuits and mobility gear, inflatable habitats, and handling of planetary "ores" for space resource utilization.

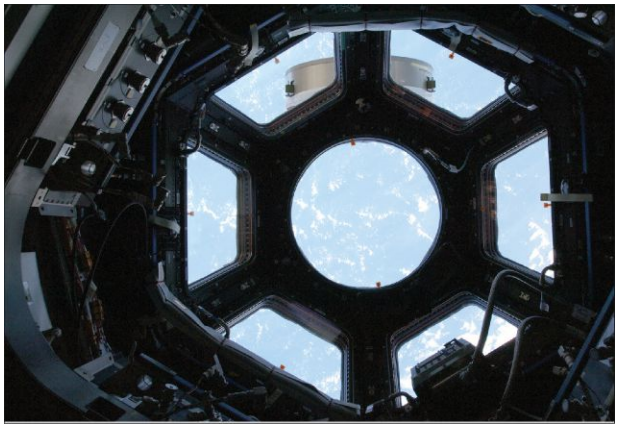
One example of such exploration-driven experiments was the October activation of a water-generation system that recycles two ISS waste products. Hamilton-Sundstrand's Sabatier reactor, installed in the Tranquility node, combines hydrogen released by the station's waste-water-to-oxygen system with carbon dioxide exhaled by the crew to produce water and methane gas (CH_4). The water is purified for crew use while the methane vents overboard. The 530 gallons of water generated annually will further close the life support loop, and reduce water demand even as the era of shuttle-supplied water ends.

The crew and flight controllers will work together on simulations to mimic operations during a deep-space voyage. "ISS is a great analog for the Mars transit phase" of an interplanetary mission, says Creamer. Controllers will introduce communications delays caused by extended light-travel times, and the crew will do without real-time interaction with the ground. These exercises should point to command, control, and planning software needed on extended deep-space missions.

A steady stream of exploration testing should follow these first steps aboard the station. The astronauts should check out a new generation of more flexible, comfortable spacesuits. Meteoritic and lunar materials should be fed into resource extraction processors operating in free fall. And lunar rover designs derived from Constellation may evolve into free-flying spacecraft like NASA's space exploration vehicle, to be tested at ISS before ferrying astronauts to the surface of a near-Earth asteroid.

Astronaut guinea pigs are still in demand, too. Creamer notes that "Our return to Earth from the station gives us a chance to explore ways of getting a crew back on their feet in a *g*-field and working efficiently after arriving on the surface of a new planet. We have to deal with re-adapting the inner ear, muscle tone and mass, and strength and coordination to working well in gravity again." He recalls that after landing "it took me about five days to be able to walk a straight line again, and two to three weeks before I considered myself fully competent at driving."

Developed and built by Thales Alenia Space in Italy, the cupola is a spectacular technological, robotized control room that allows the astronauts to see and work through seven windows, looking out 360° around the ISS.



Space station 2020

President Obama's FY11 budget proposes funds to support NASA ISS operations through 2020, in keeping with a goal endorsed last year by the ISS partners. They also agreed to examine the technical and programmatic feasibility of extending the ISS's life through at least 2025.

The station may not be alone in LEO by then: two Russian companies have proposed a commercial space

Parts of Europe and Africa are easily recognizable in this nighttime image shot by one of the Expedition 25 crewmembers flying 220 mi. above Earth.

Canadarm2 grapples the Leonardo MPLM from Discovery's payload bay for relocation to a port on the Harmony node of the ISS.

station, to be launched in 2016, and Bigelow Aerospace plans to use its inflatable Sundancer and BA330 modules in constructing a platform to host tourism and industrial activity sometime after 2015.

NASA hopes the ISS has at least 15 years of useful life ahead. When structural or systems degradation leads to its abandonment, safe disposal will be neither simple nor cheap. The station's small maneuvering engines, even with added thrust from a docked Progress cargo/tug, do not have enough fuel to guide the 900,000-lb hulk into the Pacific. A purpose-built deorbit module will cost hundreds of millions of dollars to launch and dock; an additional cost will be the embarrassing visual of dumping the $100-billion station into the ocean (with many systems still functioning). Such a denouement will be a distinctly unpleasant option for NASA and space policy makers.

A far more attractive plan is to repurpose those still-valuable components and fold them into NASA's exploration infrastructure. Laboratories or life support modules could serve as crew living space on a deep space vehicle; the 358-ft truss might support a future propellant depot or transportation node at the Earth-Moon L1 Lagrange point. Alternatively, salvaged structures might form the nucleus of an assembly garage where deep space vehicles might be constructed and checked out.

In all such proposals, the salvage value of the orbiting hardware must exceed the cost of propellant needed to shift it to a new orbit, or to launch additional support components.

Taking stock of the station

Whatever its ultimate function, the space station's current challenge is to deliver a high-profile return on the tens of billions of dollars invested in its development and construction. Already the ISS has delivered valuable lessons on international cooperation and operations, and forged partnerships that have withstood disaster aloft and shifting geopolitical winds on Earth. But to truly realize its promise, early hints of promising discoveries from the three ISS laboratories must swell into a steady stream of productive research results.

For at least the next five years, ISS will be the sole focus of the agency's human activity in space. NASA has a window of opportunity to shape the public perception of the station's value through a solid record of scientific achievement. If NASA can deliver on its research strategy of providing new scientific knowledge, new exploration technologies, and new products and processes that pay off on Earth, we may judge ISS to be a success long before 2020. But if another decade of research proves irrelevant to improving life here, or is incapable of vaulting humans into deep space, then the space station will likely be NASA's last large venture into human spaceflight.

The NASA of the 1960s had Apollo. Today's agency has the international space station, and can make the ISS an indispensable waypoint in the economic development and scientific exploration of space. It can provide engineers, scientists, and managers the experience needed to project a human presence beyond LEO, to the nearby asteroids, to the lunar surface, and eventually to Mars.

But before it can reach beyond LEO, NASA must deliver on the station's promise. From its ambitious inception through its tumultuous development, the ISS has demanded much treasure, and more than two decades of dedication and personal sacrifice from the designers, operators, and crews who built it and made it their home. The station today is a monument to successful engineering, and a triumph of international collaboration. Matching that achievement with scientific excellence and practical results will demand the same intensity of purpose.

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A global safe haven, for now

Aircraft survived the world economic crisis in better shape than any other industry. In 2009, the industry actually grew by 7%. In 2010, deliveries fell by 4.4%, but all told this is arguably the only industry in the world to finish 2010 delivering more product than when the crisis began in 2008.

With the world economy recovering but still experiencing relatively slow growth, the aircraft industry offers a unique combination of safety and long-term growth. However, it still suffers from patches of weakness, and there are risks moving forward in several key market segments.

The jetliner miracle

Today, two years through the great recession, jetliners remain the single brightest spot of the commercial economy. Production continues to rise at both prime manufacturers. Orders in 2010 look set to match deliveries, and the backlog remains above 6,500 aircraft for Airbus and Boeing alone. Boeing jets represent nearly 2% of all U.S. exports.

The primary reasons for this phenomenal performance in the face of broader economic pain are strong emerging market demand and persistently high fuel prices, which make newer equipment more desirable. Government support has played a key role as well. This has taken the form of export credit finance, as well as increased demand from government-owned airlines. Government-owned institutions such as sovereign wealth funds play an increasing role in jet finance as well.

Another important factor behind the strong jetliner sales and production is a growing appreciation for them as financial assets. The most common aircraft, Airbus's A320 and A330 and Boeing's 737-800 and 777-300ER, for example, are quite appealing to investors.

Of course, two defining characteristics of today's slack economy are a lack of good investment opportunities coupled with a strong dislike of risk. The result has been very strong, almost excessive demand for safe assets such as U.S. government debt. Jetliners fall under this category, too. Lessors have successfully attracted funds from investors looking for safe places to put their cash, such as popular current-generation jets. Through November, 145 of Airbus's 369 orders for 2010 came from lessors. Of Boeing's 480 orders, 152 are from lessors.

In short, we could be seeing a very high level of jetliner output because people with money have no better places to invest it. If investment opportunities elsewhere return with renewed global growth, and if the cost of capital increases with better times, the current fashion for jetliner investment might diminish.

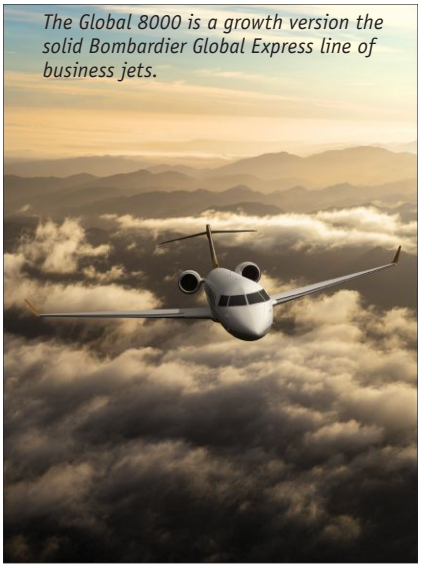
Still, on the strength of the backlog and market fundamentals, we see very little risk of jetliner market softness in the next few years. While we do see a 3.8% drop in deliveries in 2010, this is due to three highly program-specific matters. For one, because of delays with the 747-8, this will be the first year since 1969 to not see any 747 deliveries. Second, Boeing had announced a 777 rate cut, but this will rise again in 2011. And finally, Airbus's A340-500/600 looks set to end production after a relatively brief and unpopular career. Every other jetliner program will enjoy equal or greater numbers compared with 2009 output.

The popular A330 and Boeing 777 are appealing choices for investors.

Bizjet bifurcation continues

The second half of 2010 provided confirmation of a key structural change in the business jet market. The mas-

The Global 8000 is a growth version the solid Bombardier Global Express line of business jets.



sive bifurcation between the two halves of the business jet industry continues to transform the market's structure, and has inflicted considerable pain on several key players.

Historically, the business jet market could be split in half by value. The top half consists of jets costing $25 million and more (in 2010 dollars). The bottom half consists of jets costing less than $25 million. In 2009, the bottom half fell by 42.8%, while the top half fell by just 4.1%. In 2010, the top half fell an additional 7%, but the bottom half fell an additional 17.8%, bringing it down to about 60% off its 2008 deliveries peak. This represents the worst decline of any aerospace market in the present downturn. It was worse than the decline suffered by the majority of world economic markets.

Two years into this downturn, it is clear that the market continues to favor top-end aircraft. Pricing in this segment has generally held up better than in the lower and middle segments. Anecdotal information points consistently to a generally healthier sales outlook for the top-half jets. High-end jet utilization (defined by the FAA as long-range jets) held up better in 2009 than for smaller jets, falling by just 15%, compared with 19% and 20% for the short- and medium-range jets respectively. Used aircraft availability numbers reflect this as well. As of October, just 10.1% of heavy jets were up for sale, compared with 14.5% for medium jets and 16.6% for light ones.

The Gulfstream order book is looking better now than it has since the downturn on 2008.

The two key players in the bottom half, Cessna and Hawker Beechcraft, have suffered grievous losses. They have seen their businesses drop precipitously. In the interim, a powerful new competitor, Embraer, has entered their segment, aiming at taking market share at the very moment that the legacy players can least afford to fight back.

Both Cessna and Hawker continue to cut products and employees. Although macroeconomic indicators such as corporate profits look strong enough to imply an upturn in 2012, there is every likelihood that 2011 will represent a third year of pain.

Meanwhile, the companies at the top of the market continue to enjoy a reasonable level of prosperity, and are aggressively pushing ahead with new product development. According to Gulfstream, the company booked more orders in the third quarter of 2010 than in any quarter since the downturn started in mid-2008. In November, the company said it would spend $500 million on plant expansion and add 1,000 jobs in its Savannah, Georgia, facility to meet a growing market for large-cabin aircraft. Similarly, its rival Bombardier announced in October that it was launching its Global 7000 and 8000 growth versions of its high end Global Express product line.

The Tornado fleet may be retired much faster than expected.

Clearly, the bifurcation of the business jet market looks set to induce a notable structural change. What was once the top half of the market by value will from now on be the top 60-65%.

Defense: Collapse or plateau?

The U.S. and Europe are currently preoccupied with defense cuts. The massive increase in government debt and budget deficits has emboldened fiscal hawks on both sides of the Atlantic. Yet as with many other aspects of the government spending debate, Europe is actually acting on budget cuts, and the U.S. is not.

Despite the fear and hype, the FY11 U.S. defense budget is at a record level, and the cash provided by this will be trickling through the defense industrial base through 2012 and 2013. There have been no major program cuts, aside from the long-awaited termination of the Lockheed Martin F-22 and the VH-71 presidential helicopter. While a downturn in combat operations in Iraq will reduce the weapons support budget, there is little likelihood of a serious cut in weapons procurement for the next few years, at least.

However, it is notable that voices in favor of some limited defense cuts

COMPOUND ANNUAL GROWTH RATE

Market	2008-2009	2009-2010	2010-2015 (Forecast)
Large jetliners	13.5%	-3.5%	2.4%
Business aircraft	-24.3	-14.2	7.2
Regionals	-5.7	-21.7	4.6
Civil rotorcraft	-12.5	-18.4	7.9
Military rotorcraft	32.0	10.5	3.8
Fighters	20.5	6.6	3.2
Military transports	15.5	-2.0	3.8
Total	**7.0%**	**-4.4%**	**3.6%**

can now be heard on both sides of the political aisle. Even Republicans like Sen. John McCain are talking about the need to reduce defense spending. However, any discussion of specific cuts is hard to find.

One exception, however, is the Simpson-Bowles Fiscal Commission. This bipartisan deficit reduction study group has recommended a number of cuts throughout the federal budget, but two aircraft in particular have been singled out for attention. If the commission's proposals are accepted, V-22 Osprey procurement will end in a few years at 288 aircraft. F-35A procurement will be slashed, while the F-35B short takeoff and vertical landing version of the JSF will be canceled outright.

Yet even if these programs' many champions lose the fight, the commission is still recommending procurement of legacy systems as an alternative. Even if the V-22 and F-35 were cut, the Sikorsky MH-60s, Boeing F/A-18E/Fs and Lockheed Martin F-16s would gain.

In the interim, European governments have been far more aggressive in cutting their already truncated weapons programs. This is largely due to the more pressing nature of the eurozone crisis. The U.S. faces long-term challenges, but many eurozone countries are feeling pressured to cut their deficits immediately.

One problem with the European defense spending trends is that they fund systems today, but they jeopardize the future with very severe cuts. The best example of this is the U.K. RAF's fighter plans. The Ministry of Defence is now short £20 billion to pay for equipment over the decade. The RAF will still take delivery of Eurofighter Tranche 2s and 3As because those aircraft are under contract. But the legacy fleet of Tornados will likely be retired much faster than originally expected, and Eurofighter Tranche 3B will be cancelled. With this plan, the Eurofighter program will wind down in 2015/2016.

In all, in a few years we will see a day of reckoning for European military aircraft contractors. Unless something changes in its home markets, or unless it wins the key India medium multirole combat aircraft (MMRCA) competition, the last Eurofighter will be delivered in about five years. Rafale might make it to 2019. The last Gripen might be delivered in the next year or two. The last European military plane of any note might be the A400M military transport, assuming it survives the budget cuts.

This budget-cutting strategy also jeopardizes Europe's standing in the export market. If the home market retires airplanes, it does not develop upgrade and support packages for them. This basically puts export customers on notice: They might be buying a plane that turns into an orphan faster than expected. And killing the line means the time available to search for export customers is running away fast.

With the U.S. market flat or declining and European companies hobbled by weak home markets, U.S. defense primes are starting to focus on international customers. With a combination of faster economic growth rates, high resource prices that help grow government budgets, and ongoing geopolitical tension, key markets in the Mideast and Asia look set to place record orders for U.S. and European equipment.

A good example of this is the recent Saudi arms package, worth about $60 billion. It includes the largest single export fighter buy of the past 30 years, covering 84 Boeing F-15s. The India market is also ramping up. In addition to the MMRCA competition covering another record fighter buy (126 planes), in November India signed for 10 Boeing C-17 airlifters. This means the C-17 has joined the F-15 and F-16 as military aircraft programs that are being kept alive entirely through export contracts, a testament to the strength of international markets and the global market standing of U.S. contractors.

The best part of the defense market has been the rotorcraft segment. While the civil side of the business fell by 12.5% in 2009 and another 18.4% in 2010, the military side has grown by over 40% since 2008. This is primarily due to worn out fleets that need replacement and the combined impact of several key programs ramping up to full production.

Also, helicopters are one of the only tools of war with broad utility in all three major military applications: traditional warfighting, counterinsurgency, and nationbuilding/peacekeeping. And despite the civil dropoff, in the mid and long term, civil helicopter sales will be boosted by emerging market demand. Sales to China and India have been extremely strong in recent years, helping to double the civil market's value between 2004 and 2008.

In all, the outlook for both the civil and military aircraft industry is quite strong, despite some areas of weakness and risk. Our forecast for the next five years is for a total market expansion at a 3.6% compound annual growth rate (CAGR). This is somewhat weaker than the 7.5% CAGR expansion enjoyed by the industry in 2003-2009. Then again, the industry avoided any kind of serious cyclical downturn during the worst economic recession since WW II.

Richard Aboulafia
Teal Group

In the U.S. defense segment, procurement of the V-22 Osprey may end early; however, this could be good news for the MH-60.

RF electronic warfare: From cold war to network invasion

Surprisingly, the highest growth rates in defense electronics over the next decade will be in electronic warfare (EW). In a major turnaround from the past two decades, EW will offer many of the best opportunities for both market growth and value.

This is perhaps not so strange when the U.S. again faces real threats and real casualties; as in the Vietnam War, funding has turned to EW. Intelligence, protection, and connectedness will grow faster than direct shooter electronics over the next 10 years. Some post-cold-war needs are only now being addressed, with several new programs aimed at the upgrade or replacement of legacy analog systems. One specific area of growth is radio frequency (RF) EW. (The discussion below does not focus on Joint Strike Fighter systems, which were covered in an earlier column.)

EA-6B Prowler

Radar systems add PLAID

Radar warning receivers (RWRs) have been a vital component of the combat aircraft EW suite since WW II, especially for fighters and fighter-bombers, which must detect and counter multiple ground and air radar as well as radar-guided missile threats. RWRs have been mounted on nearly every modern fighter in recent decades. Because of this long legacy, today's fighters often still serve with systems procured during the cold war. Some of these older systems are approaching the end of their useful service lives, and the RWR market over the next decade should see replacement of many of these analog systems with new or upgraded digital RWRs. The Navy has been buying the Raytheon AN/ALR-67(V)3 for Super Hornets for a decade, but thousands of RWRs still in service in the Air Force and Army are 20 or more years old and will need replacing.

Northrop Grumman's (formerly Litton's) ALR-69(V) is a standard analog Air Force RWR that first entered production in 1978. It detects threat radars, processes the detected signals, and provides the operator with range and azimuth information. Almost 2,000 ALR-69s were procured for F-16 fighters.

In August 2001, Raytheon won an Air Force contract to integrate precision location and identification (PLAID) system capabilities into the ALR-69, now known as the ALR-69A(V). PLAID improves aircrew situational awareness by providing more accurate ground emitter location and unambiguous identification. Threat radar systems can disrupt operational missions even without firing, by requiring aircrew reactions that affect mission objectives.

PLAID's improved threat information allows aircrews to determine threat range/directions and to provide option responses short of mission abort or violent aircraft maneuvering, such as rerouting around hostile areas. Thus, PLAID adds a SIGINT (signals intelligence) capabil-

ELECTRONIC ATTACK (AN/ALQ-)

RDT&E+ Procurement (FY10 $ Millions)	Legacy Ftr EA	EA-6B and EA-18G	NGJ	ALQ-211 173	FMS EA	Other New EA	$Total
FY10	$548	$609	$118	$216	$4	$67	$1,562
FY11	475	634	120	266	12	94	1,601
FY12	440	584	120	321	112	122	1,699
FY13	428	342	122	328	210	163	1,593
FY14	437	96	116	353	216	231	1,449
FY15	440	180	118	220	226	270	1,454
FY16	354	190	102	216	180	271	1,313
FY17	336	194	114	216	156	278	1,294
FY18	359	114	128	220	142	284	1,247
FY19	360	90	132	196	138	292	1,208

ity to earlier RWRs. Low-rate initial production (LRIP) was awarded in October 2007, and the Air Force planned a major production run for the four-engine C-130 Hercules transport. However, the May 2009 FY10 budget put production on hold, funding only 26 LRIP systems.

The Air Force's other legacy analog RWR is BAE Systems' ALR-56(V), originally designed for the F-15 Eagle fighter. Development of the current F-15 ALR-56C began in 1981. A modernized and miniaturized version, the ALR-56M, began development in 1988 (still cold war, still analog, still a primary in-service system today) to serve on later F-16C/D fighters and some C-130 transports. Nearly 3,000 ALR-56 systems have been produced for all platforms.

Funding fate of upgrades

In mid-2009, the Air Force finally had tentative plans (or, at least, hopes) to replace or upgrade the old ALR-69s and -56s on its F-15s, F-16s, A-10s, and C-130s, with the possibility of beginning procurement to put digital PLAID ALR-69As on F-16s in FY12. They also expected to upgrade the ALR-56Cs on F-15Es and older F-15Cs with digital components. BAE Systems reportedly had a study contract for an "LRU-3+" upgrade to the ALR-56C that would insert a digital receiver derived from the JSF EW suite.

But by early this year there was no significant funding in the FY11 budget. In mid-2010, the service still hoped to replace the ALR-69, but Col. Joseph Skaja of the Air Combat Command said, "that one is probably going to fall by the wayside because of [lack of] funding."

Still, with thousands of legacy fighters to remain in service for decades, it is only a matter of time before substantial digital upgrades are funded. Teal Group has added speculative USAF digital RWR replacement/upgrade funding forecast lines for thousands of ALR-56s and -69s. It is not certain when this market will break, or who will lead it, but it will happen this decade.

For the Army and other customers, about 10,000 Northrop Grumman (formerly Litton) AN/APR-39 RWRs have been produced over the past 30 years. New APR-39 contracts continue, especially for international helicopter buys, and about 3,000 systems were still in Army service in early 2009. But Apache pilots had "lost confidence" in the APR-39 even in 1999 in Kosovo. As an interim upgrade, the Army awarded Phase 1 development funding to Northrop Grumman in FY05, focusing on processor upgrades, with a full-rate production decision awarded in the third quarter of FY08. But Phase I procurement funding dropped off substantially after FY09.

Phase 2 of the APR-39 upgrade/replacement is to develop an improved Army digital RWR for modernized platforms. In mid-2008, Army officials spoke of funding for the program starting "in a couple of years," and the FY10 budget release in May 2009 showed system design and development beginning in FY13, preceded by low levels of "prototyping" funds. In February, the FY11 budget showed development funding beginning in FY11 and ramping up to $22 million annually by FY13. This should become a major program worth hundreds of millions of dollars, but as with USAF digital RWR funding, the schedule could move either right or left.

The AN/ALQ-99 is at the core of the Prowler.

Prowlers and Growlers

Electronic attack systems, once called electronic countermeasures or radar jammers, are another near-universal fit on U.S. and international combat aircraft. EA has had much higher funding recently, and there are many new programs. Capabilities have been added beyond traditional air defense missions—Prowlers and Growlers today can target improvised explosive devices with energy beams to prematurely detonate or disable bombs, or they can generate "cones of silence" to prevent enemy electronics communications within tactical areas.

The Air Force gave up its own dedicated EA aircraft, the EF-111A Raven, in the mid-1990s. Since then the ongoing EA behemoth has been the Navy's EA-6B Prowler, providing dedicated combat EA for the USAF, Navy, and Marine Corps. At the core of the Prowler is Northrop Grumman's AN/ALQ-99(V) airborne noise jammer system, carried in three to five externally mounted pods. The current version of the system in service throughout most of the Prowler fleet is the Improved Capability-II (ICAP-II). The Navy and the Marine Corps currently operate about 111 EA-6Bs, with 90 available or deployed at any one time. However, all the Navy's Prowlers are due to be retired by FY14, and all the Marine Corps' by 2019.

A recent upgrade for a limited number of Prowlers is ICAP-III, a complete receiver and sensor update of the ICAP-II. It includes Northrop's AN/ALQ-218(V) digital wideband receiver system, reliability improvements, and upgraded computers, displays, and communications. ICAP-III allows selective-reactive "surgical" jamming, focusing energy on multiple, specific radar or communications frequencies. ICAP-II jams across larger bandwidths, dispersing jamming power. According to the com-

EA-18G Growler (USN photo by Jamie Hunter/Aviacom)

pany, "The ALQ-218 utilizes a unique combination of short, medium, and long baseline interferometer techniques with a patented passive ranging algorithm to provide geolocation of emitters for cueing jammers and other onboard sensors."

The Marines received the first of their ICAP-III upgraded Prowlers last May and will also get the 16 earlier Navy ICAP-IIIs, for a total of 32.

In June 2008 the Navy received the first EW jammer/SEAD (suppression of enemy air defense) version of the F/A-18F Super Hornet, the EA-18G Growler. It mounts the same ALQ-99 system (three pods) as the ICAP-III EA-6B, but also uses the Super Hornet's active electronically scanned array AN/APG-79(V) radar for broadband noise and reactive jamming. It has a "Wild Weasel" ability to attack nonemitting targets. Early this year the Pentagon added funding to Growler procurement ($203 million in 2011 and $2.3 billion in 2012 for 26 more aircraft), and the Navy will now likely buy at least 98 Growlers, with limited international sales also likely.

Funding began in FY09 for development of the next generation jammer (NGJ), intended to replace (or possibly upgrade) the ALQ-99 on the Growler in the 2015-2020 time frame. In addition, a new NGJ could be procured by the Marines for mounting on the JSF or a UAV, which would then replace USMC Prowlers when they are retired from 2018 to 2020.

New capabilities such as computer invasion and network attack (using an electronic beam with "malicious algorithms") are planned, to penetrate integrated command and control networks. "Every antenna is a target," says Northrop Grumman.

In September 2009, the Navy issued the final NGJ broad agency announcement for up to four competitive technology maturation contracts it planned to award, to develop detailed engineering and programmatic plans for key technology demonstrations. These contracts will be worth $15 million-$30 million each, with a 10-14-month duration.

The Navy leads the program and is taking a creative approach to capabilities, leaving them up to potential contractors, with no set specifications. Of course, this philosophy is likely to end up with yet another long and expensive RDT&E process and no production systems. Leading the current teams are ITT/Boeing, Northrop Grumman, BAE Systems, and Raytheon.

The Air Force has also been working on EA ideas, but much funding and effort has been concentrated on the JSF. In 2009, Col. Bob Schwarze, the departing USAF chief of EW and cyber warfare requirements on the Air Staff, said the Air Force, which had thousands of cold-war-era jammers, planned to buy 400 digital RF memory-upgraded AN/ALQ-131(V) pods from Northrop Grumman with $190 million in FY10-FY15 funds. However, in the FY11 budget, no procurement funding was scheduled.

The Air Force also has ideas for developing a "cognitive jammer," having solicited proposals at midyear for a new generation of EA systems capable of adapting to agile threats that rely on new dynamic RF spectra. Initial efforts will focus on algorithm development and a prototype system, but this will likely remain a development program.

International trends

Outside the U.S., on the other hand, nations that are not waiting for JSF need to pay more serious attention to upgrading or replacing legacy EA. Teal Group thus expects a large and varied foreign military sales (FMS) EA/jammer market. The FMS F-16 market, especially, could be good for several hundred new systems over our forecast period.

ITT's lightweight, inexpensive Army AN/ALQ-211(V)-derived AN/ALQ-173(V) AIDEWS (advanced integrated defense electronics warfare system) has earned several FMS contracts, with Chile, Poland, and Oman choosing AIDEWS for new F-16s in 2002 and 2003. Pakistan added an order in 2007, and Turkey followed in February 2009. Since Turkey's cancellation of the development of BAE Systems' AN/ALQ-178(V)5+ there are now two primary competitors for FAMS F-16 jammers: AIDEWS and Raytheon's AN/ALQ-187(V).

Though AIDEWS has earned more recent contracts, Raytheon's advanced countermeasures electronic system (ACES)—including the new AN/ALQ-187(V)2)—was sold to Morocco in November 2008, and Lockheed Martin chose ACES for its Indian F-16IN bid in early 2009.

With a fairly equal competition, we have chosen to break out a competitive undetermined forecast for future FMS jammers, including new-build and upgraded F-16s, as well as possibilities for other aircraft (and other EA systems). For example, in October 2008 Boeing chose BAE Systems to develop a Digital Electronic Warfare Suite for international F-15 users, in particular Saudi Arabia and Japan, leveraging technologies and common modules developed for BAE's F-22 and JSF EW suites.

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RADAR WARNING RECEIVERS (AN/ALR-)

RDT&E+ Procurement (FY10 $Millions)	Legacy RWR	ALR-67 (V)3	USAF Digital RWR	Army Digital RWR	Other New RWR	Total
FY10	$363	$154	$4	$0	$30	$551
FY11	376	132	20	5	35	568
FY12	313	126	120	10	37	606
FY13	245	108	196	22	36	607
FY14	233	116	222	26	39	636
FY15	225	108	222	35	40	630
FY16	207	92	226	52	46	623
FY17	160	62	186	56	47	511
FY18	131	40	120	66	49	406
FY19	118	36	172	64	52	442

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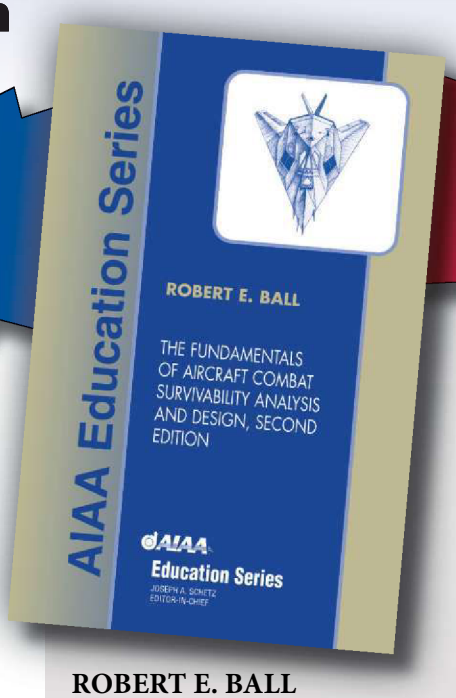

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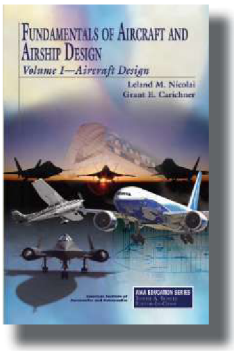

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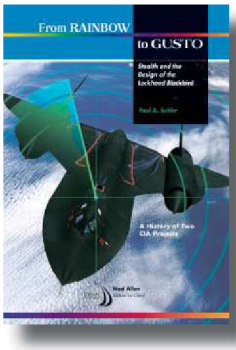

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Curiosity's MISSION to MARS

Curiosity, NASA's $2.3-billion Mars Science Laboratory (MSL) rover, is ready to push the bounds of science and technology in a search for clues to life on Mars. Although Curiosity cannot detect biological activity, it is designed to find specific geologic and carbon-based evidence relevant to past life. The 2,000-lb vehicle features a maze of sample flow paths, mini-laboratories, and instruments developed by the U.S., Europe, Russia, and Canada.

By June, the MSL spacecraft is to be shipped from Pasadena, California, to Cape Canaveral, Florida, on board an Air Force C-17. Scheduled for launch on an Atlas V rocket this November, Curiosity will lead NASA toward the future after the final shuttle mission recalls U.S. space glories of the past. MSL is targeted to land on Mars in August 2012.

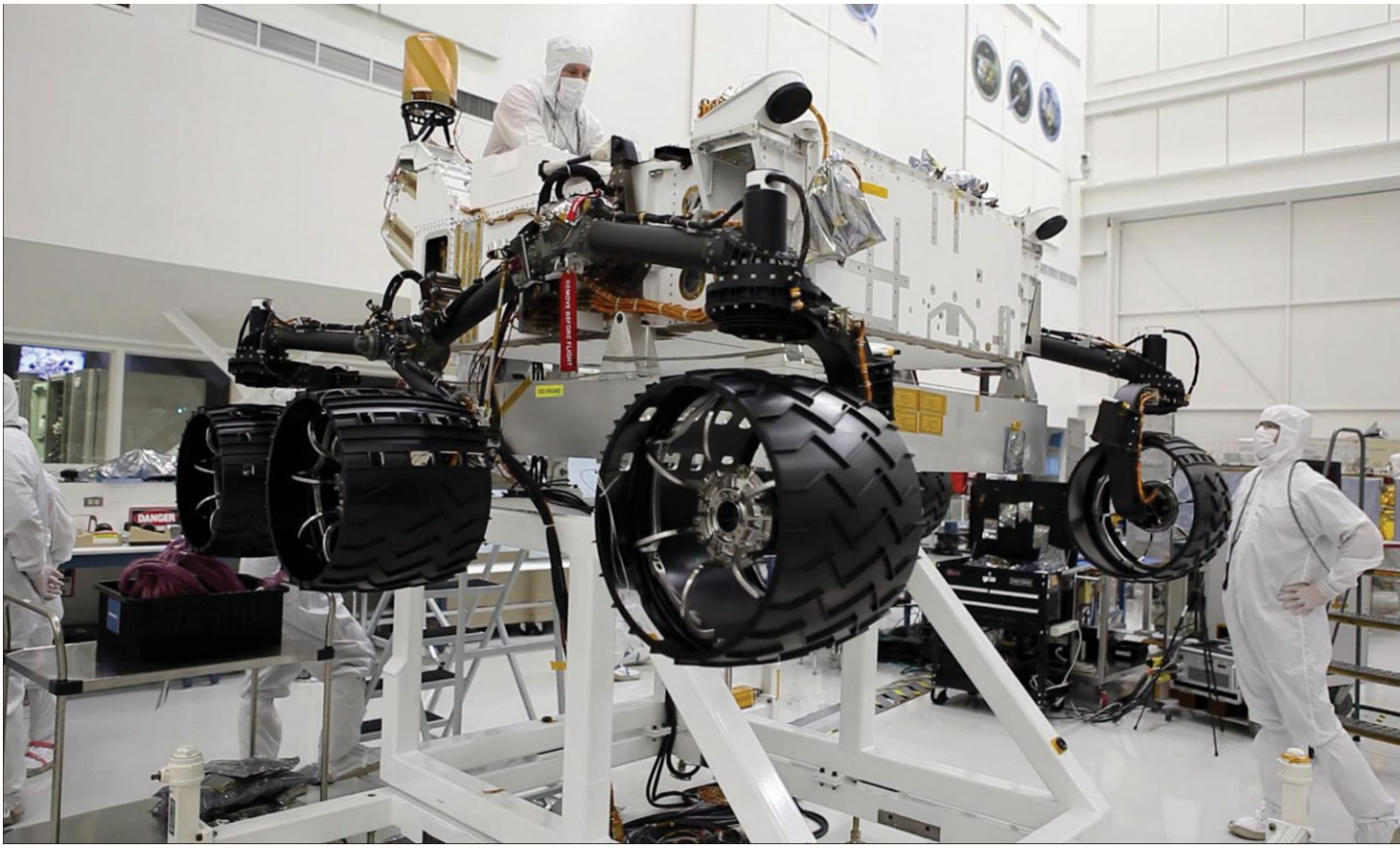
The most complex spacecraft ever developed by JPL, MSL is so vital to the search for Martian life—and to NASA's faltering exploration strategy—that Congress voted to continue the program even with a 60% cost increase and a two-year launch delay to 2011. Part of the delay resulted from disappointing motor and actuator tests conducted at temperatures from -70 F to -90 F, similar to the levels Curiosity will experience on the coldest winter nights.

Pete Theisinger, MSL project manager, says that some of MSL's difficulties have also revealed strategically important problems with U.S. aerospace components. Although declining to be specific, he notes, "There are weaknesses in the U.S. space technology parts and supply community that have surprised us at JPL."

Curiosity is over five times heavier than either Spirit or Opportunity, the Mars exploration rovers (MERs) that made airbag landings in 2004. MSL's sky crane sys-

by Craig Covault
Contributing writer

In searching for clues to life in Martian rocks and clay, NASA's Curiosity rover will also give the space program new life.



Engineers installed six new wheels on the Curiosity rover and rotated all six at once on July 9, 2010. This milestone marked the first in a series of "tuneups" to get the rover ready for a drive in the clean room at JPL, where it is being assembled.

tem will enable Curiosity to carry at least 165 lb of science instruments, compared with less than 20 lb of science hardware on Spirit and Opportunity.

Shortly after Curiosity begins to rove, a Russian robotic spacecraft will attempt to land on the Martian moon Phobos. Part of the lander is to return to Earth in 2014 with a sample of Phobos material that could be rich in Mars dust. This would be a huge achievement that might accelerate plans for manned Phobos missions.

During this first-ever round trip between Earth and Mars, the Russian spacecraft will also deploy a 250-lb Chinese Mars orbiter. China says that in about 2013 it will conduct its own launch of a heavier Mars orbiter that it is now developing.

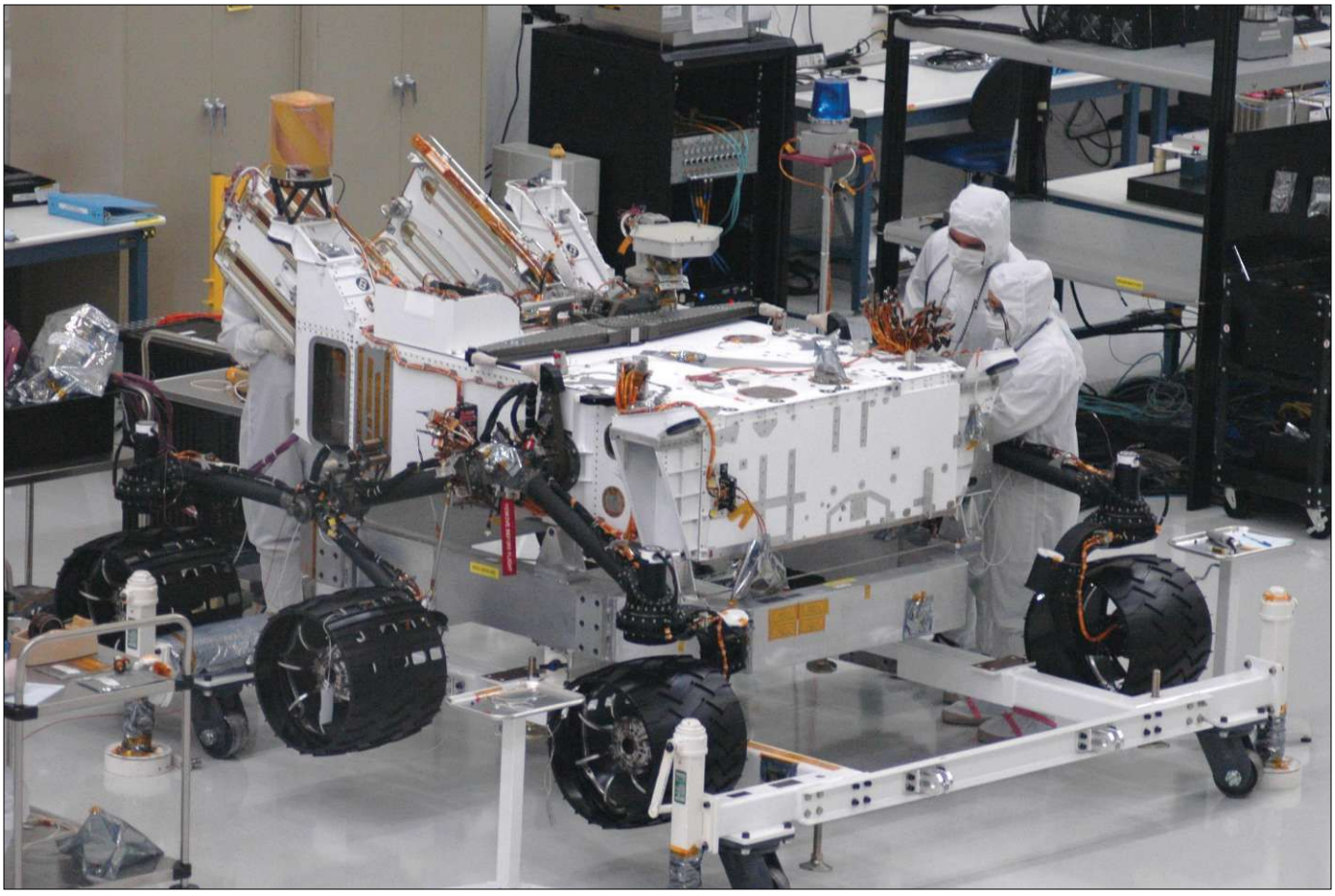
Technology

Two major technological firsts will enable MSL to do more than previous rovers and aid the design of future Mars landers too heavy for airbags. One is sky crane, a landing system that will function like an Army helicopter lowering a vehicle to the surface of, in this case, another planet.

The other first is called active guidance with aerodynamic lift, a combination that will allow MSL to fly—rather than just fall—through the Martian atmosphere. No previous Mars mission has used a maneuvering, fully guided lifting aeroshell for precise landing capability.

"It is difficult to overstate what a major step forward this is beyond the earlier MERs," says Theisinger, who also led JPL development of Spirit and Opportunity. "MSL is not your father's Mars rover," he says. "We clearly underestimated the size and scope of MSL."

But a potential problem lies within the plutonium-fueled radioisotope thermoelectric generator (RTG) that will power Curi-



MSL mockup sits with the Mars exploration rover and Sojourner rover at the Jet Propulsion Laboratory.

osity. There is concern that the critical thermocouple device in the RTG that converts heat to electricity may be degrading ahead of its specification life, says John Grotzinger, MSL program scientist.

The newly designed Boeing/Dept. of Energy multimission RTG has proven design and hardening features to prevent dispersal of any plutonium dust in the event of an Atlas V launch accident. Just in case, however, the DOE will position more than a dozen mobile emergency field teams around Cape Canaveral for the launch. If an accident occurs, the teams will immediately check for any release of plutonium 238 or radiation.

What's new and different

There are several key differences between Curiosity and its MER predecessors:

•**Ballast to leverage angle of attack.** The MSL aeroshell will eject eight blocks of ballast, together weighing 660 lb, to maintain a proper angle of attack during different phases of the landing. The ballast alone weighs 250 lb, more than the Spirit and Opportunity rovers.

•**Wheels and speed.** Curiosity will use six 50-cm-diam. wheels, compared with the 20-cm-diam. wheels on the MERs. The larger wheels will provide a 20% increase in maximum speed to 6 cm/sec.

•**Mission duration.** The formal MSL mission specification is for two Earth years of lifetime while driving 10 mi. or more. The MER specification called for 90 days and about 900 ft of driving, which both rovers blew away following their January 2004 landings. Spirit remains silent after having become stuck in mid-2009 following 5 mi. of mountain exploration, while Opportunity is ready to begin its eighth year and has passed 15 mi. on its odometer.

•**Size.** Curiosity is 9 ft long, 8.8 ft wide, and 7.2 ft tall; the MERs are 5.2 ft long, 7.5 ft wide, and 4.9 ft tall.

•**Computer power.** Curiosity's computer is substantially more powerful, says Mark W. Maimone, a lead computer and robotics engineer for the MSL and MER. He says MSL's computer is a BAE Systems Rad 750 whose overall integration was done at JPL. Its central processing unit is five times

faster than either of the MER CPUs.

Curiosity can perform runs at 100 MHz/sec, compared with 20 MHz/sec for the MERs. By contrast, a low-end home computer will have 2 GHz of power but is not radiation hardened, an upgrade that can take years of testing and certification.

More computer power will enable robotic roving to proceed faster with fewer mistakes. MSL will have the same basic capabilities as the MERs, such as hazard avoidance, the ability to circle a rock, terrain assessment, visual odometry, and autonomous arm functioning.

•Arm operations. The extra computer power will enable far more robotic arm operations, which will be substantially more demanding on MSL. Another difference is that for MSL, unlike for the MERs, the team will not have to write a sequence of hundreds and hundreds of lines of software for these daily operations.

"With MSL we will have those kinds of sequences, developed here at JPL, already on board the rover," says Chris Leger, robotic arm flight software developer and the surface software development lead for the MSL flight.

"In terms of mass and strength, the 7.5-ft MSL arm is much beefier and much stronger than the 3-ft MER arm," says Matt Robinson, lead engineer for robotic arm systems. "Just the turret on the MSL arm weighs more than the whole arm electronics and science on the smaller MER rovers," he notes.

"We have a whole different style of motions with the MSL arm, because we use a lot more 'gravity-relevant' motions to move samples where we want them to fall inside the mechanisms," adds Leger. "When we do sample processing you will see the turret spin around to do different sample orientations, while other actuators are creating vibrations to move the sample along."

Searching and sampling

The arm uses a percussion device to break rock into powder that can be moved to the rovers' mini-labs. "There are at least 50-100 different arm motions to get the samples out of the drill and over to the instruments," says Leger.

The rover will explore a once water-rich region in search of the carbon-based building-blocks of life. It will also sample Martian geology up to 10-20 mi. from the landing site and generate broader data to determine if habitable conditions ever existed during the Martian eons.

The rover's labs should be able to assess rock and soil to obtain key data, such as how much life-giving oxygen has come and gone in the Martian atmosphere over the past 4 billon years.

More than any other planetary mission in history, MSL will benefit from extremely detailed collaboration with other NASA and ESA missions orbiting Mars.

Curiosity's 7.5-ft robotic arm, which will use a percussion device to break rock into powder, is much stronger than the 3-ft MER arms.

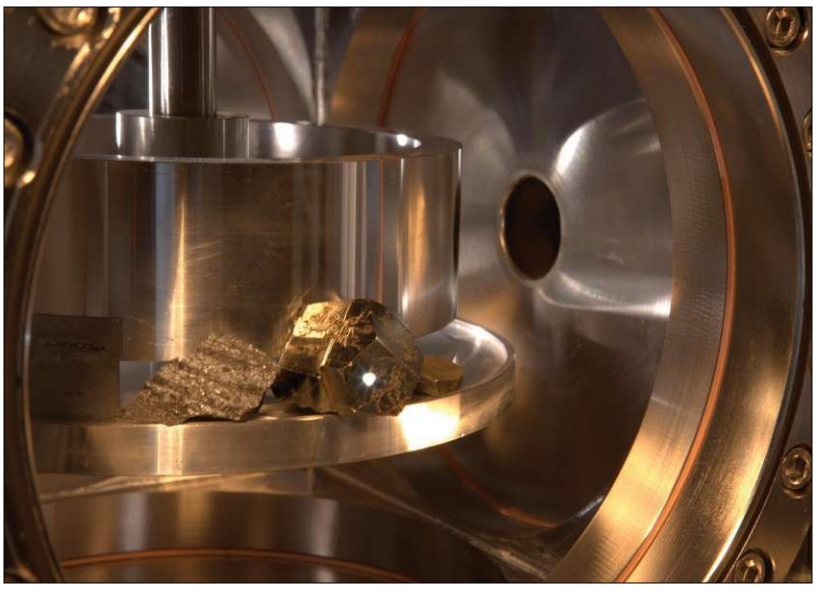
MSL's operations on the Martian surface will be more like a military campaign on Earth where reconnaissance satellites provide all manner of data before ground forces—in this case Curiosity—move in.

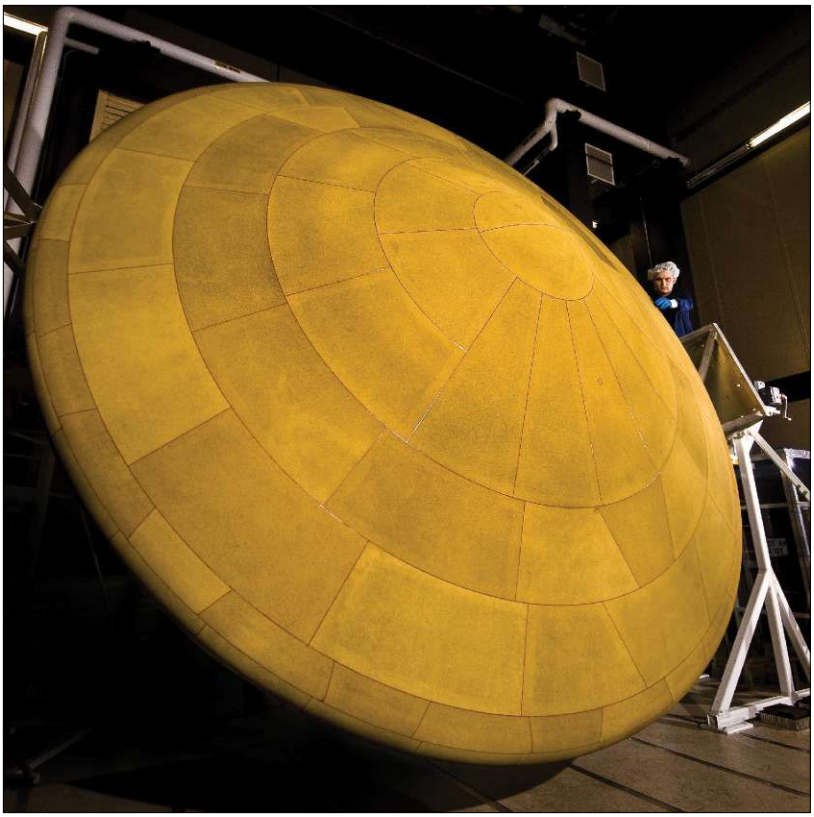
ESA's Mars Express and NASA's Mars Reconnaissance Orbiter have taken very high-resolution imagery, while the Mars Odyssey has helped trace the presence of water. They will also relay data to Earth from Curiosity, just as they continue to do for Opportunity and will do for Spirit, if it awakens from a power-starved winter.

The Wright approach

MSL's descent to the Martian surface will come 109 years after the Wright brothers made fundamental discoveries about aerodynamic lift, angle of attack, and active control. Those principles will now be demonstrated for the first time in the Martian atmosphere. MSL will use Apollo command module reentry algorithms and also roll re-

The ChemCam instrument uses a pulsed laser beam to vaporize a pinhead-size target, producing a flash of light from the ionized material (plasma) that can be analyzed to identify chemical elements in the target. Here a ball of luminous plasma erupts from the surface of an iron pyrite crystal in the sample chamber approximately 3 m from the instrument. The laser beam itself is invisible. Credit: NASA/JPL-Caltech/LANL.





The finished heat shield for the MSL, with a diameter of 4.5 m, is the largest ever built for descending through the atmosphere of any planet. Lockheed Martin Space Systems Denver built and tested the heat shield. Credit: Patrick H. Corkery. Courtesy Lockheed Martin.

versals, just like the space shuttle, to alter its lift vector during reentry.

Active guidance of a lift-generating vehicle and the sky crane will deliver the MSL rover to within a circular target area just 7.7 mi. in diameter. This compares with Pathfinder and MER unguided entries that targeted a 50 x 6-mi. ellipse. The 1976 Viking landers used a "full lift up" but unguided aeroshell that required a much larger landing footprint measuring 175 x 62 mi.

The MSL's entry into the Martian atmosphere at nearly 13,000 mph will use the largest aeroshell and heat shield ever flown in space. Curiosity and the Mars sky crane will be encased in an aeroshell shaped like an enlarged Apollo command module. It measures nearly 15 ft across its heat shield—2 ft larger than an Apollo command module and 6 ft larger in diameter than the MER and Pathfinder rover aeroshells.

Because the unique entry trajectory profile will create external temperatures of up to 3,800 F, the heat shield uses phenolic impregnated carbon ablator (PICA) thermal protection tiles. This is in place of the older Mars heritage SLA (super lightweight ablator) 561V used in past Mars landings.

On its nine-month flight, the aeroshell with the sky crane rover inside will fly attached to a large solar-array-equipped circular cruise stage. During cruise the aeroshell will have a symmetrical mass and will rotate at 2 rpm. But all that will change starting 10 min before reentry when the two 165-lb cruise balance mass weights are ejected. "During entry into the Martian atmosphere, we will fly a symmetrical aeroshell body but with asymmetric mass," says JPL's Adam D. Steltzner, manager of MSL entry, descent, and landing.

"That will make us fly at a canted angle that will enable the heat shield to develop lift," Steltzner says. To enable steering and lift control, the rover computer will calculate when to fire eight 57-lb-thrust attitude control jets to roll or bank the vehicle with the optimal angle of attack for a lift-over-drag ratio of 0.24 at Mach 24. For the first time in any Mars landing, the altitude, attitude, and velocity of the vehicle will be updated continuously in a closed-loop data stream for real-time maneuvering commands.

Innovative radar

Another key to accuracy and a safe landing will be a new radar configuration never before flown to Mars. "It has taken substantially more time to develop, but it is a superb radar," says Theisinger.

"We needed good velocity and altimetry data relative to the surface of Mars. When slowing from nearly 13,000 mph it is tough to get the velocity data correct down to under feet per sec—and that is what we need for landing this thing," says Steltzner.

"It would be difficult to near-impossible to land a vehicle like this using just an inertial measurement unit, so we chose to develop our own Ka-band six-beam radar. Recent helicopter tests of this system turned in excellent results and aided the MSL team in determining how best to cycle the antenna selection during the descent.

"We feel great about the radar," Steltzner continues. "One reason we decided to build our own is that we struggled in the past with Phoenix, MER, and Pathfinder radars when we tried to modify existing weapons system radars."

Enter sky crane

With a PICA heat shield, a flying aeroshell using Apollo-proven math, a tested parachute design, and spiffy new radar, the

untested Mars sky crane must work perfectly. Here is how that will happen:

•**Additional ballast ejection.** The first 67 mi. of the entry will be with the vehicle's mass offset to enable it to generate lift, to fly, and to maneuver to a point almost directly above the landing site. Now six more pieces of ballast, each weighing 55 lb, are ejected at 2-sec intervals to reestablish a neutral center of gravity. The ballast separation phase is designated the "surfer" maneuver (for "straighten up and fly right"), followed immediately by MSL's "victory roll" to establish proper attitude. MSL is ready for its next big event.

•**Parachute deployment.** The aeroshell hypersonic entry phase will take out 99% of the kinetic energy imparted by launch and now by Mars gravity. At 6-mi. altitude and 1,000 mph, Curiosity will deploy its Pioneer Aerospace 52.5-ft-diam parachute. On MSL the chute will be lowering a mass of 3,400 lb, including the aeroshell, sky crane, and 1-ton rover. The MSL chute will remove 99% of the remaining 1% of kinetic energy.

•**Heat shield separation.** The chute will slow Curiosity's descent velocity after 2.5 min to 358 mph at 4-mi. altitude. At this point the PICA heat shield, just 1 in. thick, will be severed, opening the bottom of the aeroshell to reveal the six-wheeled rover grasped by the sky crane with an extended platform holding all six radar antennas. All computations and commands are being done by the rover's computer.

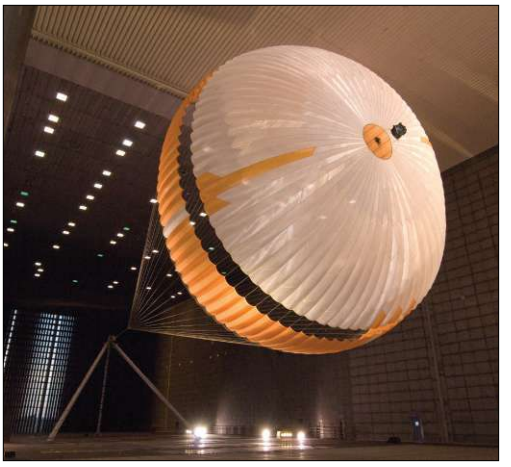
•**Radar activation.** With the heat shield gone, the sky crane's radar will be activated to measure altitude and velocity.

•**Real-time imaging.** The down-facing Mars descent imager, developed by Malin Space Science Systems, will begin taking a continuous stream of high-resolution images (up to four per second) to show the landing from the rover's perspective.

•**Backshell and parachute separation.** Descending through 6,000 ft, the vehicle will separate its backshell and parachute, revealing the sky crane and sports-car-sized rover.

Powered descent

Things begin to happen fast at backshell and parachute separation, but the first thing the sky crane and Curiosity do is nothing. The contraption is programmed to free-fall for 1 sec to be well clear of the 100-ft-long parachute canopy, risers, and backshell.



An MSL parachute test is conducted at the Ames/NFAC 80x120 wind tunnel. Credit: T. Wynne.

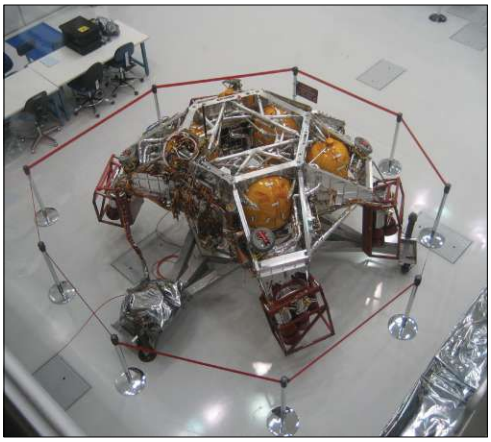
The sky crane has eight Aerojet 675-lb-thrust hydrazine-fueled Mars landing engines (MLEs). Paired on each corner, all eight MLEs are ignited as the whole shebang streaks below 5,000 ft. Engine ignition will dramatically slow the descent and gain attitude control for the fast-approaching Martian touchdown.

Next the vehicle maneuvers laterally to prevent having the backshell and parachute collide in midair or land on top of each other—the worst of luck 150 million mi. from Earth. After the lateral maneuver, the sky crane's engines will null out motions in all axes.

The rover computer will then command the sky crane to fly the vehicle to a point 656 ft above the spacecraft's estimate of where the Martian surface is.

Maximum velocity cancellation occurs at a point that the spacecraft's computer is programmed to perceive as a horizontal plane in the air—200 ft above the surface. But the computer is being tricked. The rover team calls the area "the terrain accordion," which in fact is at least 100 ft farther above the surface. This is ample space for

The aeroshell is a blunt-nosed cone that will encapsulate and protect Curiosity during its deep space cruise to Mars, and from the intense heat and friction that will be generated as the system descends through the Martian atmosphere. Credit: Adam Mattivi, courtesy Lockheed Martin.



The rocket platform (MSL descent stage) will act as a sky crane and lower the MSL rover onto Mar's surface from a hover, then fly away to crash at a safe distance.

the sky crane to exercise its descent capabilities, but with a plentiful safety margin.

Rockets blazing, the sky crane descends, but slowly—like a Marine Corps Harrier landing, though with less noise because of the super thin Mars atmosphere. Still holding Curiosity tightly, sky crane will begin to descend at a sedate 7 mph, now on the thrust of just four engines at about 50% throttle. This setting gives maximum control.

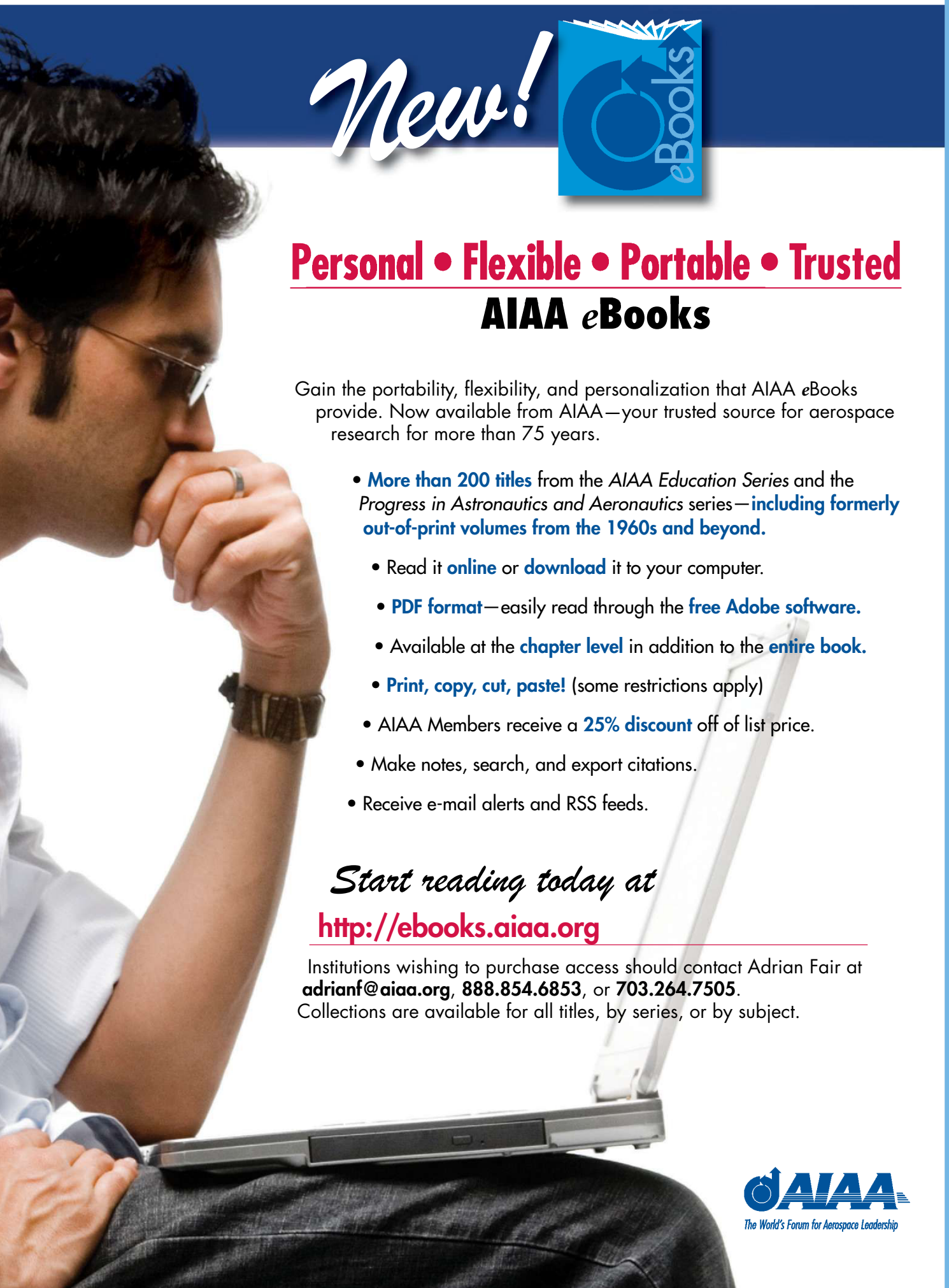
The scene all around will be of endless red terrain. When the two vehicles descend to about 70 ft, the sky crane will release the rover on a 25-ft set of lines called the bridal umbilical device (BUD). It has three load-bearing lines of woven nylon wrapped with slackened electrical umbilical.

Both the rover and sky crane will continue to drop at 2.5 ft/sec. Halfway down, Curiosity unfolds its wheels, which had been tucked in to fit inside the aeroshell.

The rover will drop more rapidly on the bridal than the sky crane is descending. Suddenly the rover computer will sense the sky crane has no load—Curiosity has been safely deposited on Mars. This will cue Curiosity to fire a cable cutter to sever the BUD. It will also cue the sky crane to begin its flyaway maneuver. Notes Steltzner, "We love to smartly say that we do not look for the touchdown event, but rather perceive the postlanding state of the vehicle."

✈✈✈

As MSL's Curiosity rover searches for evidence of life on Mars, it will do more than seek answers to an endlessly intriguing question. It will also serve to rejuvenate NASA's space program as other nations inevitably begin to challenge U.S. leadership in planetary exploration. ▲



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Son of Apollo
A new space capsule takes shape

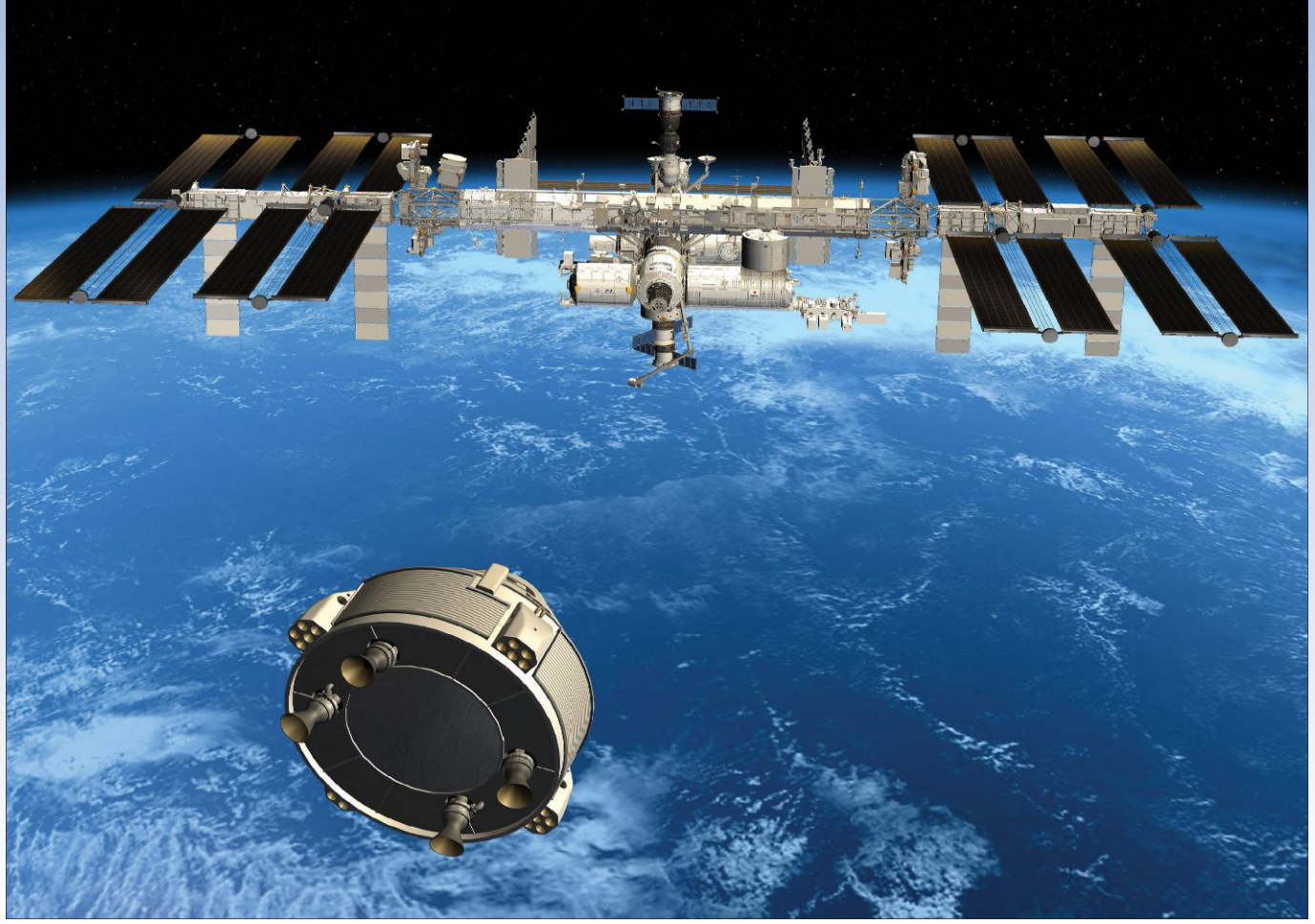
CCDev, NASA's effort to stimulate development of a space transportation capability in industry, has emphasized safety, reliability, and economy. The result is a space capsule reminiscent of the Apollo command module of the 1960s and 1970s, geared for short trips to and from the ISS. And like the Apollo module, its crew accommodations will be more spartan than those of the space shuttle.

by Frank Sietzen Jr.
Contributing writer

NASA's Commercial Crew Development (CCDev) program is the agency's effort to seed the development of a commercial capability for launching cargo to the ISS. Its aim, says the program's announcement, is to "stimulate efforts within the private sector to develop and demonstrate safe, reliable, and cost-effective space transportation capabilities." The project manages two COTS (Commercial Orbital Transportation Services) partnership agreements totaling $500 million for commercial cargo transportation demonstration flights. After a competition, two U.S. firms, Orbital Sciences and SpaceX, were selected for the activity.

First contracts

In February, through an open competition, NASA also awarded Space Act Agreements totaling $50 million to five more firms, toward commercial crew launch development. All the crew funds came from stimulus money provided in the American Recovery and Reinvestment Act of 2009, not from the NASA budget. The companies are Blue Origin in Kent, Washington; Boeing in Houston, Texas; Paragon Space Development in Tucson, Arizona; Sierra in Louisville, Colorado; and United Launch Alliance in Centennial, Colorado.



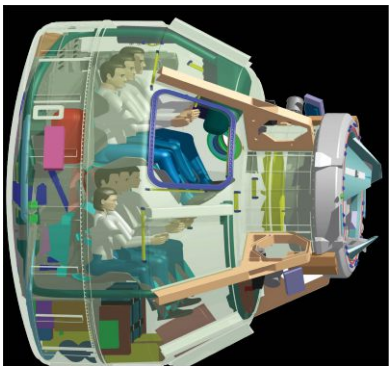
The agreements are for the design of crew-carrying spacecraft and related technology demonstrations, and investigations for future commercial support of human spaceflight. In its announcement NASA said, "Space Act Agreements will stimulate efforts within the private sector to develop and demonstrate human spaceflight capabilities." Out of the $50 million, Blue Origin will receive $3.7 million, Boeing $18 million, Paragon Space Development $1.4 million, Sierra Nevada $20 million, and United Launch Alliance $6.7 million. The project is being managed from NASA Johnson.

Using the stimulus funds, plus money received during the earlier CCDev competition, Boeing chose to accelerate design and development of a crew capsule it calls CST-100, for Commercial Space Transport 100 (100 refers to the 100 km from the ground to LEO). As a partner, Boeing selected Bigelow Aerospace, whose engineers are developing a possible space tourism destination for the Boeing capsule: a multipassenger space station comprised of inflatable modules. The company is currently testing scale models of the units in space. Bigelow could provide its space station to sovereign governments that cannot afford their own space program; this leased space could be used for scientific research.

Vehicle features

What emerged from Boeing designers is a capsule shape reminiscent of the Apollo Command Module flown to the Moon and to the Skylab space station in the 1960s and 1970s. The last such capsule was launched to rendezvous and dock with a Soyuz space vehicle in July 1975. The command module's manufacturer was a company later acquired by Boeing, Rockwell International (formerly North American Rockwell). "We have a great deal of capsule design heritage from Apollo, from the OSP [orbital spaceplane] program, and from our work on the Orion program," says Keith Reiley, Boeing's Commercial Crew Development Program Manager at the company's facility in Houston.

The spacecraft as proposed consists of two parts: a cabin called the crew module (CM), and an unpressurized unit beneath it called the service module (SM). The capsule, according to Reiley, is "bigger than Apollo and smaller than [today's] Orion." The Apollo command module was a cone 3.9 m wide at its base. The Orion's base is currently 5.02 m wide. The CST-100's base is 4.5 m wide, placing it be-



The CST-100 can accommodate a crew of up to seven.

tween Apollo and Orion. But there are major differences with Orion that make the new spacecraft closer in capability to its Apollo predecessor.

Limited accommodations, lower cost

Crew accommodations on Apollo were limited. It had no waste management facilities (the astronauts used bags) and no galley for food preparation. Hot water guns were used to reconstitute food contained in plastic pouches. An oven was carried on only two flights—Apollo 8, to provide astronauts Frank Borman, Jim Lovell, and Bill Anders a hot Christmas turkey dinner, and Apollo-Soyuz, to furnish the crew with hot meals. Orion promises better waste management facilities than those of the shuttle, and better galley equipment. The CST-100 has neither accommodation. "This is pretty primitive as far as the crew is concerned, more like Apollo," says Reiley. One reason is that the spacecraft is designed for very brief return flights from the ISS or Bigelow missions, trips lasting only a day. Another is to keep development and production costs as low as possible.

The capsule can carry up to seven astronauts arrayed in two tiers of seats. Missions with smaller crews can fly customer cargo in place of the empty seats. Windows are arranged so that the commander and pilot have rendezvous visibility, and the rest of the crew can see out via forward and side windows. Over a forward hatch on top of the capsule is a rounded ascent cover. In the center of the capsule is a main egress and entry hatch, and arrayed around the base is a series of thrusters. Boeing is using a proprietary ablative heatshield to cover the base. A parachute system is stored in mortars located around the apex, and an airbag landing system is stored above the heat shield, which is jettisoned during descent. The capsule is designed for a hard-surface landing but can be recovered in water if necessary.

The small SM consists of a short rectangle whose surface is covered in four places by radiators, four quads of thrusters, and a thermal shield that covers the bottom. An umbilical connection is also attached to the capsule. The most prominent features of the SM are two nozzles, one extending from each side.

Feeding the engines is a hypergolic bipropellant system that also fuels the thrusters. The engines provide a unique launch escape system that pressurizes the engines with 1,000 psia for a high-thrust firing that "pushes" both the CM and SM off a malfunctioning booster. The SM is then jettisoned, and the CM lands by parachute. This same engine system is used in space to maneuver the vehicle to the rendezvous target. Reiley notes the abort system can fire during any phase of the ascent: "There are no black zones," he says.

Testing activities

Boeing and Bigelow have conducted a test and validation risk-reduction program for the spacecraft to verify vehicle designs and to identify key technologies that must be matured before being integrated into the vehicle.

For simplicity and low cost, the abort apparatus uses a single pressurization system for both abort and on-orbit operations. Utilizing previous work done on the Atlas II sustainer engine, Boeing is using an ablative nozzle technology similar to that of the Rocketdyne Lance engine. The demonstration program will test engine ignition, performance, and combustion stability using a series of bipropellant fuel and oxidizer mixtures.

Previously, Boeing had tested a material called BLA (Boeing lightweight ablator) on a 5-ft-wide carrier test article. The test team formed and bonded reinforcing honeycomb to the heat shield structure, spreading batches of the BLA onto the honeycomb test structure in a single application. The CCDev testing effort uses a BLA simulated heat shield cured in an autoclave. The shield, which measures 4.2 m, demonstrates a production-ready capability. The tests will give Boeing engineers experience in assembly, production, transportation, and pressure testing for heat shields attached to the base of prospective CM capsules.

At its Avionics System Integration Facility in Houston, Boeing is testing prospective avionics software and hardware in simulated flight conditions. The company has also conducted tests involving the aluminum alloy pressure vessel of the CM to assess how the vehicle handles full pressure of the cabin in different flight environments. A full-scale boilerplate mass simulator has been used to test various elements of the recovery system, including

airbag deployment, multiple descents using different parachute configurations, and water recovery stabilization of the capsule. Bigelow constructed the boilerplate model and tested it at the company's Aquatic Test Facility in Las Vegas, Nevada.

Also under way are life support air revitalization system demonstrations using Bigelow assembled components. Demonstrations of integrated guidance and navigation systems for autonomous rendezvous and docking have drawn on previous Boeing systems developed with DARPA.

The CST-100 is designed to transport astronauts to 250-n.mi. destinations at 51.6-deg inclinations for ISS missions, and 225 n.mi. at 35-deg inclinations for Bigelow station missions. The spacecraft can operate for up to 48 hr of autonomous free flight but is primarily aimed at a day-one rendezvous with a day-two backup. It can remain docked to a station for up to 210 days while drawing less than 1 kW of trickle power. It will be compliant with NASA's human rating requirements.

Boeing is working with potential human-rated launch vehicle providers to ensure compatibility with the CST-100 capsule. This compatibility should enable the flexibility required to reach the desired commercial launch price targets.

The markets

Bob Bigelow, founder of Bigelow Aerospace, told reporters at the Farnborough Air Show last July that he was proceeding with expansion of his Nevada facilities to accommodate more rapid development of his space station's inflatable modules. He displayed his customary confidence, telling the assembled reporters that his firm is building a new plant, also in Nevada, that has no other purpose than "mass production" of inflatable habitat modules. He added that no less than 75% of all the money he expects to take from customers leasing space stations and buying seats on rockets will be passed on to launch providers like Boeing. "We expect a significant Christmas card" from them, he said. Bigelow has constructed a full-sized mock-up of the CST crew module to test the interior layout and external arrangement of grappling attachments and crew hand-holds for use during Bigelow and ISS docking.

According to Reiley, Boeing is not planning for Bigelow to be its primary launch customer. "Our primary focus is NASA as our customer," he explains, "but we are working with Bigelow Aerospace to support their orbiting space complexes as an expansion of our market." Depending on funding, first test launches could take place in three years, with first commercial crew missions by 2015.

Pressure testing of the crew compartment structure anchors was conducted in September at the Bigelow Aerospace facility in Las Vegas.

NASA releases RFI

NASA released an RFI this summer to further test industry's interest in supporting commercial crews. The purpose was to gather information that would help the agency plan an overall strategy for the development and demonstration of a commercial crew transport capability and to receive comments on NASA human-rating technical requirements currently in the draft stage.

The agency held a meeting at Headquarters in August to review CCDev progress. Officials said 35 companies had responded to a May 21 NASA solicitation seeking input on the commercial crew initiative. NASA predicts that it could fund up to four providers if Congress approves the full $5.8 billion included in President Obama's initial budget request.

Funding uncertainties

The NASA authorization mandates a government-developed capsule as well as funding for commercial crew transport. Thus it is not readily apparent how the

Boeing is working closely with Bigelow Aerospace to support their space structures.

The Orion capsule was a larger, more complex structure.

commercial space transportation system will fare if it competes directly with a Lockheed Martin Orion derivative. Nor has NASA announced if it will recompete the Orion contract as the new "multipurpose crew transportation vehicle" called for in the legislation. The original Orion CEV for ISS or Moon missions was designed for launch aboard the Ares I, and Orion's weight growth eventually made it necessary for the spacecraft itself to complete the orbit insertion burn.

Congressional instructions call for a deep-space vehicle based on the CEV's capsule shape but not necessarily of the same size or complexity as Orion. Boeing is avoiding the launch vehicle selection initially by making its vehicle compatible for launch aboard one of the Atlas, Delta, or Falcon rockets—a first since the Apollo command/service module was designed for launch aboard Saturn I and V boosters. A smaller, simpler, cheaper Lockheed capsule would seem to be a head-to-head competitor for Boeing's new entry.

On October 25 NASA issued an announcement seeking proposals from U.S. industry to further advance commercial crew space transportation concepts and mature the design and development of system elements. Awards will result in funded Space Act Agreements.

Multiple awards are expected to be announced by March 2011 for terms of up to 14 months. A total of approximately $200 million is expected to be available for awards, but funding is dependent on the FY11 appropriations from Congress.

If Boeing and Lockheed—and possibly SpaceX, with a crewed Dragon—succeed in bringing their vehicles to market, it would mark the first time that multiple production and manufacturing capabilities for manned spacecraft were in operation. Keeping the two sets of space capsules—one commercial and one federal—from eliminating each other in the new U.S. human space program may prove as difficult as building the machines themselves. A

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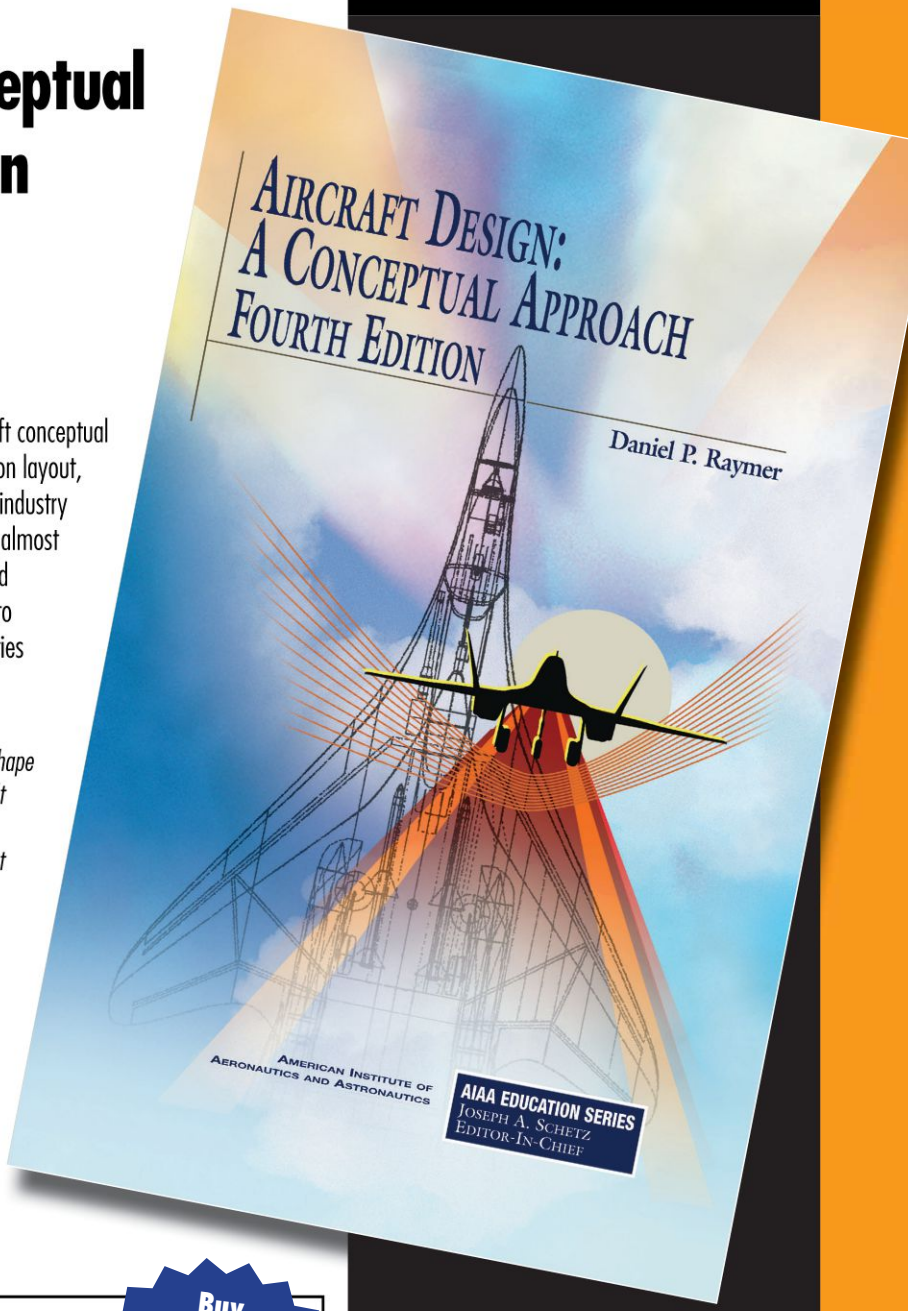

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Out of the

25 Years Ago, January 1986

Jan. 8 Voyager 2 discovers a new moon of Jupiter; throughout the following week it discovers five more, for a total of 14. NASA, *Astronautics and Aeronautics, 1986-90*, p. 8.

Jan. 28 The space shuttle Challenger explodes 74 sec after liftoff and 10 mi. above the Earth, killing all seven crewmembers—(front row) Michael J. Smith, Dick Scobee, Ronald McNair; (back row) Ellison Onizuka, Christa McAuliffe (who was to be the first teacher in space), Gregory Jarvis, and Judith Resnik. This is the worst U.S. space disaster and the 25th space shuttle launch. After an extensive investigation a panel of experts concludes that the accident was caused by a faulty seal on the right solid fuel booster, and that the craft should not have been launched at so low a temperature. NASA, *Aeronautics and Astronautics, 1986-1990*, pp. 9, 14-15.

50 Years Ago, January 1961

Jan. 6 The Bell HUL-1M helicopter, powered by an Allison T63 turboshaft engine, makes its first flight. *The Aeroplane*, Feb. 17, 1961, p. 164.

Jan. 6-7 The first U.K. symposium devoted strictly to rocket propulsion takes place at the College of Aeronautics in Cranfield, England. Organized by the Royal Aeronautical Society, the British Interplanetary Society, and the College of Aeronautics, the symposium attracts more than 100 delegates and features presentations of 17 papers surveying British work in this field. *The Aeroplane*, Jan. 13, 1961, p. 31.

Jan. 12 The first Italian space research begins with the successful launch of a U.S. Nike-Cajun sounding rocket from the Italian air force base at Perdasdefogu in Sardinia. The rocket, which carries an Italian scientific payload from the University of Rome, reaches 105 mi. and, on command, releases a stream of sodium vapor to obtain density, temperature, and other data on the outer atmosphere. *The Aeroplane*, Jan. 27, 1961, p. 80; *Flight*, Jan. 20, 1961, p. 77.

Jan. 14 A Convair B-58 Hustler averages 1,284.7 mph over a 1,000-km course near Edwards AFB, Calif., breaking three world speed records. The crew will be awarded the 1961 Thompson Trophy. *Flight*, Jan. 20, 1961, p. 73.

Jan. 19 President John F. Kennedy names Dallas-born attorney Najeeb E. Halaby, son of a Lebanese-Syrian immigrant, to be the second administrator of the FAA, the agency that regulates commercial air traffic in the U.S. He succeeds Elwood R. Quesada. A private pilot since 1933 and a Lockheed test pilot from 1941 to 1943, Halaby also served as a Navy test pilot until 1946 and made the first transcontinental jet flight. From 1948 to 1954 he was the deputy assistant secretary of defense for international security and from 1955 to 1957 was vice chairman of the White House Aviation Facilities Study Group, which helped form the FAA. In 1978, his daughter Lisa Halaby marries King Hussein of Jordan and becomes Queen Noor. *The Aeroplane*, Feb. 3, 1961, p. 113.

Jan. 19 American Telephone and Telegraph is authorized by the FCC to undertake experiments for radio repeater satellites that may include voice and TV signals transmitted between Holmdel, N.J., and receiving ground stations in the U.K., West Germany, and France. This is an important step toward communication satellites. *The Aeroplane*, Feb. 3, 1961, p. 123.

Jan. 19 NASA selects Hughes Aircraft to develop the Project Surveyor unmanned soft lunar landing spacecraft that is to touch down on the Moon and sample its surface. *The Aeroplane*, Feb. 10, 1961, p. 151.

Jan. 24 For the first time, a Hawk surface-to-air missile intercepts a high-speed Corporal surface-to-surface ballistic missile in flight at White Sands Proving Ground, N.M. Earlier, the Hawk had destroyed short-range Little John and Honest John unguided missiles. *The Aeroplane*, Feb. 10, 1961, p. 136.

Jan. 26 Italy's new Fiat 7002 medium-range helicopter with two-bladed rotor makes its first flight at Caselle airfield near Turin, Italy. The craft is powered by a Fiat 4700 turbogenerator with the rotor driven by "cold jets." It carries a useful load of 1,598 lb, has a seating capacity for a pilot and six passengers, a 186-mi.

Past

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

range, and a top speed of 106 mph. *The Aeroplane*, Feb. 10, 1961, p. 136, and Feb. 17, 1961, p. 163.

Jan. 30 At a conference in Strasbourg, France, delegates from the governments of several European countries approve Anglo-French proposals to develop a joint European vehicle for launching satellites. *Flight*, Feb. 10, 1961, p. 172.

Jan. 31 The Mercury MR-2 space capsule with the chimpanzee Ham aboard is boosted to a suborbital 15-min flight by a modified Redstone rocket, successfully launched, and recovered from Cape Canaveral, Fla., although splashdown is made 130 mi. farther away and faster than planned. Thus the capsule remains in the Atlantic Ocean for 3 hr before being retrieved by a Marine helicopter. *The Aeroplane*, Feb. 10, 1961, p. 52; *United States Naval Aviation 1910-1980*, p. 241.

Jan. 31 A pair of De Havilland Gyron Junior DGJ 10 turbojet engines, the first British turbojets designed for supersonic speeds, are installed and flown in a Gloster Javelin aircraft. Each engine provides 10,000 lb of sea-level thrust. The Javelin is serving as a test-bed for the engines that are to power the Bristol 188 all-steel supersonic research aircraft. *The Aeroplane*, Feb. 10, 1961, p. 135.

75 Years Ago, January 1936

Jan. 2 French writer and aviator Antoine de Saint-Exupery, already acclaimed for his poetic novels *Southern Mail* and *Night Flight,* is found, along with his mechanic, in the Egyptian desert 95 mi. east of Cairo. The two had been lost for three days following an attempt to establish a new Paris-Saigon record. Their Caudron Simoun aircraft hit the ground at full speed and skidded over the sand until it stopped. Unhurt, the men walked for two days until they exhausted their food rations, and were found soon after. Saint-Exupery later writes *Wind, Sand and Stars, Flight to Arras,* and *The Little Prince. Flight*, Jan. 9, 1936, p. 36.

Jan. 9 Three De Havilland Dragon Rapides light airliners adapted for military use arrive in Spain from England and are turned over to the Spanish air force for service in Morocco. *The Aeroplane*, Jan. 22, 1936, p. 111.

Jan. 14 Roscoe Turner's transcontinental speed record of 10 hr 2 min 51 sec is broken when Howard Hughes flies from Burbank, Calif., to Newark, N.J., in 9 hr 27 min 10 sec. His plane is a 950-hp Wright Cyclone G Series powered Northrop Gamma. Flying nonstop, Hughes averages 263.5 mph for the 2,450-mi. flight. *Aero Digest*, February 1936, p. 74.

Jan. 20 The Navy Bureau of Engineering approves development of radio meteorgraphs, later called radiosondes, which are weather-recording instruments sent aloft by free balloons. Data are gathered and transmitted to ground stations for use in weather forecasting and flight planning. The Navy's Bureau of Aeronautics recommended the development. E. Emme, ed., *Aeronautics and Astronautics 1915-60*, p. 33.

100 Years Ago, January 1911

Jan. 26 From San Diego Bay, Calif., Glenn Curtiss takes off in his first seaplane and makes a successful water landing. The machine, called a hydro-aeroplane, is a standard biplane with pontoons. A few days later he flies the plane 5 mi. over the sea. Alphonse Pénaud of France may have been the first to patent the idea of a seaplane in 1874, and Fabre flew his float plane in March 1910, but it is Curtiss who develops the first practical float plane. In addition, he is credited with inventing the step that helps break the hydrodynamic forces that often prevent the float from leaving the water's surface. He also adds wheels, creating an amphibian that can operate on both land and water. On Nov. 12, 1912, at the Washington Navy Yard, a Curtiss Hydro will become one of the first aircraft to be catapulted. C. Gibbs-Smith, *Aviation*, pp. 44, 153, 161, 164.

And During January 1911

—French Capt. Albert Étevé tests the first practical airspeed indicator. C. Gibbs-Smith, *Aviation*, p. 158.

THE UNIVERSITY of TENNESSEE
KNOXVILLE
COLLEGE of ENGINEERING

The Department of Mechanical, Aerospace and Biomedical Engineering (MABE) invites applications and nominations for 2 Assistant/Associate Professors in the respective areas of (1) **air-breathing** and (2) **rocket propulsion.** Primary consideration will be given to those with research and teaching interests in computational thermofluids, acoustics, and combustion. Specific subareas of interest for the positions include, respectively: (1) gas-turbine systems, ramjet/scramjets, hypersonics, spray combustion, thermal management, aerothermodynamics, and combustion processes; and (2) solid, liquid, or hybrid rocketry, computational aerothermodynamics, aerospace system modeling, acoustics, swirl and injection-driven flow modeling, supercritical combustion, and propellant-flow interactions. **The two positions will be located at the University of Tennessee Space Institute (UTSI) in Tullahoma, TN.** The position(s) will include a competitive compensation package commensurate with experience and qualifications. For additional information about the Institute and the Department, visit web sites at www.utsi.edu and www.engr.utk.edu.

Duties and Expectations: Teaching at the graduate level is required, including the recruitment of new graduate students. Faculty will be expected to develop and promote individual sponsored research initiatives as well as participate in research teams with other faculty. Effective interaction with industry, especially Arnold Engineering Development Center in Tullahoma, will be essential to success.

Required Qualifications: An earned doctorate in mechanical/aerospace/chemical engineering or closely related field, superb academic credentials, and strong potential for developing a vibrant, externally funded research program in air-breathing and/or rocket propulsion are required. A strong commitment to teaching excellence at the graduate level and appropriate publications in leading scholarly journals are also required. In addition, the ability to obtain approval to work on DOD projects is essential.

Application: Individuals interested in applying should submit as a single PDF file: a letter of intent clearly indicating the area of interest in either (1) air-breathing or (2) rocket propulsion; a statement of teaching and research interests; a curriculum vitae; copies of 3 publications; and contact information for at least 3 professional references to the search chair, Dr. Joseph Majdalani, Professor and Arnold Chair of Excellence in Advanced Propulsion, at maji@utsi.edu. Review of applications and nominations will begin February 1, 2011, and will continue until the positions are filled.

The University of Tennessee is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA institution in the provision of its education and employment programs and services. All qualified applicants will receive equal consideration for employment without regard to race, color, national origin, religion, sex, pregnancy, marital status, sexual orientation, gender identity, age, physical or mental disability, or covered veteran status.

DEPARTMENT OF AEROSPACE ENGINEERING
WICHITA STATE UNIVERSITY
Positions in Aerospace Structures and Flight Mechanics

The Wichita State University (WSU) Aerospace Engineering department has two faculty positions available in aerospace structures and flight mechanics. The tenure track positions, at the Assistant Professor rank, include teaching, research, scholarship, and service responsibilities.

Applicants must hold a doctorate in aerospace engineering or a strongly related engineering discipline. Additionally, applicants must have at least one degree in aerospace engineering or have notable aerospace industry/research lab experience. A demonstrated ability to teach, conduct research, publish, communication effectively, and a commitment to diversity are also required.

WSU, located in the Air Capital, has a proud history. The department's undergraduate and graduate (MS & PhD) programs are strong and play an important educational and research role in the city, region, and nation. In fact, the National Science Foundation ranked WSU third among all U.S. universities in aerospace research and development expenditures (for fiscal year 2007). Furthermore, the department and National Institute for Aviation Research (NIAR) are home to an outstanding collection of wind/water tunnel, aircraft icing, composites, structural testing, fatigue/fracture, flight mechanics, crash dynamics, and computational laboratories.

The WSU campus is an attractively landscaped architectural showplace with approximately 15,000 students. Wichita, a community of approximately 450,000 people, is home to aerospace leaders Cessna Aircraft, Hawker-Beechcraft, Bombardier Learjet, Boeing, Airbus, and Spirit AeroSystems.

U.S. citizens or permanent residents with an undergraduate degree in aerospace engineering are preferred. Applicants should clearly state their status or ability to work in the US. Salary is commensurate with qualifications and experience. If interested, apply online - submitting a resume, a letter of introduction discussing your teaching and research philosophies, and contact information for at least six references located in the United States. The closing date for these positions is February 28, 2011, or the end of each successive month until the position is filled. WSU is an EEO/AA employer.

Offers of employment are contingent upon completion of a satisfactory criminal background check as required by Kansas Board of Regents policy. Candidates must go online at http://jobs.wichita.edu to apply for the positions.

AEROSPACE ENGINEERING AND MECHANICS
UNIVERSITY OF MINNESOTA

The Department of Aerospace Engineering and Mechanics seeks to fill two tenure-track positions at the assistant professor level. One position is in the area of aerospace systems and the second is in the area of fluid mechanics. Applications are invited in all areas of aerospace systems and fluids particularly those that complement the current research activities in the department, and bridge current and emerging fields.

Current research activities in the aerospace systems area include robust control, optimization, navigation, guidance and advanced computer software methods as applied to the design and operation of aircraft, spacecraft and autonomous vehicles.

Current research activities in the fluid mechanics area include turbulent flows, multi-phase flows, micro-scale flows, computational fluid dynamics, rarefied flows, and high-temperature gas dynamics.

Successful candidates for both positions will participate in all aspects of the department's mission, including teaching at the undergraduate and graduate levels, supervision of undergraduate and graduate students, service responsibilities, and will be expected to develop an independent, externally-funded research program. In particular, the candidates will be expected to teach aerospace engineering courses including service courses in mechanics and undergraduate and graduate courses in fluid mechanics or aerospace systems.

Applicants must have an earned doctorate in a related field by the date of appointment. Experience beyond the doctorate degree is desirable. Although our focus will be at the rank of Assistant Professor, exceptional candidates will be considered at the rank of associate or full professor. It is anticipated that the appointment will begin fall 2011.

To apply for this position, candidates must go to http://www1.umn.edu/ohr/employment/index.html and search for requisition no. (insert 6 digit no). Please attach your letter of application, detailed resume, names and contact information of three references.

Application Deadline: The initial screening of applications will begin on December 1, 2010; applications will be accepted until the position is filled.

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FSU Mechanical Engineering Faculty Search

THE DEPARTMENT OF MECHANICAL ENGINEERING at Florida State University and Florida A&M University's jointly administered College of Engineering invites applications for tenure track faculty positions in the areas of Experimental Fluid Mechanics and Thermal Sciences with an emphasis on high-speed flows and advanced diagnostics. The position is at the Assistant Professor level; however, exceptional candidates will also be considered for senior appointments. Special consideration will be given to candidates who have a strong background in research areas that are presently being actively pursued within the Department and the Florida Center for Advanced Aero-Propulsion, FCAAP, (a multi-university Center of Excellence led by Florida State University, http://www.fcaap.com/). Some of these areas of research include: active flow and noise control, advanced flow diagnostics; sensor, actuator and control design; micro-fluidics, bio-inspired flight and micro-air vehicles.

Successful candidates will be expected to teach and develop mechanical engineering courses at the undergraduate and graduate levels, and conduct high quality, externally sponsored research. In addition to FCAAP, our faculty have established a number of nationally recognized, inter-disciplinary research programs and the Department is home to several state-of-the art research facilities and Centers of Excellence that offer excellent opportunities for collaboration and growth. Some of these include: the National High Magnetic Field Laboratory and the Institute for Energy Systems, Economics, and Sustainability, along with a number of facilities within the Department (see www.eng.fsu.edu/me).

The position is a tenure track academic faculty line at the Florida State University. A Ph.D. in Engineering or a related field is required. Applications from minorities and women are strongly encouraged.

Applicants are encouraged to apply by January 15, 2011 for full consideration, although the application process will remain open until suitable candidates have been found. Candidates interested in being considered should send a cover letter which includes a brief discussion of their research and teaching philosophy and future plans and a curriculum vita, with at least three references to:

Chair, Faculty Search Committee
Department of Mechanical Engineering
FAMU-FSU College of Engineering
2525 Pottsdamer Street, Room A229
Tallahassee, FL 32310
mefacsearch@eng.fsu.edu

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Aerospace Materials and Aerospace Design Faculty Positions
Aerospace Engineering Department at Texas A&M

The Department of Aerospace Engineering at Texas A&M University in College Station, Texas is seeking applicants for two tenure-track faculty positions with a potential start in Fall 2011. We are seeking outstanding individuals in the areas of multifunctional aerospace materials and aerospace vehicle design. It is expected that the appointments will be at the assistant professor level, but an associate professor appointment is possible, dependent upon qualifications presented.

For the aerospace materials position, all relevant specialties will be considered, including but not limited to, multifunctional nanocomposites, advanced and function-ally graded materials, and high-temperature materials. For the aerospace design position, applications are encouraged from individuals with aerospace vehicle design experience and a general background in aerodynamics, flight mechanics, structures, or propulsion. Applicants should hold an earned doctoral degree in aerospace engineering or another closely related discipline.

The successful candidates will be expected to teach courses in aerospace materials or design at the undergraduate and graduate levels, as well as initiate and sustain a high-quality, externally funded graduate research program in their related field, publish in archival journals, and mentor graduate and undergraduate students.

ABOUT OUR PROGRAM: The Department of Aerospace Engineering has a strong academic and research program with more than 30 faculty members who represent a broad spectrum of research interests in the areas of materials and structures, aerodynamics and propulsion, and dynamics and controls. See http://aero.tamu.edu for details or contact Dr. Dimitris Lagoudas, Department Head, lagoudas@tamu.edu.

HOW TO APPLY: Submit a detailed resumé, cover letter, brief statement of research and teaching interests, and the names and contact information of five references to:

Dr. Amine Benzerga
Aerospace Materials Search Chair
facultymat@aero.tamu.edu

Dr. John Valasek
Aerospace Design Search Chair
facultydes@aero.tamu.edu

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Faculty Openings
Aeronautics & Astronautics

The School of Aeronautics & Astronautics (AAE) at Purdue University seeks outstanding individuals with a Ph.D. and a strong background relevant to aerospace engineering. Currently, AAE faculty members conduct research and teaching in the broad disciplines of Aerodynamics, Aerospace Systems, Astrodynamics and Space Applications, Dynamics and Control, Propulsion, and Structures and Materials. Candidates with interests in these areas are encouraged to apply. Details about the School, its current faculty, and research may be found at the Purdue AAE website https://engineering.purdue.edu/AAE

Candidates should have a distinguished academic record, exceptional potential for world-class research, and a commitment to both undergraduate and graduate education. Tenure-track positions are available at the assistant and associate ranks. For consideration, please submit curriculum vitae, statement of teaching and research interests, and the names and addresses of at least three references to the College of Engineering Faculty Hiring website, https://engineering.purdue.edu/Engr/AboutUs/Employment/indicating interest in AAE. Review of applicants begins 1/15/11 and continues until the positions are filled.

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Open-Rank Faculty Position in Combustion/Propulsion

Department of Aerospace Engineering

University of Illinois at Urbana-Champaign

The Department of Aerospace Engineering at the University of Illinois at Urbana-Champaign is seeking candidates at all academic ranks for a full-time faculty position beginning as early as August 16, 2011. Applications from women and underrepresented minorities are especially welcome and are strongly encouraged.

The Department seeks exceptional candidates for a tenure-track or tenured faculty position with expertise in the fundamental science and engineering of computational combustion and/or propulsion, including multi-phase reactive flows, energetic materials, alternative fuels (including sustainable and clean fuels), micro-combustion or micro-propulsion. Outstanding candidates with expertise in other aspects of combustion or propulsion, or other areas of fluid mechanics in general, including those with an exceptional experimental background, will also be considered.

Please visit http://jobs.illinois.edu to view the complete job announcement and application instructions. Applications are due by 01/07/11, to receive full consideration.

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ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

AIAA Bulletin

AIAA Executive Director Robert Dickman (right) signs translation agreements with Liu Xin, General Manager of China Aviation Publishing & Media. Back row (L to R): Wang Yingjie, President of the AVIC Economic & Technology Institute; AIAA Managing Director of Technical Activities Megan Scheidt; Edward "Ned" Allen, Lockheed Martin and editor-in-chief of AIAA Library of Flight; Zhang Xinguo, Executive Vice President of the Aviation Industry Corporation of China; AIAA Managing Director of Technical Publications Rodger Williams; Joseph W. Lee, International Consulting Services, associate editor *Journal of Aircraft*; and John D. Anderson, Jr, University of Maryland and National Air and Space Museum, AIAA author. See the special section on AIAA collaboration with China on pages **B6–B7**.

JANUARY 2011

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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
2011				
4–7 Jan	**49th AIAA Aerospace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition (Oct)**	Orlando, FL	*Jan 10*	**1 Jun 10**
24–27 Jan†	**The Annual Reliability and Maintainability Symposium (RAMS)**	Lake Buena Vista, FL (Contact: Walt Willing, 410.765.7372, walter.willing@ngc.com, www.rams.org)		
Feb†	**The "Space Shuttle: An Engineering Milestone" Symposium**	Atlanta, GA (Contact Ms. Cindy Pendley, 404.385.8587, cindy.pendley@aerospace.gatech.edu)		
7–9 Feb	**Airworthiness, CBM, and HUMS Specialists' Meeting**	Huntsville, AL (Contact: Robert King, 256.313.9016; Rob.L.King@us.army.mil)		
7–10 Feb†	**Nuclear and Emerging Technologies for Space 2011 (NETS-2011)**	Albuquerque, NM (Contact: Shannon Bragg-Sitton, sitton@tamu.edu, http://anstd.ans.org/NETS2011.html)		
9–10 Feb	**14th Annual FAA Commercial Space Transportation Conference (Dec)**	Washington, DC		
13–17 Feb	**21st AAS/AIAA Space Flight Mechanics Meeting**	New Orleans, LA Contact: Peter Lai, 310.336.2367, www.space-flight.org/AAS_meetings/2011_winter/2011%20winter.html	*May 10*	**11 Oct 10**
5–12 Mar†	**2011 IEEE Aerospace Conference**	Big Sky, MT Contact: David Woerner, dwoerner@ieee.org, www.aeroconf.org		
28–30 Mar†	**3AF-46th Symposium of Applied Aerodynamics**	Orleans, France (Contact: Anne Venables, secr.exec@aaafasso.fr, http://www.aaafasso.fr)		
29–31 Mar	**Infotech@Aerospace 2011 Conference (Jan)**	St. Louis, MO	*Jul/Aug 10*	**13 Sep 10**
4–7 Apr	**52st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference (Jan)** **19th AIAA/ASME/AHS Adaptive Structures Conference** **13th AIAA Non-Deterministic Approaches Conference** **13th AIAA Dynamics Specialist Conference** **12th AIAA Gossamer Systems Forum** **7th AIAA Multidisciplinary Design Optimization Specialist Conference**	Denver, CO	*Apr 10*	**9 Aug 10**
11–14 Apr	**17th AIAA International Space Planes and Hypersonic Systems and Technologies Conference (Jan)**	San Francisco, CA	*Apr 10*	**1 Sep 10**
13–15 Apr†	**1st CEAS Specialist Conference on Guidance, Navigation & Control**	Munich, Germany Contact: DGLR, +49 228 30 80 5-0, gnc@dglr.de, www.ceas-gnc.eu		
11 May	**AIAA Aerospace Spotlight Awards Gala**	Washington, DC		
18–20 May†	**Sexto Congreso Argentino de Tecnologia Espacial (Sixth Argentine Congress on Space Technology)**	San Luis, Argentina Contact: Pablo de León, 701.777.2369 (U.S.); deleon@aate.org; www.aate.org		
23–26 May	**21st AIAA Aerodynamic Decelerator Systems Technology Conference and Seminar**	Dublin, Ireland	*May 10*	**7 Oct 10**
30 May–1 Jun†	**18th St Petersburg International Conference on Integrated Navigation Systems**	St. Petersburg, Russia Contact: Prof. V. Peshekhonov, +7 812 238 8210, elprib@online.ru, www.elektropribor.spb.ru		
30 May–1 Jun†	**2nd International IAA Symposium on Private Human Access to Space**	Arcachon, France Contact: Christophe Bonnal, +33.1 60.87.74.89 (Fax); www.avantage-aquitaine.com		
2 Jun	**Aerospace Today ... and Tomorrow: An Executive Symposium**	Williamsburg, VA		
6–8 Jun	**17th AIAA/CEAS Aeroacoustics Conference (31st AIAA Aeroacoustics Conference)**	Portland, OR	*Jun 10*	**9 Nov 10**
9–11 Jun†	**5th International Conference on Recent Advances in Space Technologies**	Istanbul, Turkey		
13–17 Jun†	**International Conference on Aircraft and Engine Icing and Ground Deicing**	Chicago, IL Contact: Frank Bokulich, fbokulich@sae.org		
26–30 Jun†	**International Forum on Aeroelasticity and Structural Dynamics 2011 (IFASD2011)**	Paris, France (Contact: Anne Venables, secr.exec@aaaf.asso.fr, www.ifasd2011.com)		

DATE	MEETING (Issue of *AIAA Bulletin* in which program appears)	LOCATION	CALL FOR PAPERS (*Bulletin* in which Call for Papers appears)	ABSTRACT DEADLINE
27–30 Jun	**29th AIAA Applied Aerodynamics Conference** **41st AIAA Fluid Dynamics Conference and Exhibit** **20th AIAA Computational Fluid Dynamics Conference** **42nd AIAA Thermophysics Conference** **6th AIAA Theoretical Fluid Mechanics Conference** **42nd AIAA Plasmadynamics and Lasers Conference** **3rd AIAA Atmospheric and Space Environments Conference**	Honolulu, HI	*Jun 10*	**17 Nov 10**
17–21 Jul	**41st International Conference on Environmental Systems**	Portland, OR	*Oct 10*	**15 Nov 10**
31 Jul–4 Aug†	**2011 AAS/AIAA Astrodynamics Specialist Conference**	Girdwood, AK	*Dec 10*	**5 Apr 11**
		Contact: William T. Cerven, 571.307.4208, william.t.cerven@aero.org, http://www.space-flight.org/docs/2011_astro/2011_astro.html		
1–3 Aug	**9th Annual International Energy Conversion Engineering Conference**	San Diego, CA	*Jul/Aug 10*	**23 Nov 10**
1–3 Aug	**47th AIAA/ASME/SAE/ASEE Jointi Propulsion Conference & Exhibit**	San Diego, CA	*Jul/Aug 10*	**23 Nov 10**
8–11 Aug	**AIAA Guidance, Navigation, and Control Conference** **AIAA Atmospheric Flight Mechanics Conference** **AIAA Modeling and Simulation Technologies Conference**	Portland, OR	*Jul/Aug 10*	**17 Jan 11**
20–22 Sep	**7th AIAA Biennial National Forum on Weapon System Effectiveness (SECRET/U.S. ONLY)**	Virginia Beach, VA	*Sep 10*	**14 Feb 11**
20–22 Sep	**11th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference including Lighter-Than-Air and Balloon Systems**	Virginia Beach, VA	*Sep 10*	**7 Feb 11**
21–22 Sep	**AIAA Centennial of Naval Aviation Forum "100 Years of Achievement and Progress" (Jointly held with ATIO)**	Virginia Beach, VA	*Sep 10*	**7 Feb 11**
26–29 Sep	**AIAA SPACE 2011 Conference & Exposition**	Long Beach, CA	*Sep 10*	**25 Jan 11**
3–7 Oct†	**62nd International Astronautical Congress**	Cape Town, South Africa (www.iac2011.com)		
26–28 Oct†	**2nd Aircraft Structural Design Conference**	London, UK (Contact: Hinal Patel-Bhuya, Hinal.patel@aerosociety.com, www.aerosociety.com/conferences)		
2–4 Nov†	**6th International Conference Supply on the Wings**	Frankfurt, Germany Contact: Prof. Dr. Richard Degenhardt, +49 531 295 3059; +49 531 295 2232 (Fax)		
2012				
9–12 Jan	**50th AIAA Aerospace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition**	Nashville, TN	*Jan 11*	**1 Jun 11**
4–6 Jun	**19th St Petersburg International Conference on Integrated Navigation Systems**	St. Petersburg, Russia Contact: Prof. V. Peshekhonov, +7 812 238 8210, elprib@online.ru, www.elektropribor.spb.ru		
14–22 Jul	**39th Scientific Assembly of the Committee on Space Research and Associated Events (COSPAR 2012)**	Mysore, India Contact: http://www.cospar-assembly.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 http://www.aiaa.org/content.cfm?pageid=292.

AIAA Courses and Training Program

DATE	COURSE	VENUE	LOCATION
2011			
8–9 Jan	**CFD for Combustion Modeling**	Aerospace Sciences Meeting	Orlando, FL
8–9 Jan	**Modern Design of Experiments**	Aerospace Sciences Meeting	Orlando, FL
8–9 Jan	**Basic Measurement Uncertainty, Methods and Applications**	Aerospace Sciences Meeting	Orlando, FL
8–9 Jan	**C++ in Aerospace Simulations**	Aerospace Sciences Meeting	Orlando, FL
8–9 Jan	**Systems Requirements Engineering**	Aerospace Sciences Meeting	Orlando, FL
8–9 Jan	**Perturbation Methods in Science and Engineering**	Aerospace Sciences Meeting	Orlando, FL
8–9 Jan	**Verification and Validation in Scientific Computing**	Aerospace Sciences Meeting	Orlando, FL
8–9 Jan	**Sustainable (Green) Aviation**	Aerospace Sciences Meeting	Orlando, FL
1 Feb–31 Jul	**Introduction to Spaceflight**	*Distance Learning*	
1 Feb–31 Jul	**Fundamentals of Aircraft Performance & Design**	*Distance Learning*	
27–28 Mar	**Electro-Optical Systems for Aerospace Sensing Applications**	Infotech@Aerospace	St Louis, MO
2–3 Apr	**Design of Aircraft Structures**	Structures Conferences	Denver, CO
2–3 Apr	**The Fundamentals of Composite Structure Design**	Structures Conferences	Denver, CO
2–3 Apr	**Structural Dynamics in Mechanical Design**	Structures Conferences	Denver, CO
2–3 Apr	**Computational Methods in Aeroelasticity**	Structures Conferences	Denver, CO
9–10 Apr	**Fundamentals of Hypersonic Aerodynamics**	Int'l Space Planes & Hypersonics	San Francisco, CA
4–5 Jun	**Computational Aeroacoustics: Methods and Applications**	Aeroacoustics Conference	Portland, OR
25–26 Jun	**Computational Multiphase Flow**	Fluid Dynamics Conferences	Honolulu, HI
25–26 Jun	**Modern Flow I**	Fluid Dynamics Conferences	Honolulu, HI
25–26 Jun	**Turbulence Modeling for Computation Fluid Dynamics**	Fluid Dynamics Conferences	Honolulu, HI
25–26 Jun	**Sensitivity Analysis and Uncertainty Propagation for Computational Models**	Fluid Dynamics Conferences	Honolulu, HI
25–26 Jun	**Microfluidics and Nanofluidics: Fundamentals and Applications**	Fluid Dynamics Conferences	Honolulu, HI
16–17 Jul	**Space Environment and Its Effects on Space Systems**	Int'l Conf. on Environmental Systems	Portland, OR
4–5 Aug	**Liquid Propulsion Systems—Evolution and Advancements**	Joint Propulsion Conf	San Diego, CA
4–5 Aug	**Pressure Vessel Design Requirements and Verification Guidelines**	Joint Propulsion Conf	San Diego, CA
4–5 Aug	**Hybrid Rocket Propulsion**	Joint Propulsion Conf	San Diego, CA
4–5 Aug	**Air Breathing Propulsion Design**	Joint Propulsion Conf	San Diego, CA
4–5 Aug	**Electric Propulsion for Space Systems**	Joint Propulsion Conf	San Diego, CA
6–7 Aug	**Aircraft and Rotorcraft System Identification Engineering Methods and Hands-on Training using CIFER®**	GNC Conferences	Portland, OR
6–7 Aug	**Aircraft Handling Qualities**	GNC Conferences	Portland, OR
6–7 Aug	**Mathematical Introduction to Integrated Navigation Systems with Applications**	GNC Conferences	Portland, OR
6–7 Aug	**Modeling Flight Dynamics with Tensors**	GNC Conferences	Portland, OR
6–7 Aug	**Modern Missile Guidance**	GNC Conferences	Portland, OR
6–7 Aug	**Vision Based Control for Autonomous Vehicles**	GNC Conferences	Portland, OR
17–19 Sep	**Spacecraft Design and System Engineering**	ATIO/LTA/Balloons & Weapons Conf w/Naval Aviation Forum	Virginia Beach, VA
18–19 Sep	**Tactical Missile Design and System Engineering**	ATIO/LTA/Balloons & Weapons Conf w/Naval Aviation Forum	Virginia Beach, VA
25–26 Sep	**Introduction to Space Systems**	SPACE Conference	Long Beach, CA
25–26 Sep	**Systems Engineering Validation and Verification**	SPACE Conference	Long Beach, CA
25–26 Sep	**The Space Environment: Implications for Spacecraft Design**	SPACE Conference	Long Beach, CA

To receive information on courses listed above, write or call AIAA Customer Service,
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800.639.2422 or 703.264.7500 (outside the U.S.). Also accessible via the internet at www.aiaa.org/courses.

From the **Corner** Office

COLLABORATION WITH CHINA

China: "It is a riddle, wrapped in a mystery, inside an enigma …" No, wait—that was Winston Churchill's characterization of Russia. But it seems there are many similarities, at least in what we understand about China today. The rest of Churchill's quote is probably just as applicable: "… but perhaps there is a key. That key is Russian national interest." The key to how China acts is Chinese national interest. And, lest we think otherwise, the same can be said for the United States and every other sovereign nation.

As reported on pages **B6–B7** in the *Bulletin* this month, AIAA interaction with Chinese aerospace continues to grow. I'm sure there are members that applaud this initiative, and members that think it is crazy. Since I've been "behind" much of this, I'd like to share my perspectives.

Two years ago, I attended a one-day, space-related symposium in Beijing. It was my first visit to China, and the first time I had much contact with Chinese aerospace professionals. Several things impressed me: China was working across a broad range of space programs; China was willing to discuss much of what they were doing in what we'd call "civil" space—much, not all; China acknowledged that in many areas they are "a long way behind western technology," but they are committed to catch up. Perhaps the biggest eye-opener was that much of the rest of the international aerospace community already had significant ties with their Chinese counterparts. Near the end of the symposium, an older Chinese participant gave what was essentially a "rant" against the United States. I was surprised (and offended) at the time, but as I thought about it, I saw it through a different lens. The symposium was intended to be very collegial, and it was. My guess is that this gentleman, and his views, were known to his Chinese colleagues. It would have been very easy for the Chinese hosts to deny him access, to ensure everything went "as scripted." They didn't—and neither would we. I expect the Chinese leadership was as embarrassed as we were surprised, but the event was intended to include a broad spectrum of participants and ideas. There were many differing views expressed, and that was a good thing.

Later, I met with Liu Xin, head of what was then the Chinese Aviation Industry Press (AIP). AIP had contacted us through an intermediary about publishing some of our books. The idea was unique: the English book would have some (significant) fraction with accompanying Chinese translation—so that students could learn technical English with the help of explanations in their native language. The prospect seemed intriguing, but I spent 37 years working inside the U.S. Air Force space program, and collaboration with the Chinese wasn't something I'd ever considered. The discussions with Liu Xin were enough for me to ask our staff publications team to work with the VP-Publications, and the various authors about whether we might make something work. Obviously, our books are on the open market and there are no ITAR issues, but we approached the relationship very carefully, nonetheless.

While this was going on with respect to aviation, a delegation for the Chinese Society of Astronautics (CSA) had visited us at AIAA Headquarters. Last year, Megan Scheidt, our staff Managing Director, Technical and International Activities, and I cut short our participation in the International Astronautical Congress in Korea to go to Beijing to meet with CSA and also with AIP. During the visit, we initiated discussions about a Memorandum of Understanding with CSA that was subsequently approved by the AIAA Board and signed by President David Thompson when he visited China this past March, and reviewed the progress on the book publishing.

As a result of the discussions that had taken place over the past two years, we were able to organize the space-related AIAA Corporate Member visit that took place in October, and we hosted a senior aviation delegation here in early November. To say that the visits were productive and have led to personal contacts that were unexpected (and not even considered possible two years ago by many of us) would be an understatement. In addition, the Board will consider another MOU, this time with the Chinese Society of Aeronautics and Astronautics (CSAA). Unlike AIAA, there are two professional societies in China serving the aerospace community, CSA for space and CSAA for aviation.

All this is background and status, but doesn't answer the question: "why?" Part of that answer goes back to the Russians. In 1975, the United States and the Soviet Union accomplished the joint Apollo–Soyuz mission with the two capsules docking in space. The U.S. commander was Tom Stafford, who went on to become a Lieutenant General as the Deputy Chief of Staff (Research, Development and Acquisition) for the USAF. I don't think there was anyone in the business that didn't know that by 1975 our "space technology" was far advanced from the Soviets. But the prospect of better understanding between the two superpowers was considered more important than the risk of technology transfer. The situation today with China isn't that different.

The Chinese aerospace industry is robust, and the academic infrastructure that is producing technically skilled professionals is enormous. The first commercial orders for the 737/320-class Chinese C-919 are in hand. The C-919 includes systems from around the world, including engines from GE and controls from Honeywell. The Long March rocket has a history of successful missions comparable to U.S., Russian, and European launch vehicles. (And, no, the insights gained through the ITAR violations in the late 1990s are not the reason they have successful rockets. They began flying the Long March family in 1970.)

In my mind, the better we understand what anyone else is doing, and the better others understand us, the less chance of a misunderstanding that could lead to catastrophic consequences. I'm not referring to detailed technology insights where we have a competitive advantage and certainly not to national security aspects of our aerospace activities. But if a Chinese firm wants to build rocket propellant tanks to sell to the United States, and it makes good business sense, I wouldn't worry about what "they'd learn" about our rockets, and I'd welcome knowing more about how, and how well, they build the tanks. If a consequence of that happening is that our sales to China increase, all the better. It happens today with aircraft systems; I see no reason why it can't with space systems.

The final aspect of my thinking is more personal. Almost without exception, the Chinese aerospace professionals I've dealt with have been open, friendly, gracious, and very competent. They are fun and interesting to be with. They are also businessmen. They know who I am, they know my military career. To a lesser extent, probably, I know who they are. That they have worked on "national security" aviation or space systems is almost a certainty—and neither of us would ever discuss any sensitive part of our background. That they would "report back" that we had talked is also almost a certainty—just as I am required to do. That happens to be true for almost every foreign national that is a senior aerospace professional.

To close the circle, I don't think it is in the United States' interest for one of the largest trading partners, and the holder of a significant fraction of our national debt, to be "a riddle, wrapped in a mystery, inside an enigma..." To the extent we can, I hope that AIAA's initiatives with our counterparts in China can help unwrap that mystery.

Bob Dickman
bobd@aiaa.org

SPECIAL SECTION: AIAA COLLABORATION WITH CHINA

In its efforts to truly be a global leader, AIAA is focused on increasing its international participation, in particular through partnering with other organizations to sponsor activities on a global basis. To reflect the desired global perspectives fully, the AIAA Strategic Plan targets growth in AIAA's currently underrepresented international aerospace communities, specifically including Argentina, Brazil, China, Central and Eastern Europe, India, Japan, Korea, and Russia.

Over the past two years, there has been much focus on China. AIAA President Mark Lewis stated: "With China's apparent interest in world aerospace markets, AIAA looks forward to appropriate opportunities to expand our collaboration and cooperation with China's aerospace community. Expanded interactions and mutual understanding should strengthen ties between the American and Chinese aerospace communities, which may allow for greater understanding and cooperation between our nations. AIAA anticipates a positive working relationship with our Chinese colleagues in the years to come, and is hopeful that our partnership will produce positive outcomes for our aerospace communities."

AIAA Membership in China

- 121 Professional Members *(6 Associate Fellows, 51 Senior Members)*
- 71 Student Members
- 6 Educator Associates
- 2 Student Branches *(Northwestern Polytechnical University, Hong Kong University of Science & Technology)*

After a series of meetings and discussions about possible collaboration over the past two years, AIAA formalized a Memorandum of Understanding (MOU) with the Chinese Society of Astronautics (CSA) in March 2010. Identified areas of collaboration include: cosponsoring each others' activities, collaborating on conferences covering topics of mutual interest, copublishing and disseminating information of interest to each others' memberships, and organizing visits of members to each others' countries. One of the articles in this special section is about the executive visit to China by some AIAA corporate members in October 2010.

On the aviation side, in the last year AIAA has signed publications agreements for 13 AIAA book titles with the Aviation Industry Press in China to allow selected books to be translated in Chinese and published in China. Information about this initiative is detailed in one of the articles in this special section. In addition, AIAA has had preliminary discussions with the aeronautics society in China about possible collaboration in various areas.

AIAA CORPORATE MEMBERS VISIT CHINA

Craig Day, AIAA Director, Business Development

In October, an AIAA delegation of senior U.S. space industry executives visited China. The trip, part of our Corporate Member program, was intended to establish communication between the commercial space sectors of the two countries.

The group began its week of meetings at the U.S. Embassy in Beijing. The delegation was fortunate to meet with the Economic Minister Counselor and staff from the Science and Technology office. This session afforded the delegates the opportunity to learn about the current economic environment in China and the state of international business there. The overall message of the discussion was that the delegation's meetings with industry should be aimed at initiating communication as a first step toward building better relationships with Chinese industry officials. Over the subsequent four days, the delegation met with numerous high-level representatives from Chinese industry and visited many of the sites and facilities that are responsible for designing, manufacturing, testing, integrating, and operating the majority of China's spacecraft and launch vehicles; from commercial telecommunications spacecraft to human spaceflight hardware.

China Satcom's business is focused in three areas: space operations, ground services, and location-based services. At the time of the delegation's visit, China Satcom had six spacecraft on orbit under its responsibility with another three in development by Chinese industry and two platforms on order from international partners. The organization is working toward becoming a leader in providing satellite services not just in China, but internationally as well, with a goal of having 15 spacecraft in operation by 2015.

The China Center for Resources Satellite Data and Application (CRESDA) currently operates three Earth observation satellites and provides data processing and modeling with application to resource management, environmental protection, and disaster monitoring.

Since the launch of China's first satellite in 1970, the China Academy of Space Technology (CAST) has been instrumental in the success of Chinese space programs. CAST is focused on product development in three areas: satellite design and manufacture, human spaceflight, and deep space exploration. With approximately 13,000 employees and 16 subsidiary organizations, CAST has the capability to manufacture 13 spacecraft per year and plans to be involved with 20 spacecraft launches in 2011, up from 14 in 2010. On the human spaceflight side, it was clear from the visit to CAST that the country is moving forward

AIAA's corporate member delegation to China met with Dr. Ma Xingrui, President of China Aerospace Science and Technology Corporation (CASC), in Beijing on 26 October. Front row (l to r): Guo Lianping (CASC), John Sommerer (JHU/APL), Bob Lindberg (NIA), Ma Xingrui (CASC), Kevin Kremeyer (PM&AM Research), Brewster Shaw (Boeing). Second row (l to r): Mike Hamel (Orbital Sciences), Brad Perrett (AvWeek), Dennis Mills (Pratt & Whitney Rocketdyne), Hu Zhongmin (CASC), Yang Lunhua (CSA), Xu Tong (CASC). Back row (l to r): Craig Day (AIAA), Craig Weston (US Space LLC), Patrick Liu (AIAA), Mark Wilkins (ULA).

systematically, in a sustainable way with the necessary funding and support from their government.

Founded in 1957, the China Academy of Launch Vehicle Technology (CALT) has become the largest entity for research, design, test, and manufacture of launch vehicles in China. CALT has primary responsibility for the design and manufacture of the Long March family of launch vehicles and currently employs approximately 22,000 staff, of which about 8,000 are engineers. Since the first satellite launch in 1970, the Long March family of launch vehicles has had 86 successful flights, placing more than 120 domestic and international spacecraft into orbit, including the 3 manned Shenzhou flights to date. Current developments at CALT are centered around the new Long March 5 series of launch vehicles. The delegation also met with the president of the China Great Wall Industry Corporation (CGWIC), which is responsible for providing commercial Long March launch services to the international market.

In Shanghai, the delegation visited the Shanghai Academy of Spaceflight Technology (SAST). In addition to competing with CAST for some spacecraft design projects, SAST also does work in solar energy, composite materials, and even autoparts. The AIAA group had an opportunity to visit a photovoltaic design, manufacture, and testing center as well as a small satellite assembly facility at SAST.

The delegation agreed that the trip was a productive one, having met with the highest levels of leadership at each of the organizations. All of the Chinese executives were eager to share their recent accomplishments and near-term plans. Beyond the facility tours, however, the most important aspect of the visit was the initial relationship building the group was able to accomplish with the industry leadership in China. The open and transparent welcome given by each organization was most encouraging. While the current regulatory environment in the United States may not be conducive to productive cooperation in many areas, there are topics related to Earth observation and space exploration that could potentially be explored for opportunities to collaborate with China.

This trip would not have been successful without the strong support and cooperation from the Chinese Society of Astronautics, the U.S. Department of State Office of Space and Advanced Technology, the U.S. Embassy in Beijing, and the American Chamber of Commerce in Shanghai. Without the support of our corporate members, the trip would not have been possible. AIAA would like to thank all of these groups for making this trip worthwhile and productive.

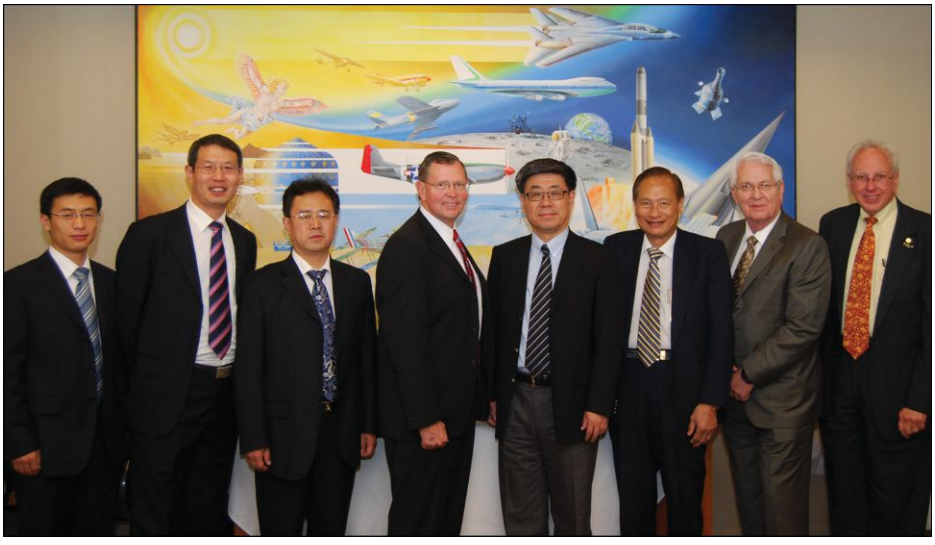
AIAA EXPANDS COLLABORATION WITH CHINA AVIATION PUBLISHING & MEDIA

David Arthur, AIAA Book Acquisitions and Development Editor

On Friday, 5 November, AIAA welcomed a delegation led by Dr. Zhang Xin Guo, Executive Vice President of the Aviation Industry Corporation of China to its Reston, VA, headquarters. Areas of current and possible future collaboration were discussed during the meeting. AIAA Executive Director Robert Dickman, along with AIAA members Dr. John D. Anderson Jr., Dr. Edward "Ned" Allen, and Dr. Joseph W. Lee welcomed Dr. Zhang and his colleagues, Wang Yingjie, President of the AVIC Economic & Technology Institute; Liu Xin, General Manager of China Aviation Publishing & Media; and Li Sunan, Vice Director of China Aviation Publishing & Media.

During the meeting, AIAA signed agreements for the Chinese translation of nine AIAA books with China Aviation Publishing & Media Co. Ltd., a subsidiary of Aviation Industry Corporation of China. These agreements will expand upon AIAA's existing relationship with China Aviation Publishing & Media, which has already published translations of the AIAA titles *Flight Vehicle Performance and Aerodynamic Control*, by Frederick O. Smetana, and *Black Hawk: The Story of a World Class Helicopter*, by Ray D. Leoni.

AIAA Executive Director Robert Dickman (left) and Dr. Zhang Xin Guo, Executive Vice President of the Aviation Industry Corporation of China.



AIAA welcomes representatives of the Aviation Industry Corporation of China and China Aviation Publishing & Media. Left to right: Li Sunan; Liu Xin; Wang Yingjie; Robert Dickman; Zhang Xin Guo; Joseph W. Lee; Edward "Ned" Allen; John D. Anderson, Jr.

Discussions exploring future collaboration focused on the Chinese Society of Aeronautics and Astronautics of which Dr. Zhang is also a vice president. Particular interest was expressed in possible visits to China by AIAA members. Potential future cooperation concerning conferences and professional development courses was also explored.

In addition to Friday's meeting and dinner, on Saturday, 6 November, AIAA staff escorted the delegation for a day of sightseeing in Washington, DC, which included a visit to the Smithsonian Institution's National Air & Space Museum.

AIAA ANNOUNCES 2011 ASSOCIATE FELLOWS

The 2011 Associate Fellow Grade Committee met in August 2010 and selected 186 members for upgrade to Associate Fellow. The Membership Committee approved all selected.

The requirements for Associate Fellow as stated in the bylaws are as follows: Associate Fellows may be nominated by any AIAA member in good standing; a maximum of one Associate Fellow per every 150 voting members may be upgraded annually; nominees must be AIAA Senior Members and have at least 12 years professional experience; nominees must be recommended by three members in good standing of Associate Fellow grade or higher.

The 2011 Associate Fellows will be honored at the AIAA Foundation Associate Fellow Dinner on Tuesday, 4 January 2011, at the Orlando Marriott World Center, Orlando, FL, in conjunction with the 49th AIAA Aerospace Sciences Meeting and Exhibit.

REGION I

Central Pennsylvania
Jack W. Langelaan, Pennsylvania State University
Alok Sinha, Pennsylvania State University

Connecticut
Won-Wook Kim, Pratt & Whitney Rocketdyne
Marios C. Soteriou, United Technologies Corporation
Gregory Tillman, United Technologies Corporation

Hampton Roads
Kathy H. Abbott, Federal Aviation Administration
Mehdi Ahmadian, Virginia Polytechnic Institute and State University
Richard D. Anderson, Anderson Associates
Kenneth S. Ball, Virginia Polytechnic Institute and State University
Javid Bayandor, Virginia Polytechnic Institute and State University
Christine M. Belcastro, NASA Langley Research Center
Carey S. Buttrill, NASA Langley Research Center
Craig S. Collier, Collier Research Corporation
Fayette S. Collier, NASA Langley Research Center
Peter F. Covell, NASA Langley Research Center
Michael G. Gilbert, NASA Langley Research Center
Keith D. Hoffler, Adaptive Aerospace Group, Inc.
Brian R. Hollis, NASA Langley Research Center
Joseph H. Morrison, NASA Langley Research Center
LaTunia G. Pack Melton, NASA Langley Research Center
Mayuresh Patil, Virginia Polytechnic Institute and State University
Russ D. Rausch, NASA Langley Research Center
Ray Rhew, NASA Langley Research Center
Richard A. Thompson, NASA Langley Research Center

Long Island
Joseph R. Fragola, Valador, Inc.
Mohammad H. N. Naraghi, Manhattan College

Mid-Atlantic
Nadine Aubry, Carnegie Mellon University
Ralph L. McNutt, Jr., The John Hopkins University Applied Physics Laboratory
Julie K. Thienel, NASA Goddard Space Flight Center
Robin M. Vaughan, The John Hopkins University Applied Physics Laboratory

National Capital
Torger J. Anderson, Institute for Defense Analyses
Amr M. Baz, University of Maryland
John R. Bramer, Carnegie Mellon Software Engineering Institute
Gregg E. Burgess, Orbital Sciences Corporation
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Robert D. Strain, Goddard Space Flight Center

New England
Richard D. Charles, United States Army Natick Soldier Research, Development and Engineering Center
Charles R. Dauwalter, Milli Sensor Systems and Actuators, Inc.
Jason K. Hui, BAE Systems
Eytan Modiano, Massachusetts Institute of Technology
Eugene E. Niemi, Jr., University of Massachusetts Lowell
Brian L. Wardle, Massachusetts Institute of Technology
Brian C. Williams, Massachusetts Institute of Technology

Northern New Jersey
Frederick L. Dryer, Princeton University
Tobias Rossmann, Rutgers The State University of New Jersey
Sohail Zaidi, Princeton University

Southern New Jersey
Bakhtier Farouk, Drexel University

REGION II

Alabama/Mississippi
Pravin Aggarwal, NASA Marshall Space Flight Center
William J. Atkinson, The Boeing Company
Gary C. Cheng, The University of Alabama at Birmingham
Stephen Cook, Dynetics
Peter A. Curreri, NASA Marshall Space Flight Center
Christian H. Tournes, Davidson Technologies, Inc.

Atlanta
Joe Patrick, Jr., Lockheed Martin Corporation
Amy Pritchett, Georgia Institute of Technology
Stephen M. Ruffin, Georgia Institute of Technology
David A. Spencer, Georgia Institute of Technology
Mitchell L. Walker, II, Georgia Institute of Technology

Cape Canaveral
Robert D. Cabana, NASA John F. Kennedy Space Center
Michael S. Deimeke, Scitor Corporation
David C. Fleming, Florida Institute of Technology
Daniel R. Kirk, Florida Institute of Technology

Carolina
Ashok Gopalarathnam, North Carolina State University
Charles E. Hall, Jr., North Carolina State University

Central Florida
Randal T. Allen, Lone Star Aerospace, Inc.
Anil V. Rao, University of Florida

Tennessee
Nathan S. Dougherty, Jr., ERC-Incorporated
Joseph Majdalani, The University of Tennessee Space Institute
Robert H. Nichols, The University of Alabama at Birmingham

REGION III

Columbus
Maarten Uijt De Haag, Ohio University
Jianchao Zhu, Ohio University

Dayton/Cincinnati
Jonathan Black, Air Force Institute of Technology
Thomas A. Bonser, GE Aviation
Michael J. Foust, GE Aviation
Frank S. Gulczinski, III, Air Force Research Laboratory
William Harrison, Air Force Research Laboratory
Richard E. Huffman, Jr., Air Force Institute of Technology
James M. Snead, Spacefaring Institute LLC

Illinois
Kenneth T. Christensen, University of Illinois at Urbana Champaign
Michael T. Heath, University of Illinois at Urbana Champaign
Dimitrios C. Kyritsis, University of Illinois at Urbana Champaign
Mordechai A. Levin, Masterflight Foundation

Indiana
William E. Anderson, Purdue University

Michigan
BogdanI Epureanu, University of Michigan
John A. Shaw, University of Michigan
Kon-Well Wang, University of Michigan
Christopher B. Watkins, GE Aviation

Northern Ohio
Raymond S. Castner, NASA Glenn Research Center
Nancy R. Hall, NASA Glenn Research Center
Christopher E. Hughes, NASA Glenn Research Center
Daniel L. Sutliff, NASA Glenn Research Center

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Sean P. Kearney, Sandia National Laboratories
Thomas W. Murphey, Air Force Research Laboratory

Houston
Sharath S. Girimaji, Texas A&M University
Satya Pilla, The Boeing Company
Edward B. White, Texas A&M University

North Texas
Terry J. Burress, Lockheed Martin Corporation
Larry Lawson, Lockheed Martin Corporation
Steven Lenvik, Lockheed Martin Corporation
Paul D. McClure, Lockheed Martin Corporation
Lee Sampson, Lockheed Martin Corporation
June R. Shrewsbury, Lockheed Martin Corporation
Robert M. Taylor, Lockheed Martin Corporation
Adnan Yucel, Lockheed Martin Corporation

Southwest Texas
Srinivas V. Bettadpur, University of Texas at Austin, Center for Space Research
KuangTsan K. Chiang , Southwest Research Institute

Christina T. Chomel, University of Texas at Austin, Applied Research Laboratories
Dale A. Cope, Southwest Research Institute
Michael T. Frye, University of the Incarnate Word
Richard A. Gramann, University of Texas at Austin, Applied Research Laboratories
Troy Irwin, Booz Allen Hamilton
R. Grant Lannon, Applied Technologies
Belinda G. Marchand, University of Texas at Austin

REGION V

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Hui Hu, Iowa State University

Rocky Mountain
David L. Clark, Lockheed Martin Corporation
David M. Klaus, University of Colorado at Boulder
Scott E. Palo, University of Colorado at Boulder

St. Louis
Michael E. Benne, The Boeing Company
Brandon H. Wegge, The Boeing Company

Twin Cities
James G. Casler, University of North Dakota

REGION VI

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Jeffrey K. Greason, XCOR Aerospace
Eric V. Schrock, Lockheed Martin Corporation
Doug G. Talley, Air Force Research Laboratory

Arrowhead
Edward D. McCullough, Rockwell Space Systems Division

Los Angeles
Winnie W. Choy, The Boeing Company
Dean E. Davis, The Boeing Company
Adam L. Dershowitz, Exponent
Fokion N. Egolfopoulos, University of Southern California
David J. Gorney, The Aerospace Corporation
Gary N. Henry, United States Air Force
Steve C. Komadina, Northrop Grumman Corporation
David M. Landis, The Aerospace Corporation
Jeffrey R. Laube, Northrop Grumman Corporation
Dennis D. Poulos, Poulos Air & Space
Gwynne E. Shotwell, SpaceX

Orange County
Jerry Q. Huang, The Boeing Company

Pacific Northwest
Charles S. Beard, The Boeing Company
Adiel Guinzburg, The Boeing Company
Taehyoun Kim, The Boeing Company
Gerald E. Mabson, The Boeing Company
Mostafa Rassaian, The Boeing Company
Karl J. Rein-Weston, The Boeing Company

Phoenix
Steven J. Battel, Battel Engineering
Mehul P. Patel, Innovative Technology Applications Company, LLC

Sacramento
Julie A. Van Kleeck, Aerojet
Warren K. Yasuhara, Aerojet

San Diego
Hermann M. Altmann, Helm Industries LLC
Aaron Drake, Northrop Grumman Corporation
Charles Toups, The Boeing Company

San Fernando Pacific
Atherton A. Carty, Lockheed Martin Corporation
Stephen Y. Yun, The Boeing Company

San Francisco
Michael J. Aftosmis, NASA Ames Research Center
Tahir Gokcen, Eloret Corporation
Shon R. Grabbe, NASA Ames Research Center
Ab Hashemi, Lockheed Martin Corporation
Ike C. Hsu, Lockheed Martin Corporation
Claire J. Tomlin, Stanford University

San Gabriel Valley
James E. Graf, Jet Propulsion Laboratory
Jon A. Sims, Jet Propulsion Laboratory
Randii Wessen, Jet Propulsion Laboratory

REGION VII

Canada
David R. Greatrix, Ryerson University
Omer L. Gulder, University of Toronto, Institute for Aerospace Studies
Xiaohua Wu, Royal Military College of Canada

China (PRC)
Song Fu, Tsinghua University

France
Jean Francois F. Guery, SNPE Materiaux Energetiques

Germany
Christian O. Paschereit, Technial University of Berlin
Jens Strahmann, Airbus

Great Britain
Paul G. Tucker, Cambridge University
Xuesong Wu, Imperial College London

India
Vaidyanathan Swaminathan, Vikram Sarabhai Space Centre, Indian Space Research Organisation
Lakshmi Venkatakrishnan, National Aerospace Laboratories

Ireland
Michael G. Hinchey, University of Limerick

Italy
Marcello Onofri, University of Rome La Sapienza

Russia
Alexander N. Lukin, Western-Caucasus Research Center

South Africa
Gerhard Venter, Stellenbosch University

South Korea
Hong-Gye Sung, Korea Aerospace University

Taiwan
Chihyung Wen, National Cheng Kung

AIAA leadership was pleased to have the opportunity to visit the Museum of Flight in Seattle, WA, and present William E. Boeing, Jr., with a Certificate of Appreciation for his lifelong role in aviation, his dedicated support to education, and his significant commitment to the preservation of air and space history.

Pictured left to right: Terri Morse, Larry Brase, Dave Knowlen, William E. Boeing Jr., Bob Dickman, Merrie Scott, Klaus Dannenberg, Doug Ball, Scott Eberhardt, and Mike Lavelle.

Important Announcement
New Editor-in-Chief Sought for the *Journal of Aircraft*

Thomas Weeks, current Editor-in-Chief of AIAA's *Journal of Aircraft*, will step down from his position after 32 years of service at the end of 2011. We are seeking an outstanding candidate with an international reputation for this position. This is an open process, and the final selection will be made only on the basis of the applicants' merits.

The Editor-in-Chief is responsible for maintaining and enhancing the journal's quality and reputation as well as establishing a strategic vision for the journal. He or she receives manuscripts, assigns them to Associate Editors for review and evaluation, and monitors the performance of the Associate Editors to ensure that the manuscripts are processed in a fair and timely manner. The Editor-in-Chief works closely with AIAA Headquarters staff on both general procedures and the scheduling of specific issues. Detailed record keeping and prompt actions are required. The Editor-in-Chief is expected to provide his or her own clerical support, although this may be partially offset by a small expense allowance. AIAA provides a computer and 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 journal; full résumés; and complete lists of published papers, to:

Rodger Williams
American Institute of Aeronautics and Astronautics
1801 Alexander Bell Drive, Suite 500
Reston, VA 20191-4344
703/264-7551 FAX
E-mail: rodgerw@aiaa.org

A minimum of two letters of recommendation also are required. The recommendations should be sent by the parties writing the letters directly to Mr. Williams at the above address, fax number, or e-mail. To receive full consideration, applications and all required materials must be received at AIAA Headquarters by **1 March 2011**, but applications will be accepted until the position is filled.

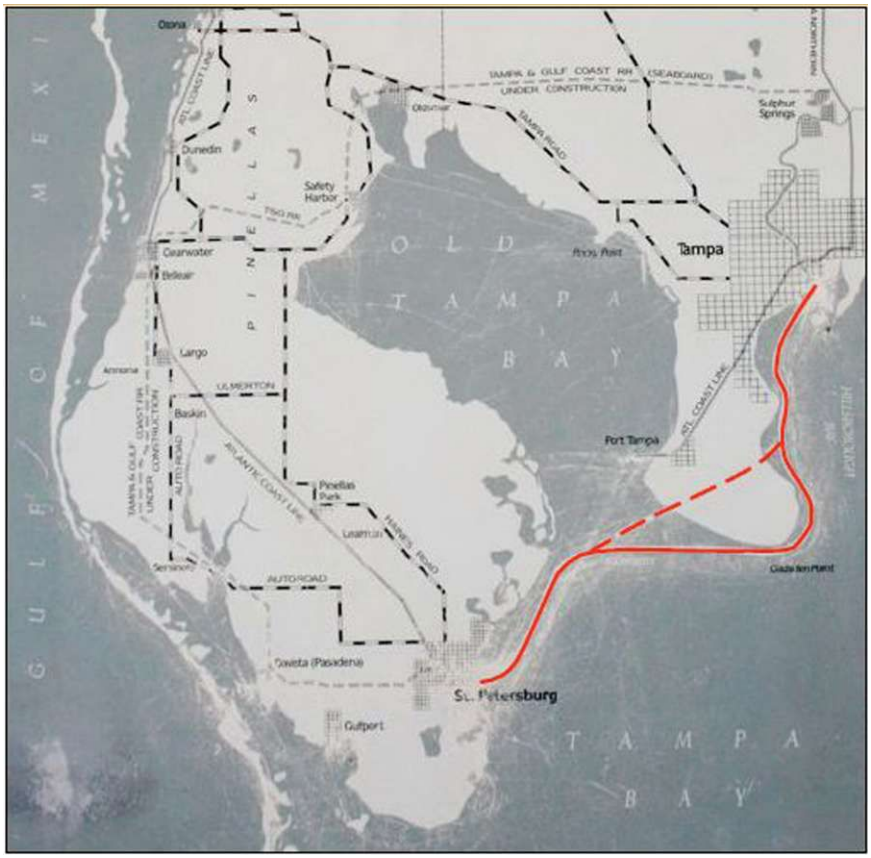
A selection committee appointed by the AIAA Vice President–Publications Michael B. Bragg will seek candidates and review all applications received. The search committee will recommend qualified candidates to the AIAA Vice President–Publications, who in turn will present a recommendation to the AIAA Board of Directors for approval. All candidates will be notified of the final decision.

AIAA CELEBRATES HISTORIC SITES IN FLORIDA AND NEW YORK

The AIAA Historic Sites Committee recently held two ceremonies designating historic aerospace sites. On 29 October, AIAA Region II Directory Alan Lawrey designated the **St. Petersburg Yacht Basin** as a historic site. Although at first glance this might seem like an unusual choice, it was actually the site of the first flight of the world's first commercial airline. The St. Petersburg-Tampa Airboat line commenced operations on 1 January 1914. Its pilot, Tony H. Jannus, carried freight and one passenger across the Tampa Bay to the City of Tampa in a Benoist Type XIV airboat. This aircraft had been constructed by Thomas W. Benoist of St. Louis, who shared responsibility for the airline's operation with the airline general manager, Percival E. Fansler. Scheduled were two round trips daily between St. Petersburg and Tampa. Demand was such that two aircraft were needed for passenger transport, one flown by Tony's brother Roger. A third aircraft was acquired for the school for flight instruction that Benoist established. With the end of the tourist season in April, the service was terminated, the last official flight taking place on 5 May 1914. According to Benoist, "We have not made much money, but I believe we have proved that the airplane can be successfully used as a regular means of transportation and commercial carrier."

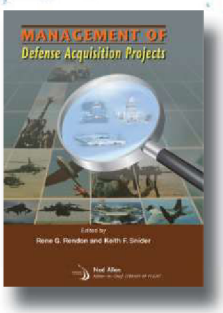
The Historic Sites ceremony was held at the St. Petersburg History Museum in conjunction with an annual press conference held by the Tony Jannus Society to honor the annual Tony Jannus Award winner.

Far to the north, on 1 December, AIAA designated the **Cornell Aeronautical Laboratory** as a Historic Site. It started as the research laboratory of the Curtiss-Wright Airplane Company, and was transferred to Cornell in 1946. In the ensuing years, this facility touched every aspect of aviation and space research. Every military aircraft and space vehicle developed in the United States from the end of World War II to present day has been tested at this facility. Through its affiliation with the Guggenheim Aviation Safety Research Center at Cornell University, it established the foundation for modern aviation safety, including the development of the modern flight helmet. In addition, many of the principles of hypersonic ground testing are based on the early work performed at this location. The research pioneered at this location went well beyond mere aviation and space, developing entirely new areas of research such as netted air defense systems, modern weather prediction, pattern recognition, and multimodal transportation systems.



The flight between St. Petersburg and Tampa was 23 minutes. Roads at the time were generally unpaved, so a road trip between the two cities could take a full day.

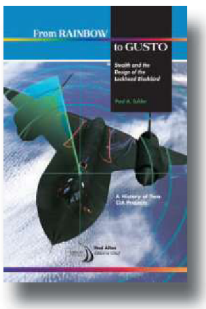
New and Best-Selling Books from AIAA



"An excellent way to get a solid grounding in the complex and challenging acquisition process."
—**Jacques S. Gansler**, Ph.D., University of Maryland, and former Under Secretary of Defense for Acquisition, Technology and Logistics

Management of Defense Acquisition Projects

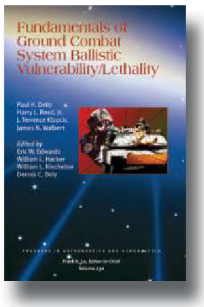
Rene G. Rendon and Keith F. Snider
Naval Postgraduate School
2008, 292 pages, Hardback, ISBN: 978-1-56347-950-2
List Price $64.95
AIAA Member Price: $49.95



A History of Two CIA Projects. *Based on interviews, memoirs, and oral histories of the scientists and engineers involved, as well as recently declassified CIA documents, and photographs, reports, and technical drawings from Lockheed and Convair, this is a technical history of the evolution of the Lockheed A-12 Blackbird.*

From RAINBOW to GUSTO: Stealth and the Design of the Lockheed Blackbird

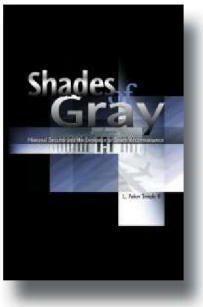
Paul A. Suhler
2009, 300 pages, Paperback, 1SBN: 978-1-60086-712-5
List Price $39.95
AIAA Member Price $29.95



While the focus of this book is on ground combat system vulnerability, many of the principles, methodologies, and tools discussed are also applicable to the air and sea system communities.

Fundamentals of Ground Combat System Ballistic Vulnerability/Lethality

Paul H. Deitz, Harry L. Reed Jr., J. Terrence Klopcic, and James N. Walbert
Progress in Astronautics and Aeronautics, Vol. 230
2009, 384 pages, Hardback, ISBN: 978-1-60086-015-7
List Price $119.95
AIAA Member Price: $89.95



"I urge all who are serious about understanding the development of the national security space arena to read it."
—Roger D. Launius
Smithsonian Institution

Shades of Gray: National Security and the Evolution of Space Reconnaissance

L. Parker Temple III
2005, 554 pages, Hardback, ISBN: 978-1-56347-723-2
List Price $29.95
AIAA Member Price: $24.95

Also From AIAA

Weaponeering: Conventional Weapon System Effectiveness

Morris Driels, Naval Postgraduate School
2004, 466 pages, Hardback, ISBN: 978-1-56347-665-5
List Price: $99.95
AIAA Member Price: $74.95

The Fundamentals of Aircraft Combat Survivability Analysis and Design, Second Edition

Robert E. Ball, Naval Postgraduate School
2003, 889 pages, Hardback, ISBN: 978-1-56347-582-5
List Price: $104.95
AIAA Member Price: $79.95

Mathematical Methods in Defense Analyses, Third Edition

J. S. Przemieniecki, Air Force Institute of Technology
AIAA Education Series
2000, 421 pages, Hardback, ISBN: 978-1-56347-397-5
List Price: $104.95
AIAA Member Price: $79.95

The Missile Defense Equation: Factors for Decision Making

Peter J. Mantle, Mantle & Associates, LLC
2004, 525 pages, Hardback, ISBN: 978-1-56347-609-9
List Price: $99.95
AIAA Member Price: $74.95

Effective Risk Management: Some Keys to Success, Second Edition

Edmund H. Conrow, CMC, CPCM, PMP
2003, 554 pages, Hardback, ISBN: 978-1-56347-581-8
List Price: $84.95
AIAA Member Price: $64.95

Approximate Methods for Weapon Aerodynamics

Frank G. Moore, Naval Surface Warfare Center
Progress in Astronautics and Aeronautics, Vol. 186
2000, 464 pages, Hardback, ISBN: 978-1-56347-399-9
List Price: $119.95
AIAA Member Price: $89.95

Order online at www.aiaa.org/books

AIAA

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UMD STUDENTS SUPPORT AIAA AT USA SCIENCE AND ENGINEERING FESTIVAL WITH AERODYNAMIC DEMONSTRATIONS

Graduate (G) and Undergraduate (UG) students from the AIAA Student Chapter in the Department of Aerospace Engineering at the University of Maryland supported AIAA outreach efforts at the USA Science and Engineering Expo on the National Mall on 23–24 October 2010. This outreach activity by students of the AIAA National Capital Section was undertaken to support AIAA's outreach efforts for K–12 students, as well as the general public.

Thousands stopped by the AIAA booth, facilitated by Lisa Bacon, AIAA Program Manager for STEM and K–12 Outreach, to learn about the physics of flight, especially the forces of lift, drag, weight, and thrust. Aerodynamic forces of lift and drag were demonstrated using a small-scale model of an open circuit wind tunnel that was refurbished over the summer of 2010 by a high school intern, Chani Wereley. Students demonstrated trailing edge vortices using threads, stall, and "drag races" using diecast models of sports cars versus SUVs, where the vehicle with the greatest drag was pushed by the air flow faster and, so, won the race. The festival was accompanied by glorious 75° sunny weather in October, and a great time was had by all!

University of Maryland Students from the Smart Structures Laboratory in the Dept. of Aerospace Engineering with the newly refurbished open-circuit wind tunnel model. Front row (l to r): Ami Powell (G), Min Mao (G), Erica Hocking (G), Andrew Becnel (G). Back row (l to r): Nick Wilson (G), Harinder Singh (G), Shane Boyer (UG), Ben Woods (G), Prof. Norm Wereley, and Robbie Vocke (G). Absent: Ryan Robinson (G) and Chani Wereley (Intern).

The Western Region Activities Committee reviewed progress toward Institute Strategic goals at the Western Headquarters in El Segundo in late August. Pictured, seated: Jane Hansen, John Rose, Jim Martin, Jeff Jepson, Eric Nichols; standing: Ranney Adams, Bruce Wilson, Phil Smith, Matt Angiulo, Bob Welge, Bala Ramamurthy, Dean Davis, Dean Miller, Ying-Ling Lee, Scott Eberhardt, Eliza Sheppard, Stephen Brock, John Metcalf, and Dan Bursch.

AIAA award presented at Missile Sciences Conference: Louis Cassel (left), 2010 recipient of the AIAA Missile Systems Technical Award, with Randy Sturgeon (right) of the Missile Systems Technical Committee.

Region III Director Sivaram Gogineni, Paul Bevilaqua, and Andrew Pool.

On 13 October, the Indiana Section had their first event for this year with their new chair, Andrew Pool. They hosted Distinguished Lecturer, Paul Bevilaqua, at a dinner meeting. He gave a very interesting and informative presentation on the development of the F-35 Joint Strike Fighter. The event was well attended with 74 attendees.

HUTCHINSON RECOGNIZED FOR EXCEPTIONAL EFFORT

Jane Hansen presented a Special Service Citation to **AIAA Associate Fellow Herb Hutchinson** for exceptional effort in mentoring and encouraging the best and brightest students in Region VI as part of the 2010 Student Paper Conference.

Hutchinson served as Conference Judging Panel Chair. He traveled over 500 miles to serve as an on-site judge—from Thousand Oaks, CA, to the University of Arizona in Tucson. After judging their technical presentations, Hutchinson wrote experienced commentaries and words of encouragement to each of the many student presenters. His constructive, heartfelt comments provided students with invaluable information. Hutchinson went out of his way to interact informally with the students and share his experiences with them about technology development, engineering, ground and flight testing, and career planning. Many students commented that Herb had significantly impacted their life, despite the short time spent together at the student conference.

Upon receiving his award, Hutchinson commented, "It was time for me to put something back into the Engineering well. I truly hope that many other retired "gray-hair" engineers would join in that effort to replenish the Engineering well with their own personal experiences and real-world lessons learned." Hutchinson advises young engineering students on the brink of their engineering careers: "Engineers should not wait to be fully ready for an assignment, but should press forward and do the best job they can with any assigned engineering task—design, analysis, or test—and regardless of the absence of any precedence existing how to approach and conduct that task. Experience is the best teacher."

Hutchinson has been a member of AIAA for 59 years, joining the Institute of Aeronautical Sciences in 1951. A retired aeronautical engineer, he received his BAE and MSAE degrees from Georgia Tech. He was employed for 21 years by 4 different aircraft manufacturers nationwide and 20 years by the USAF Aeronautical Systems Division as a Civilian Engineer (GS-15). His 41-year career highlights include serving as Chief System Engineer for the USAF Lightweight Fighter Prototype Program and technically directing the design, test, and development of the YF-16 and YF-17 air vehicles and their transition to operational status as the USAF F-16 Air Combat Fighter and USN/USMC F/A-18 Hornet. The USAF Thunderbirds have flown and are flying the F-16 fighter at numerous National and International Air Shows, as the U.S. Navy Blue Angels fly the F/A-18 fighter. Hutchinson draws primarily from these programs to pass on real-life examples of problems that engineers will likely encounter and will need to resolve in their engineering careers. If you are inspired by his story, contact AIAA Customer Service at 800.639.2422 or custserv@aiaa.org, and ask how you can get involved.

Jane Hansen presenting a Special Service Citation to Associate Fellow Herb Hutchinson.

OBITUARY

Associate Fellow Jaremenko Died in October

Igor Jaremenko passed away on 2 October 2010 at the age of 86. He was a 57-year member of AIAA.

Mr. Jaremenko immigrated to the United States in 1950 from Ukraine. He had a B.S. degree in aeronautical engineering from the Indiana Institute of Technology in 1955, and an M.S. degree in engineering from the University of Akron, Ohio, in 1967. He was a specialist in aerodynamics.

He was employed at North American Aviation from 1956 to 1961, working on naval aircraft, and by Goodyear Aerospace from 1961–1967, working on parachutes. He then went to Martin Marietta in Orlando and Denver and worked on Viking and Skylab. Next, he was employed by Rockwell International Space Division from 1973 until retirement in 1990, assigned to the Space Shuttle. He received the NASA Apollo medallion and the AIAA Space Flight Award, as well as other commendations.

Mr. Jaremenko was very active in the AIAA Orange County Section for many years, serving as section chair and in the offices of treasurer, public policy chair, newsletter editor, and honors and awards chair. He was very active in contributing to AIAA student paper contests as a judge and in mentoring students in AIAA design/build/fly contests. His other notable volunteer activities include participating on international teams monitoring elections in his native Ukraine in 1994 and 2004.

New Standard Available
AIAA Space Systems Verification Program and Management Process (AIAA S-117-2010)

Just released, this standard enforces a systematic approach to planning and executing verification programs for manned and unmanned space systems based on a distributed approach that corrects fundamental deficiencies associated with the traditional centralized verification approach. It corrects generic problems in conducting verification that existed even during post-Total System Program Responsibility or "Faster, Better, Cheaper" policy that prospered late 1990 through early 2000 for developing complex space systems. This standard is intended to help those in the space community develop reliable systems that meet requirements while ensuring proper accommodations of heritage and/or commercial systems in their developing systems..

To download a copy, go to **http://www.aiaa.org** (free for AIAA Members).

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 February 2011**.

A nomination form can be downloaded from **www.aiaa.org**, or AIAA members may submit nominations online after logging in with their user name and password. Answers to frequently asked questions or guidelines on submitting nominations for AIAA awards may be found at **www.aiaa.org/content.cfm?pageid=289**.

Aerospace Guidance, Navigation, and Control Award
The award is presented to recognize important contributions in the field of guidance, navigation and control.

Aerospace Power Systems Award
This award is given for a significant contribution in the broad field of aerospace power systems, specifically as related to the application of engineering sciences and systems engineering to the production, storage, distribution, and processing of aerospace power.

Aircraft Design Award
The award is presented to a design engineer or team for the conception, definition, or development of an original concept leading to a significant advancement in aircraft design or design technology.

Daniel Guggenheim Medal
Nominations due to AIAA by 1 February
The industry-renowned Guggenheim Medal honors persons who make notable achievements in the advancement of aeronautics. AIAA, ASME, SAE, and AHS sponsor the award.

de Florez Award for Flight Simulation
This award is named for the late Admiral Luis de Florez and is presented for an outstanding individual achievement in the application of flight simulation to aerospace training, research, and development.

Energy Systems
The award is presented for a significant contribution in the broad field of energy systems, specifically as related to the application of engineering sciences and systems engineering to the production, storage, distribution, and conservation of energy.

F. E. Newbold V/STOL Award
The award recognizes outstanding creative contributions to the advancement and realization of powered lift flight in one or more of the following areas: initiation, definition and/or management of key V/STOL programs; development of enabling technologies including critical methodology; program engineering and design; and/or other relevant related activities or combinations thereof which have advanced the science of powered lift flight.

George M. Low Space Transportation Award
This award honors the achievements in space transportation by Dr. George M. Low, who played a leading role in planning and executing all of the Apollo missions, and originated the plans for the first manned lunar orbital flight, Apollo 8.

Haley Space Flight Award
The award is presented for outstanding contributions by an astronaut or flight test personnel to the advancement of the art, science, or technology of astronautics.

Hap Arnold Award for Excellence in Aeronautical Program Management
The award is presented to an individual for outstanding contributions in the management of a significant aeronautical or aeronautical-related program or project.

J. Leland Atwood Award
Nominations due to AIAA by 1 January
This award is bestowed annually upon an aerospace engineering educator in recognition of outstanding contributions to the profession. AIAA and ASEE sponsor the award.

Mechanics and Control of Flight Award
This award is presented for an outstanding recent technical or scientific contribution by an individual in the mechanics, guidance, or control of flight in space or the atmosphere.

Multidisciplinary Design Optimization Award
The award recognizes an individual for outstanding contributions to the development and/or application of techniques of multidisciplinary design optimization in the context of aerospace engineering.

Otto C. Winzen Lifetime Achievement Award
In memory of Otto C. Winzen, a pioneer of modern-day ballooning, the award is presented for outstanding contributions and achievements in the advancement of free flight balloon systems or related technologies.

Piper General Aviation Award
Formerly the General Aviation Award, this award honors William Piper, and is presented for outstanding contributions leading to the advancement of general aviation.

Space Automation and Robotics Award
The award is presented for leadership and technical contributions by individuals and teams in the field of space automation and robotics.

Space Science Award
The award is presented to an individual for demonstrated leadership of innovative scientific investigations associated with space science missions.

Space Operations and Support Award
The award is presented for outstanding efforts in overcoming space operations problems and assuring success, and recognizes those teams or individuals whose exceptional contributions were critical to an anomaly recovery, crew rescue, or space failure.

Space Systems Award
Formerly the Spacecraft Design Award, the award is presented to recognize outstanding achievements in the architecture, analysis, design, and implementation of space systems.

von Braun Award for Excellence in Space Program Management
This award gives national recognition to an individual(s) for outstanding contributions in the management of a significant space or space-related program or project.

William Littlewood Memorial Lecture
Nominations due to AIAA by 1 February
The Lecture perpetuates the memory of William Littlewood, who was renowned for the many significant contributions he made to the design of an operational requirements for civil transport aircraft. The topics for the Lecture, which is presented in even years, shall deal with a broad phase of civil air transportation considered of current interest and major importance.

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

Infotech@Aerospace 2011 Conference
Unleashing Unmanned Systems

29–31 March 2011
Hyatt Regency St Louis at the Arch
St. Louis, MO

Synopsis

Infotech@Aerospace (I@A) is AIAA's premier forum for modern aerospace applications focusing on information-enabled systems, algorithms, hardware, and software. I@A provides a unique opportunity for fostering advances and interactions across these disciplines. The attendees and authors span military, scientific, commercial, and academic communities that are dominated by the communication of information via computers and software that will shape the 21st-century development of aerospace systems. Scientific and engineering issues related to architecting, designing, developing, operating, and maintaining modern aerospace and defense systems will be addressed. This includes aircraft, spacecraft, ground systems, robots, avionics, and sensors, as well as systems of systems. Of particular interest are autonomous, cooperative, and unmanned systems; communication and networked systems; robotic systems; and human-machine interactions. Select technical papers will be considered for publication in the *Journal of Aerospace Computing, Information, and Communication* (*JACIC*).

2011 Conference Theme: Unleashing Unmanned Systems

In recent years, Unmanned Systems (US) have proven their value in a wide variety of applications. Development of new US capability is expanding at an accelerating pace—in the air, in space, on the ground, and on and under the ocean. Customers continue to expect and demand even greater flexibility and responsiveness to meet a growing list of desired operations and applications.

This explosion of US applications began with several highly successful military applications. It is hard to pick up a newspaper today and not read of the expansion and success of Unmanned Aircraft Systems (UAS) in prosecuting current conflicts in the Middle East. We have seen the UAS applications grow from being mainly surveillance platforms to now carrying weapons and electronic warfare payloads. And commanders now demand even more, such as hyperspectral payloads, cargo resupply, and recovery of downed airmen. Ground robotic systems continue to expand with important missions such as investigating Improvised Explosive Devices.

In addition, US are already becoming mainstream tools for addressing many non-military applications. For example: 1) The Department of Homeland Security now operates UAS routinely for border protection; 2) the National Oceanic and Atmospheric Administration is using UAS for hurricane and polar ice cap monitoring; and 3) the United States Forest Service has partnered with NASA for imaging missions for wildfires in Southern California. Growth potential for further expansion of UAS and ground robotics applications in both government and civil applications is very strong, and many other groups are exploring the potential uses for US, such as: 1) law enforcement applications; 2) disaster response; 3) aerial photography; 4) crop dusting; 5) news event coverage; 6) package delivery; and 7) pipeline and power line monitoring.

Unleashing the full potential of US requires a diverse toolkit of information technology and systems. These become the core building blocks to enable system capabilities. Though these building blocks have a level of capability as standalone systems, they must be must be integrated successfully into increasingly complex systems and systems of systems to achieve the desired operational effects. Infotech@Aerospace 2011 will explore many of the core technologies and integration considerations that will truly "Unleash Unmanned Systems".

Special Events

Tuesday, 29 March

0800–0930 hrs
Plenary Speakers

"The Imperative for the Integration of Intelligence, Surveillance and Reconnaissance": Lt. General David A. Deptula, USAF (Ret.), Former Deputy Chief of Staff for Intelligence, Surveillance and Reconnaissance, U.S. Air Force

"Small Satellites and Cool Missions": S. Pete Worden, Center Director, NASA Ames Research Center

1000–1200 hrs
Plenary Policy Panel

Moderator: Brian Argrow, Director, Research and Engineering Center for Unmanned Vehicles, University of Colorado

Panelists: Ardyth M. Williams, Air Traffic Manager, Unmanned Aircraft Systems Office, Air Traffic Organization, Federal Aviation Administration (FAA); Robin Murphy, Raytheon Professor of Computer Science and Engineering, Texas A&M University; Robbie Hood, Director, NOAA's Unmanned Aircraft Systems (UAS) program; Michael C. Kostelnik, Major General, USAF (Ret.), Assistant Commissioner, Office of CBP Air & Marine, U.S. Customs and Border Protection

Wednesday, 30 March

1130–1300 hrs
Awards Luncheon

1800–2100 hrs
Boeing Prologue Room Aviation Museum Tour

Due to space limitations, the first 110 registered attendees (based on a first-come, first-served basis) will be confirmed for this particular activity. Shuttle buses will be provided for transport to and from the Boeing facility. Registered attendees confirmed for the Boeing tour will be notified accordingly and provided additional details once this activity has been closed out.

Thursday, 31 March

1130–1300 hrs
Plenary Technical Panel Discussion

Moderator: Brian Argrow, Director, Research and Engineering Center for Unmanned Vehicles, University of Colorado

Panelists: Xiaogong Lee, Acting Manager for Avionics Research, Federal Aviation Administration; Tim Brown, Director Interdisciplinary Telecommunications Program, University of Colorado; J. C. Lede, Director, Unmanned Systems, Raytheon; Darryl Davis, President, Boeing Defense, Space & Security Phantom

Box lunches will be available for purchase.

1800–2030 hrs
Anheuser Busch Brewery Tour
Cost: $20
Enjoy a private tour for Infotech@Aerospace participants that includes learning the entire process of making and bottling beer and ends with a taste testing. Tour includes a visit to the Clydesdale Stables and Paddock, Beechwood Lagering Cellars, Brewhouse, and Bevo Packaging Plant. The tour and taste testing lasts approximately 1.5 hours. Buses depart the Hyatt Regency at the Arch at 1800 hrs and return by 2030 hrs.

AIAA Intelligent Systems Student Paper Competition
The AIAA Intelligent Systems Committee is hosting the 4th Intelligent Systems Student Paper Competition at I@A 2011, sponsored by the Digital Avionics Technical Committee and the Intelligent Systems Technical Committee. Up to four finalists will present their papers during a special student paper competition session, from which the Best Paper/Presentation will be selected, and receive a $1,000 prize at the Honors and Awards Luncheon.

Cyber Café

Wireless internet will be provided in all meeting spaces from Monday, 28 March, 1200 hrs, through Thursday, 31 March, 1900 hrs.

Pre-Conference Publications Sale—Save An Extra 15% Off

Conference attendees can save an extra 15% off of any books* prior to the conference. Details about how to participate are posted on the conference Web site under Publications Sale, located to the right of the page. **(Exclusions Apply)*

Conference Proceedings

This year's conference proceedings will be available in one format: online proceedings—available **22 March 2011**. 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 conferences technical papers. For those registering onsite, you will be provided with instructions at registration.

Plenary Panels

The 2007 Symposium for Civilian Applications of Unmanned Aircraft Systems (CAUAS) assembled experts and stakeholders to develop an integrated vision for the future of UAS for civilian applications. An outcome was the declaration that 2008–2017 will be the "Public Decade," where civilian agencies in the United States will lead in the application of UAS technologies and the integration of UAS into the National Airspace System (NAS). Three applications areas emerged as those predicted to be of major importance during the Public Decade: 1) Disaster Response; 2) National Security; and 3) Climate Change.

For Infotech@Aerospace 2011, several panelists from the 2007 CAUAS symposium will join other UAS policy and applications experts for two plenary panel discussions. The first panel session will focus broadly on policy and regulatory issues for civilian applications of UAS (Tuesday, 29 March, 1000–1200 hrs). They will discuss the progress that has been made in policies that control access and operations in the NAS, including an update on the authorization and waiver process for public UAS, and the status of new rules developed for the operation of small UAS. The second session (Thurday, 31 March, 1130–1330 hrs) will focus on technical issues related to UAS operations for civilian applications of UAS in the National Airspace System. The panelists will discuss requirements for a communications infrastructure to support UAS operations, progress in sense and avoid technologies, and advances in unmanned aircraft performance.

Registration Information

All participants are urged to register on the AIAA Web site at **www.aiaa.org/events/I@A**. Registering in advance saves conference attendees time and up to $200. A check made payable to AIAA or credit card information must be included with your registration form. A PDF registration form is available on the AIAA Web site. Print, complete, and mail or fax with payment to AIAA. Address information is provided.

Early-bird registration forms must be received by **28 February 2011**. Preregistrants may pick up their materials at the advance registration desk. All those not registered by **27 March 2011** may do so at the on-site registration desk. All nonmember registration prices include a one-year AIAA membership. If you require more information, please call 703.264.7500 or e-mail chrisb@aiaa.org.

I@A 2011 registration fees are as follows:

	Early Bird By 28 Feb	**Standard** 29 Feb–27 Mar	**On Site** Starting 28 Mar
Full Conference with Online Proceedings			
Member	$755	$855	$955
Nonmember	$910	$1010	$1110

Includes sessions Tuesday–Wednesday, Tuesday evening reception, Wednesday awards luncheon, and single-user access to the online conference proceedings.

Full-Time Undergraduate Student			
Member	$20	$30	$40
Nonmember	$50	$60	$70

Includes conference sessions only.

Full-time Undergraduate Student Plus Tickets			
Member	$125	$135	$145
Nonmember	$155	$165	$175

Includes sessions Tuesday–Wednesday, Tuesday evening reception, and Wednesday awards luncheon (excludes conference proceedings).

Full-Time Graduate or Ph.D. Student			
Member	$60	$70	$80
Nonmember	$90	$100	$110

Includes conference sessions only.

Full-Time Graduate or Ph.D. Student Plus Tickets			
Member	$165	$175	$185
Nonmember	$195	$205	$215

Includes sessions Tuesday–Wednesday, Tuesday evening reception, and Wednesday awards luncheon (excludes conference proceedings).

Full-Time Retired			
Member	$40	$50	$60

Includes sessions Tuesday–Wednesday, Tuesday evening reception, and Wednesday awards luncheon participation only.

Discounted Group Rate			
	$680 per person	$680 per person	N/A

Advance only. 10% discount off early-bird member rate for 10 or more individuals from the same organization who register and pay at the same time with a single form of payment. Includes all catered events and online proceedings. A complete typed list of registrants, along with completed individual registration forms and a single payment, must be submitted by the preregistration deadline of **2 April 2011**. No substitutions.

Executive Chair
Lawrence O. Brase
Technical Fellow, Structures Technology
Boeing Defense, Space & Security

General Chair
John R. Moore
Rockwell Collins

Technical Program Chair
Nhan Nguyen
NASA Ames Research Center

Deputy Technical Program Chair
Tim Howard
EOSESS LLC

Technical Events Chair
Brian Argrow
University of Colorado, Boulder

Professional Development Registration Fees for Electro-Optical Systems for Aerospace Sensing Applications*

	By 18 Feb	19 Feb–18 Mar	19–27 Mar
AIAA Member	$900	$1100	$1200
Nonmember	$1050	$1250	$1350

Register for this course and attend the InfoTech@Aeropace Conference for FREE! Includes Sessions only.

Extra Tickets

Tuesday Evening Reception	$55
Wednesday Awards Luncheon	$50
Thursday Box Lunch	$25
Thursday Brewery Tour	$20
Online Proceedings	$170

On-Site Registration

On-site registration hours are as follows:

Sunday, 27 March	0700–1700 hrs (Course registration only)
Monday, 28 March	1500–1900 hrs
Tuesday, 29 March	0700–1700 hrs
Wednesday, 30 March	0700–1700 hrs
Thursday, 31 March	0700–1600 hrs

Notice on Visas

If you plan to attend an AIAA technical conference or course held in the United States and you require a visa for travel, it is incumbent upon you to apply for a visa with the U.S. Embassy (consular division) or consulate with ample time for processing. To avoid bureaucratic problems, AIAA strongly suggests that you submit your formal application to U.S. authorities a minimum of 120 days in advance of the date of anticipated travel.

To request a letter of invitation, please fill out and submit the online Invitation Letter Request Form. You can also request a letter of invitation by contacting:

ATTN: Customer Service
American Institute of Aeronautics and Astronautics
1801 Alexander Bell Drive, Suite 500
Reston, VA 20191-4344
703.264.7500 • 703.264.7657 FAX
E-mail: custserv@aiaa.org

AIAA cannot directly intervene with the U.S. Department of State, consular offices, or embassies on behalf of individuals applying for visas.

Hotel Reservations

AIAA has made arrangements for a block of rooms at the Hyatt Regency St. Louis at the Arch, 315 Chestnut Street, St. Louis, MO 63102. Room rates are $125 for single/double occupancy. A deposit in the amount of one night's room and tax will be due for guaranteed reservations 14 days after the room is confirmed and no later than the cutoff date of **7 March 2011**. All room reservations must be guaranteed. This deposit is refundable if the reservation is canceled before 1500 hrs, 72 hours prior to the guest reservation arrival date. Reservations may be made, modified, or canceled online at https://resweb.passkey.com/go/aiaa2011**,** or by calling 888.421.1442 (toll-free) or 402.592.6464 and referring to the AIAA Infotech@Aerospace Conference. These rooms will be held for AIAA until **7 March 2011**. After 7 March, any unused rooms will be released to the general public. You are encouraged to book your hotel room early.

Conference Sponsorship Opportunities

When your brand is on the line, AIAA sponsorship can raise the profile of your company and put you where you need to be. Available packages offer elevated visibility, effective marketing and branding options, and direct access to prominent decision makers from the aerospace community. Contact Cecilia Capece at ceciliac@aiaa.org or 703.264.2570 for more details.

U.S. Nationals (U.S. Citizens and Permanent Residents) are reminded that it is their responsibility to comply with ITAR and Technology Transfer restrictions. Visit **www.aiaa.org** for more details.

In today's highly competitive marketplace, you need every advantage to stay on top! Let AIAA Professional Development pave the way to you future and continuing success! As the premier association representing professionals in aeronautics and astronautics, AIAA has been a conduit for furthering professional development for more than sixty years. AIAA is committed to keeping the aerospace professional at their technical best. AIAA offers the best instructors and courses to meet the professional's career needs.

Electro-Optical Systems for Aerospace Sensing Applications
27–28 March 2011

This course will provide an introduction to electro-optical systems for practicing aerospace engineers. Non-specialists in electro-optics, such as systems engineers, specialists in related disciplines (such as computer/software, electrical, and mission planning), and those who integrate and interact with EO payloads are encouraged to attend. The course assumes that attendees will have a basic undergraduate degree in a technical field but does not require specialization in any optics-related field.

Features of the Course: review of basic EO design principles; methods for predicting and assessing performance; current topics in airborne; ground and space-based EO systems; and applications to unmanned and networked systems including unmanned sensor networks

Register for this course and attend the InfoTech@Aeropace Conference for FREE! Includes Sessions Only.

Program at a Glance

Tuesday, 29 March 2011

0800–0930 hrs
Welcome and Keynotes

1000-1200 hrs
Plenary Policy Panel

1330–1730 hrs
Afternoon Technical Sessions
Adaptive Control
Aerospace Autonomy and Situational Awareness (ASR8)
Aerospace Robotics
Aerospace Visualization Techniques
Cooperative UAS
Intelligent Systems Special Topic
ISHM: Principles Strategies and Standards of Fault Management
Multi-Core Computers, Software and Applications
Neural & Fuzzy Systems
Systems-of-Systems Integrity/Trustworthiness
UAS Sense & Avoid Technologies
UAS Special Topic
Unmanned Systems Integrity/Trustworthiness

Wednesday, 30 March 2011

0800–1130 hrs
Morning Technical Sessions
Adaptive Control
Collaborative Control of Small Unmanned Aerial Systems
Human Machine Interface—Aerospace Applications I
Introduction to Trusted Software Development: Tutorial
ISHM: Fault Management
ISHM: ISHM and Control Systems
Plug and Play Networks
Sensor Systems
UAS Sense & Avoid Technologies
V&V of Aerospace Systems

1130–1330 hrs
Awards Luncheon

1330–1800 hrs
Afternoon Technical Sessions
Aerospace Robotics Applications
Applications of Adaptive Control and Optimization for Wind and Solar Energy Systems: Tutorial
Cooperative UAS
Data and Information Fusion
Fault Management for Systems Integrity/Trustworthiness
Integrated Decision Making in Dynamic Environments
ISHM: Prognostics
Neuromorphic Computing for Autonomous Intelligent Systems Operation
Plug and Play Software, Tools and Development Environments
UAS Missions
UAS Special Topic
UAV Flight Systems

Thursday, 31 March 2011

0800–1130 hrs
Morning Technical Sessions
ISHM: Implementations
Aerospace Autonomy & Automation Aids
Application of Intelligent Propulsion
ISHM: Intelligent Sensors
Plug and Play Applications
Sensors and Instrumentation
Teaching Intelligent Systems
UAS Design & Training
UAS Guidance & Control
UAV Navigation & Control

1130–1330 hrs
Plenary Technical Panel

1330–1700 hrs
Afternoon Technical Sessions
Evolutionary Design of Intelligent Systems
Intelligent Flight Planning and Guidance
IS Technologies for Environmental Tracking
ISHM: Strategies and Applications
ISHM: Tools and Technologies for Implementation
Real Time Embedded Computing Systems and Applications
Software Systems Special Topic
Space Networking
Space Networks and Intelligent Systems
Spacecraft Automation & Control
UAS Special Topic
UAV Applications
Vision-Based Sensing

For complete conference information, visit the Web site at *www.aiaa.org/events/I@A.*

52nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference
19th AIAA/ASME/AHS Adaptive Structures Conference
13th AIAA Non-Deterministic Approaches Conference
13th AIAA Dynamics Specialists Conference
12th AIAA Gossamer Systems Forum
7th AIAA Multidisciplinary Design Optimization Specialist Conference

4–7 April 2011
Sheraton Denver
Denver, CO

52nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference—Technologies for the Next Generation of Aircraft

The 52nd Structures, Structural Dynamics, and Materials Conference (SDM) is sponsored by AIAA, ASME, ASCE, AHS, and ASC. This established annual conference is a widely acknowledged event that provides a unique forum dedicated to the latest developments in the collective disciplines of structures, structural dynamics, materials, design engineering, and survivability. The 52nd Conference will also host the 19th AIAA/ASME/AHS Adaptive Structures Conference, the 13th AIAA Non-Deterministic Approaches Conference, the 13th AIAA Dynamics Specialists Conference, the 12th AIAA Gossamer Systems Forum, and the 7th AIAA Multidisciplinary Design Optimization Specialist Conference. Plenary presentations, given by recognized, forward-thinking invited speakers, will be a special feature of the conference. This year's presentations will be organized around the potential applications of structures, structural dynamics, and materials in the next generation of aircraft.

19th AIAA/ASME/AHS Adaptive Structures Conference

The 19th Adaptive Structures Conference, which brings together basic and applied researchers from diverse disciplines in academia, government, and industry, is the premier conference focused on the advancement of adaptive structures technology and its application to aerospace systems.

13th AIAA Non-Deterministic Approaches Conference

The need for Non-Deterministic Approaches (NDA) to manage uncertainty is becoming increasingly recognized within the aerospace industry. These approaches, which include both probabilistic and non-probabilistic methods, provide treatment of high consequence of failure events associated with the development and operation of aerospace systems.

13th AIAA Dynamics Specialists Conference

The 13th AIAA Dynamics Specialists Conference theme is emerging structural dynamics technologies that will enable development of the next generation of aerospace vehicle systems.

12th AIAA Gossamer Systems Forum

An emerging class of large-scale, lightweight structures is enabling a paradigm shift in design, launch, and operation of spaceflight systems. Spacecraft with structural characteristics optimized for operation in space and for the ability to collapse into small packages for launch yield order-of-magnitude reductions in mass, launch volume, and life-cycle cost, as compared to large spaceflight systems.

7th AIAA Multidisciplinary Design Optimization Specialist Conference (MDO)

Multidisciplinary design optimization (MDO) focuses on optimizing the performance and reducing the costs of complex systems that involve multiple interacting disciplines, such as those found in aircraft, spacecraft, automobiles, industrial manufacturing equipment, and various consumer products, as well as on the development of related methodologies. MDO is a broad area that encompasses design synthesis, sensitivity analysis, approximation concepts, optimization methods and strategies, artificial intelligence, and rule-based design—all in the context of integrated design dealing with multiple disciplines, and interacting subsystems or systems of systems.

Special Events

Welcome Reception

1800–1930 hrs

Please join us at the opening reception—a perfect opportunity to visit with your colleagues and jump start the conference.

Awards Luncheon

Join fellow attendees at the Wednesday, 6 April 2011, AIAA Awards Luncheon from 1200–1400 hrs. The prestigious Walter J. and Angeline H. Crichlow Trust Prize will be presented. The luncheon is included in the registration fee where indicated. Additional tickets may be purchased for $42 via the registration form found at **www.aiaa.org/events/sdm** or on site at the AIAA registration desk, based on availability.

Student Papers Awards

On Wednesday, 6 April 2011, a limited number of students will receive recognition for their papers, and $2,000 in prizes, at the SDM conference awards luncheon through the Jefferson Goblet Award, The Harry H. and Lois G. Hilton Award, The Lockheed

Martin Award, and The American Society of Composites Award. The Student Papers Technical Chair is Gregory A. Schoeppner, Air Force Research Laboratory.

Cyber Cafe (Internet Access)

Computers with complimentary Internet access will be available for conference attendees during the following hours:

Sunday, 3 April	1500–2000 hrs
Monday, 4 April	0700–2000 hrs
Tuesday, 5 April	0700–2000 hrs
Wednesday, 6 April	0700–2000 hrs
Thursday, 7 April	0700–1600 hrs

Pre-Conference Publications Sale—Save An Extra 15% Off

Conference attendees can save an extra 15% off of any books* prior to the conference. Details about how to participate are posted on the conference Web site under Publications Sale, located to the right of the page. **(Exclusions Apply)*

Conference Proceedings

This year's conference proceedings will be available in one format: online proceedings—available **28 March 2011**. 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 conferences technical papers. For those registering onsite, you will be provided with instructions at registration.

Registration Information

All participants are urged to register on the AIAA Web site at **www.aiaa.org/events/sdm**. Registering in advance saves conference attendees time and up to $200. A check made payable to AIAA or credit card information must be included with your registration form. A PDF registration form is available on the AIAA Web site. Print, complete, and mail or fax with payment to AIAA. Address information is provided.

Early-bird registration forms must be received by **7 March 2011**. Preregistrants may pick up their materials at the advance registration desk. All those not registered by **2 April 2011** may do so at the on-site registration desk. All nonmember registration prices include a one-year AIAA membership. If you require more information, please call 703.264.7500 or e-mail lynned@aiaa.org.

Registration fees are as follows:

	Early Bird By 7 Mar	**Standard** 8 Mar–2 Apr	**On Site** Beginning 3 Apr
Full Conference with Online Proceedings			
AIAA Member	$675	$775	$875
Nonmember	$830	$930	$1030

Includes sessions Monday–Thursday, Monday evening reception, Wednesday awards luncheon, and single-user access to the online conference proceedings.

Full-Time Undergraduate Student			
AIAA Member	$20	$30	$40
Nonmember	$50	$60	$70

Includes conference sessions only.

Full-Time Undergraduate Student Plus Tickets			
AIAA Member	$127	$137	$147
Nonmember	$157	$167	$177

Includes sessions Monday–Thursday, Monday evening reception, and Wednesday awards luncheon (excludes conference proceedings).

Full-Time Graduate or Ph.D. Student			
AIAA Member	$60	$70	$80
Nonmember	$90	$100	$110

Includes conference sessions only.

52nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference

General Chair
Rajiv A. Naik
Pratt & Whitney

Technical Program Chair
Gregory M. Odegard
Michigan Technological University

19th AIAA/ASME/AHS Adaptive Structures Conference

General Chair
Norman M. Wereley
University of Maryland

Technical Program Chair
Edward V. White
The Boeing Company

13th AIAA Non-Deterministic Approaches Conference

General Chair
Philip S. Beran
Air Force Research Laboratory (AFRL/RBSD)

Technical Program Chair
Thiagarajan Krishnamurthy
NASA Langley Research Center

13th AIAA Dynamics Specialists Conference

General Chair
Paul F. Taylor
Gulfstream Aerospace Corporation

Conference Technical Chair
John B. Kosmatka
University of California San Diego

12th AIAA Gossamer Systems Forum

General Chair
Houfei Fang
Jet Propulsion Laboratory

Technical Program Chair
Sergio Pellegrino
California Institute of Technology

7th AIAA Multidisciplinary Design Optimization Specialist Conference (MDO)

General Chair
Christopher A. Mattson
Brigham Young University

Technical Program Chair
Vladimir O. Balabanov
The Boeing Company

Full-Time Graduate or Ph.D. Student Plus Tickets			
AIAA Member	$167	$177	$187
Nonmember	$197	$207	$217

Includes sessions Tuesday–Wednesday, Monday evening reception and Wednesday awards luncheon (excludes conference proceedings).

Full-Time Retired AIAA Member			
AIAA Member	$40	$50	$60

Includes sessions Monday–Thursday, Monday evening reception, and Wednesday awards luncheon participation only.

AIAA Programs

In today's highly competitive marketplace, you need every advantage to stay on top! Let AIAA Professional Development pave the way to you future and continuing success! As the premier association representing professionals in aeronautics and astronautics, AIAA has been a conduit for furthering professional development for more than sixty years. AIAA is committed to keeping the aerospace professional at their technical best. AIAA offers the best instructors and courses to meet the professional's career needs.

On 2–3 April, AIAA is offering the following professional development short courses in conjunction with the AIAA Structures Conferences. Register for one of these courses and attend the SDM Conference for FREE! Includes sessions only.

Computational Methods in Aeroelasticity *(Instructors: Gautam SenGupta and Jack Castro)*
This course provides an introduction to numerical methods used in aeroelasticity. Topics include introduction of basic concepts; interpolating structural modes to an aerodynamic mesh; linear unsteady aerodynamic tools: Strip Theory, Vortex Lattice, and Doublet Lattice methods; application of CFD for transonic nonlinear flow; model reduction methods used in aeroelastic formulation; and nonlinearity and uncertainty analysis in aeroelasticity.

Design of Aircraft Structures *(Instructor: Michael Mohagahan)*
An examination into the latest concepts and lessons learned in design of aircraft metal and composite structures, including evolution of design criteria, structural design concepts, evolution of advanced materials, static strength, buckling, durability and damage tolerance, practical design considerations, validation, and certification. Design and analysis exercises are included to involve students in the learning process.

Fundamentals of Composite Structure Design *(Instructor: Rickard Benton Heslehurst)*
Receive a fundamental understanding of the structural design requirements for composites. Key topics discussed in this course include structural design requirements; laminate configuration sizing and distribution; structural performance estimation and understanding; other structural considerations—holes, joints, ply termination; and operational environment issues.

Structural Dynamics in Mechanical Design *(Instructor: Dennis Philpot)*
This course is designed to provide the student with a good theoretical, as well as practical, knowledge of the methodologies for performing dynamic analysis on a wide range of structural and mechanical systems. Throughout the course, equal attention will be given to both the methods of classical analysis techniques and the theories on which the methods are based. Key topics include dynamic loads and boundary conditions; foundational topics in energy methods; Newtonian Dynamics: first- and second-order systems; Multiple-Degree-of-Freedom (MDOF) Systems; dynamic response of MDOF Systems; and dynamics in the mechanical design process.

Discounted Group Rate

	$608 per person	$608 per person	N/A

Advance only. 10% discount off early-bird member rate for 10 or more individuals from the same organization who register and pay at the same time with a single form of payment. Includes all catered events and online proceedings. A complete typed list of registrants, along with completed individual registration forms and a single payment, must be submitted by the preregistration deadline of **2 April 2011**. No substitutions.

*Professional Development Registration Fees**

	By 25 Feb	26 Feb–25 Mar	26 Mar–2 Apr
AIAA Member	$895	$1095	$1195
Nonmember	$1045	$1245	$1345

Register for one of the courses and attend the SDM Conference for FREE! Includes sessions only.

Extra Tickets

Monday Evening Reception	$65
Wednesday Awards Luncheon	$42
Online Proceedings	$170

On-Site Registration

On-site registration hours are as follows:

Saturday 2 April	0700–1700 hrs (course registration only)
Sunday, 3 April	1500–1900 hrs
Monday, 4 April	0700–1700 hrs
Tuesday, 5 April	0700–1700 hrs
Wednesday, 6 April	0700–1700 hrs
Thursday, 7 April	0700–1600 hrs

Notice on Visas

If you plan to attend an AIAA technical conference or course held in the United States and you require a visa for travel, it is incumbent upon you to apply for a visa with the U.S. Embassy (consular division) or consulate with ample time for processing. To avoid bureaucratic problems, AIAA strongly suggests that you submit your formal application to U.S. authorities a minimum of 120 days in advance of the date of anticipated travel.

To request a letter of invitation, go to **http://aiaa.org/content.cfm?pageid=230&lumeetingid=2412&viewcon=visa**. AIAA cannot directly intervene with the U.S. Department of State, consular offices, or embassies on behalf of individuals applying for visas.

Hotel Information

AIAA has made arrangements for a block of rooms to be held at the Sheraton Denver Downtown, 1550 Court Place, Denver, CO 80202, phone: 303.893.3333. Rates are $179 plus applicable taxes for single or double occupancy. Rooms will be held until **1 March 2011** or until the block is full. Please make your reservations early to avoid missing the discounted rate. In addition, please mention AIAA when you make your reservations to be included in this block.

Federal Government Employees: A limited number of rooms have been blocked at the current federal per diem rate at the hotel. Ask for the AIAA Government Block when making your reservations, as there may not be rooms available at that rate outside the AIAA block.

Conference Sponsorship Opportunities

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U.S. Nationals (U.S. Citizens & Permanent Residents) are reminded that it is their responsibility to comply with ITAR and Technology Transfer restrictions. Visit **www.aiaa.org** for details.

Program at a Glance

Monday, 4 April 2011

0800–0900 hrs
SDM Keynote
"Opportunities for Next-Generation Aircraft Enabled by Revolutionary Materials"
Dr. Charles Harris, Director, Research Directorate, NASA Langley Research Center, Hampton, VA

0930–1200 hrs
Morning Technical Sessions
Aircraft Flutter I
Aircraft Structural Design I
Analysis of Joints and Interfaces
Ballistic Flash, Fire, and Thermal Degradation
Deployable Space Structures for Cubesats
Design of Composite Structures I
Integrated Computational Materials Engineering (ICME) I
Limit Cycle Oscillations
Modeling of Textile Composites
Non-Deterministic Approaches to Structural Health Management I
Plate and Shell Dynamics
Uncertainty Quantification in Model Validation
Wind Turbine Blade Materials and Manufacturing

1330–1430 hrs
SDM Lecture
"Parametric Model Reduction for Time-Critical Applications and Emerging Technology Trends"
Charbel Farhat, Vivian Church Hoff Professor of Aircraft Structures; Chairman, Department of Aeronautics and Astronautics; Director, Army High Performance Computing Research Center, Stanford University, Stanford, CA

1500–1800 hrs
Afternoon Technical Sessions
Aeroservoelasticity
Beam Dynamics
Damping and Vibration Suppression
Design and Testing of Composite Structures I
Modeling of Damage in Composite Laminates & Textile Composites
Nanostructured Materials I
Non-Deterministic Approaches for Aircraft I
Non-Deterministic Approaches for Engineering Problems I
Simulation of Impact, Blast, and Crash Dynamics
Structural Analysis Methods I
Structural Testing
Survivability, Damage Assessment, and Expedient Repair
Wind Turbine Design and Optimization

Tuesday, 5 April 2011

0800–0900 hrs
ASC Keynote
"SMART Rotor Development and Wind Tunnel Test"
Friedrich K. Straub, The Boeing Company

0930–1200 hrs
Morning Technical Sessions
Adaptive Structures Applications
Aircraft Flutter II
Analysis of Beams
Analysis of Laminated Composites
Fracture and Damage I
Integrated Computational Materials Engineering (ICME) II
Mirrors and Reflectors
Multi-Body Dynamics
Non-Deterministic Approaches to Structural Health Management II
Non-Deterministic Methods Development I
Optimization Frameworks and Applications
RotorCraft Dynamics
Wind Turbine Structures and Mechanics

1200–1300 hrs
Invited Panel
Panel Session on Research and Funding Directions for Gossamer Systems

1330–1430 hrs
NDA Keynote
"New Horizons in Uncertainty Quantification"
Dr. Mark C. Anderson, Program Manager for Verification and Validation, Advanced Simulation and Computing Program, Los Alamos National Laboratory, Los Alamos, NM

GSF Keynote
"The World's First Solar Sail, Ikaros, and Hybrid Solar Power Sail For Outer Solar Systems"
Dr. Junichiro Kawaguchi, Professor, Space Systems Engineering, Institute of Space and Astronautical Science (ISAS); Program Director, Lunar and Planetary Exploration Center (JSPEC); Hayabusa Project Manager, Japan Aerospace Exploration Agency (JAXA), Kanagawa, Japan

1500–1800 hrs
Afternoon Technical Sessions
Adaptive Structures Analyses and Methods
Composite Materials / Structural Optimization
Design and Analysis of Novel Composite Architectures
Flutter of Flexible Aircraft
IKAROS Solar Sail
Multiobjective / Multilevel Optimization
Nanostructured Materials II
Non-Deterministic Approaches for Engineering Problems II
Novel Approaches for Computational Simulation
Structural Health Monitoring
Structural Health Monitoring the Dynamicists Way
Vibration Testing
Wind Turbine Aeroelasticity and Loads

Wednesday, 6 April 2011

0800–0900 hrs
DSC Keynote
"Air Vehicle Aeroelasticity—Lessons Learned & Future Challenges"
Gerald D. Miller, Chief Engineer, High Altitude Long Endurance Systems, Phantom Works, Advanced Unmanned Systems, The Boeing Company

0930–1200 hrs
Morning Technical Sessions
Adaptive Structures—Structural Health Monitoringv
Aeroelastic / Aerodynamic Optimization
Aircraft Structural Design II
Characterization of Damage and Fatigue in Materials
Design Engineering
Fatigue Analysis
Joined Wing Sensorcraft Aeroservoelastic Wind Tunnel Test Program
Multi-Discipline Analysis for Hypersonic Structures I
Non-Deterministic Methods Development II
Novel Deployable Structures
Panel Flutter and Cylinder Dynamics
Space Structure Dynamics

AIAA Programs

1200–1400 hrs
Awards Luncheon
"Structures, Structural Dynamics and Materials Challenges in 21st Century Aeronautical Propulsion"
Speaker: Dr. Alan H. Epstein, Vice President, Technology and Environment, Pratt & Whitney, East Hartford, CT

1430–1800 hrs
Afternoon Technical Sessions
Aircraft Loads
Deployable Booms
Design and Analysis of Tailored Composites
Dynamics of Adaptive Structures
Dynamics of Micro-Aircraft and Joined-Wing Aircraft
Fracture and Damage II
Multi-Discipline Analysis for Hypersonic Structures II
Nanostructured Materials III
Non-Deterministic Approaches for Aircraft II
Nonlinear Dynamics and Aeroelasticity
Probabilistic Fatigue and Fracture
System Identification
Wing / Airfoil / Aircraft Optimization

1730–1830 hrs
ASME Lecture

Thursday, 7 April 2011

0800–0900 hrs
MDO Keynote
"Multidisciplinary Design Optimization: Engineering the Future from Airplanes to Climate Change"
Prof. Achille Messac, Distinguished Professor and Department Chair of Mechanical and Aerospace Engineering, Syracuse University, Syracuse, NY

0930–1200 hrs
Morning Technical Sessions
Actuation of Adaptive Wings
Computational Aeroelasticity I
Design of Composite Structures II
Fatigue, Fracture and Buckling of Materials
Multi-Discipline Analysis for Hypersonic Structures III
Multifunctional Materials Special Session
Non-Deterministic Optimization
Spacecraft Dynamics
Stiffness and Strength of Materials for Gossamer Structures
Structural Analysis Methods II
Structural Stability and Buckling
Topology Optimization

1300–1600 hrs
Afternoon Technical Sessions
Aerospace Structural Design
Analysis of Plates and Shells
Computational Aeroelasticity II
Design and Testing of Composite Structures II
Design of Adaptive Wings
Launch Vehicle Dynamics
Microstructural Effects and Inelastic Behavior
Non-Deterministic Approaches for Engineering Problems III
Nonlinear Dynamics
Optimization Applications
Optimization Methods

For complete conference information, visit the Web site at *www.aiaa.org/events/sdm.*

New and Forthcoming Titles

On Sale Now!

Encyclopedia of Aerospace Engineering: 9-Volume Set

Richard Blockley and Wei Shyy, University of Michigan

2010, 5500 pages, Hardback
ISBN-13: 978-0-470-75440-5
List Price: $3,750.00
On Sale Now! $3,195.00 (*Shipping/Handling is extra*)
Good through 31 January 2011

Emergence of Pico- and Nanosatellites for Atmospheric Research and Testing

Purvesh Thakker and Wayne Shiroma

Progress in Astronautics and Aeronautics Series, 234
2010, 384 pages, Hardback
ISBN: 978-1-60086-768-2
List Price: $99.95
AIAA Member Price: $74.95

Principles of Flight Simulation

David Allerton, University of Sheffield

AIAA Education Series
2010, 471 pages, Hardback
ISBN-13: 978-1-60086-703-3
AIAA Member Price: $74.95
List Price: $94.95

Multiple Scales Theory and Aerospace Applications

Rudrapatna V. Ramnath

AIAA Education Series
2010, 640 pages, Hardback
ISBN: 1-60086-762-0
AIAA Member Price: $74.95
List Price: $99.95

Unmanned Aircraft Systems: UAVS Design, Development and Deployment

Reg Austin

2010, 384 pages, Hardback
ISBN: 978-1-60086-759-0
AIAA Member Price: $94.95
List Price: $124.95

SKYCRANE: Igor Sikorsky's Last Vision

John A. McKenna

Library of Flight
2010, 128 pages, Paperback
ISBN: 978-1-60086-756-9
AIAA Members: $29.95
List Price: $39.95

German Development of the Swept Wing—1935–1945

Edited by Hans-Ulrich Meier

Library of Flight
2010, 580 pages, Hardback
ISBN: 978-1-60086-714-9
AIAA Member Price: $69.95
List Price: $89.95

Test and Evaluation of Aircraft Avionics and Weapons Systems

Robert McShea

AIAA Education Series
2010, 800 pages, Hardback
ISBN: 978-16008-760-6
AIAA Member Price: $114.95
List Price: $149.95

Fundamentals of Aircraft and Airship Design, Volume I: Aircraft Design

L. Nicolai and G. Carichner

AIAA Education Series
2010, 960 pages, Hardback
ISBN: 978-1-60086-751-4
AIAA Member Price: $89.95
List Price: $119.95

Cooperative Path Planning of Unmanned Aerial Vehicles

Antonios Tsourdos, Brian White, and Madhavan Shanmugavel

Progress in Astronautics and Aeronautics Series, Vol. 235
November 2010, 216 pages, Hardback
ISBN: 978-1-60086-779-8
AIAA Member Price: $94.95
List Price: $124.95

Design and Analysis of Composite Structures: With Applications to Aerospace Structures

Christos Kassapoglou

AIAA Education Series
December 2010, 328 pages, Hardback
ISBN: 978-1-60086-780-4
AIAA Member Price: $79.95
List Price: $104.95

View complete descriptions and order 24 hours a day at www.aiaa.org/new

AIAA **Programs**

17th AIAA International Space Planes and Hypersonic Systems and Technologies Conference

11–14 April 2011
Grand Hyatt San Francisco
Union Square, San Francisco, CA

Synopsis

The objective of the 17th AIAA International Space Planes and Hypersonic Systems and Technologies Conference is to provide a forum for international discussion and exchange of information about leading-edge research and development activities associated with space planes and hypersonic atmospheric flight vehicles and the technologies underpinning these capabilities. The conference will consist of overviews of national programs from Asia, Australia, Europe, and North America; programmatic summaries of major ongoing activities; invited lectures by distinguished researchers, technical oral and poster presentations; and panel discussions on current issues and future directions.

Who Should Attend the 2011 Hypersonics Conference? And Why?

This event will provide professionals from industry and research institutions, as well as students working in the field of aeronautics and astronautics, an opportunity to meet major contributors from around the world who are working in R&D efforts on hypersonic sustained and accelerated flight. The conference gives a detailed status of the state of the most advanced activities in the field and an excellent overview of the current state of the art in hypersonic and reentry flight.

What is the Hot Topic for Discussion at the 2011 Hypersonics Event?

The hot topic for the 2011 event revolves around recent hypersonic flight experiments and planning for the future. Highlights of the conference will include discussions of the airbreathing ramjet engine and X51 flight testing.

What Will my Takeaway be from Having Attended the 2011 Event?

In addition to learning how to plan for future test experiments, attendees will have the unique opportunity to network and meet key people in industry from around the world. The major takeaway will be a clearer overall picture of the hypersonic systems industry.

Special Events

Opening Plenary Session

On Monday, 11 April, the Plenary Session will be held at 0830 hrs. Conference Introduction: David Van Wie, JHUAPL.

Culpepper Lecture

On Tuesday, 12 April, the Culpepper Lecture will be held at 1300 hrs.

Awards Luncheon

This year's awards luncheon will be held on Wednesday, 13 April, at 1200 hrs. Distinguished Speaker: TBD.

Pre-Conference Publications Sale—Save An Extra 15% Off

Conference attendees can save an extra 15% off of any books* prior to the conference. Details about how to participate are posted on the conference Web site under Publications Sale, located to the right of the page. **(Exclusions Apply)*

Conference Proceedings

This year's conference proceedings will be available in one format: online proceedings—available **4 April 2011**. 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 conferences technical papers. For those registering onsite, you will be provided with instructions at registration.

Accompanying Persons

Accompanying persons are invited to met on Monday, 11 April, at 1000 hrs in the Grand Terrace. Information about local attractions, activities, and tours will be available at that time.

Registration Information

All participants are urged to register on the AIAA Web site at **www.aiaa.org/events/hypersonics**. Registering in advance saves conference attendees time and up to $200. A check made payable to AIAA or credit card information must be included with your registration form. A PDF registration form is available on the AIAA Web site. Print, complete, and mail or fax with payment to AIAA. Address information is provided.

Early-bird registration forms must be received by **14 March 2011**, and standard registration forms will be accepted until **9 April 2011**. Preregistrants may pick up their materials at the advance registration desk. All those not registered by 9 April 2011 may do so at the on-site registration desk. All nonmember registration prices include a one-year AIAA membership. If you require more information, please call 703.264.7500 or e-mail sandrat@aiaa.org.

Registration fees are as follows:

	Early Bird By 14 March	**Standard** 15 Mar–9 Apr	**On Site** Beginning 10 Apr
Full Conference with Online Proceedings			
Member	$850	$950	$1050
Nonmember	$1005	$1105	$1245

Includes sessions Monday–Thursday, Monday evening reception, Wednesday awards luncheon, and single-user access to the online conference proceedings.

Full-Time Undergraduate Student			
Member	$20	$30	$40
Nonmember	$50	$60	$70

Includes conference sessions only.

Full-Time Undergraduate Student Plus Tickets

Member	$165	$175	$185
Nonmember	$195	$205	$215

Includes conference, Monday evening reception, and Wednesday awards luncheon only (excludes conference proceedings).

Full-Time Graduate or Ph.D. Student

Member	$60	$70	$80
Nonmember	$90	$100	$110

Includes conference sessions only.

Full-Time Graduate or Ph.D. Student Plus Tickets

Member	$205	$215	$225
Nonmember	$235	$245	$255

Includes conference, Monday evening reception, and Wednesday awards luncheon only (excludes conference proceedings).

Full-Time Retired

Member	$40	$50	$60

Includes sessions Monday–Thursday, Monday evening reception, and Wednesday awards luncheon.

Discounted Group Rate

	$765 per person	$765 per person	N/A

Advance only. 10% discount off early-bird member rate for 10 or more individuals from the same organization who register and pay at the same time with a single form of payment. Includes all catered events and online proceedings. A complete typed list of registrants, along with completed individual registration forms and a single payment, must be received by the preregistration deadline of **6 April 2011**. No substitutions.

*Professional Development Registration Fees**

	By 25 Feb	26 Feb–1 Apr	2–9 Apr
Member	$1095	$1195	$1245
Nonmember	$1245	$1345	$1395

*Register for the short course offered at the conference and attend the International Space Planes and Hypersonic Systems and Technologies Conference for FREE! Includes sessions only.

Extra Tickets

Monday Evening Reception	$85
Wednesday Awards Luncheon	$60
Online Proceedings	$140

General Chair Emeritus
Heribert Kuczera
EADS Space Transportation, Retired, Germany

General Chair Emeritus
David W. Stallings
USA

Technical Program Committee

Chair
David Van Wie
Johns Hopkins University Applied Physics Laboratory

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François Falempin
MBDA France

Germany
Klaus Hannemann
German Aerospace Center, DLR

Italy
Gennaro Russo
CIRA

Pacific Basin
Masataka Maita
Japan Aerospace Exploration Agency

On-Site Registration

On-site registration hours are as follows:

Saturday, 9 April	0700–1700 hrs (Course registration only)
Sunday, 10 April	1500–1900 hrs
Monday, 11 April	0700–1700 hrs
Tuesday, 12 April	0700–1700 hrs
Wednesday, 13 April	0700–1700 hrs
Thursday, 14 April	0700–1600 hrs

In today's highly competitive marketplace, you need every advantage to stay on top! Let AIAA Professional Development pave the way to you future and continuing success! As the premier association representing professionals in aeronautics and astronautics, AIAA has been a conduit for furthering professional development for more than sixty years. AIAA is committed to keeping the aerospace professional at their technical best. AIAA offers the best instructors and courses to meet the professional's career needs.

On 9–10 April, AIAA is offering the following professional development short course in conjunction with the AIAA International Space Planes and Hypersonic Systems and Technologies Conference. Register for this course and attend the onference for FREE (Conference sessions only).

Fundamentals of Hypersonic Aerodynamics *(Instructor: John D. Anderson Jr.)*

This course focuses on the basic fundamental principles of hypersonic aerodynamics. It is a self-contained course for those students and professionals interested in learning the basic physical aspects of hypersonics. It assumes no prior familiarity with the subject. If you have never worked extensively in the area, or never studied hypersonics, this course is for you. It is a cohesive presentation of the fundamentals, a development of important theories and techniques, a discussion of salient results with emphasis on physical aspects, and a presentation of modern thinking on the subject. The course is organized around the classic textbook by the instructor, *Hypersonic and High-Temperature Gas Dynamics*.

AIAA Programs

Notice on Visas

If you plan to attend an AIAA technical conference or course held in the United States and you require a visa for travel, it is incumbent upon you to apply for a visa with the U.S. Embassy (consular division) or consulate with ample time for processing. To avoid bureaucratic problems, AIAA strongly suggests that you submit your formal application to U.S. authorities a minimum of 120 days in advance of the date of anticipated travel.

To request a letter of invitation, please fill out and submit the online Invitation Letter Request Form. You can also request a letter of invitation by contacting:

ATTN: Customer Service
American Institute of Aeronautics and Astronautics
1801 Alexander Bell Drive, Suite 500
Reston, VA 20191-4344
703.264.7500 • 703.264.7657 FAX
E-mail: custserv@aiaa.org

AIAA cannot directly intervene with the U.S. Department of State, consular offices, or embassies on behalf of individuals applying for visas.

Hotel Information

AIAA has made arrangements for a block of rooms at the Grand Hyatt San Francisco, 345 Stockton St., San Francisco, CA 94108. Room rates are $172 for single or double occupancy, plus applicable room tax.

Reservations can be made at **https://resweb.passkey.com/go/DAST**. Once you have clicked the link, select "attendee" under guest type; then select appropriate dates and continue by selecting "search" to choose room type and enter guest information.

Government Employees: There are a limited number of sleeping rooms available at the government per diem rate; federal government ID is required. Reservations can be made at **https://resweb.passkey.com/go/DAST**. Once you have clicked the link, select "federal government" under guest type; then select appropriate dates and continue by selecting "search" to choose room type and enter guest information.

These rooms will be held for AIAA until **21 March 2011** or until the room block is full, then released for use by the general public. The Grand Hyatt San Francisco will require a major credit card with expiration date to reserve a room. Should you prefer to call directly for reservations, call 888.421.1442 or 402.592.6464 and ask for the AIAA block.

Conference Certificate of Attendance Available

Certificates of Attendance are available for attendees who request documentation at the conference. AIAA offers this service to better serve the needs of the professional community. Claims of hours or applicability toward professional education requirements are the responsibility of the participant. Please request your copy at the on-site registration desk.

AIAA Foundation Associate Fellows Dinner

186 Institute members have recently been elected to the grade of Associate Fellow. These new Associate Fellows will be inducted during the AIAA Foundation Associate Fellows Dinner, Tuesday, 4 January 2011, at 1900 hrs, in Orlando, Florida. Each year, the Institute recognizes exemplary professionals for their accomplishments in engineering or scientific work, outstanding merit, and contributions to the art, science, or technology of aeronautics or astronautics.

Please support your colleagues, and join us for the induction of the 2011 Associate Fellows. Tickets to this prestigious event are available on a first-come, first-served basis and can be purchased for $85 via the 49th AIAA Aerospace Sciences Meeting registration form, or on site based on availability. Business attire is requested.

AIAA
The World's Forum for Aerospace Leadership

Program at a Glance

Monday, 11 April 2011

0830 hrs
Plenary Session
Conference Introduction: David Van Wie, JHUAPL

0840 hrs
Welcome and Opening Remarks
Mark Lewis, University of Maryland

0900 hrs
National Reports
- USA Applied Hypersonics: TBD
- USA Basic Research: John Schmisseur, AFOSR Program Manager
- ESA Present and Future Perspectives: Giorgio Tumino, ESA
- Australia National Report: Russell Boyce, UQ
- Japan National Report: Masataka Maita, JAXA
- China National Report: Jing Fan & Xinyu Chang, Institute of Mechanics, Chinese Academy of Science, Beijing
- Indian National Report: TBD
- France National Report: Francous Falempin, MBDA
- Italy National Report: Gennaro Russo, CIRA
- Germany National Report: Klaus Hannemann, DLR

1420 hrs
Conference Planning
David Van Wie, JHUAPL

1500 hrs
Afternoon Technical Sessions
Flight Test I
Hypersonic Fluid Dynamics
Ground Test Facilities I
Scramjet Isolators
Fuel Cooled Structures

Tuesday, 12 April 2011

0830 hrs
Distinguished Lecture
Graham Candler, McKnight Presidential Professor, Aerospace Engineering & Mechanics, University of Minnesota

1000 hrs
Morning Technical Sessions
Transpiration/Film Cooling
Aerodynamics
Advanced Engine Cycles I
Program Overviews
Scramjet Performance I

1300 hrs
Distinguished Lecture
Culpepper Lecture

1400 hrs
Afternoon Technical Sessions *(These afternoon technical paper sessions have six papers each. There is an afternoon break at 1530 hrs)*
Experimental Vehicles and Testbeds
Aerothermodynamics
Ground Test Facilities II
3D Inlets I
Scramjet Analyses

Wednesday, 13 April 2011

0830 hrs
Distinguished Lecture
Richard Mutzman and James S. Murphy, Air Force Research Lab: X51

1000 hrs
Morning Technical Sessions
High Temperature Materials and Structures
Configuration Aerodynamics I
Advanced Vehicles Concepts I
Inlet Analyses
Scramjet Performance II

1200 hrs
Awards Luncheon
Distinguished Speaker: TBD

1330 hrs
Afternoon Technical Sessions
Scramjet Performance III
Configuration Aerodynamics II
Advanced Vehicle Concepts II
Advanced Engine Cycles II
Scramjet Fuel Injection and Mixing

Thursday, 14 April 2011

0830 hrs
Distinguished Lecture
Richard Morgan, Director, Centre for Hypersonics, University of Queensland, Australia

1000 hrs
Morning Technical Sessions
Flight Test II
Aerodynamics/Plasmadynamics
MHD/Flow Control
3D Inlets II
Scramjet Ignition and Flameholding

1200 hrs
Distinguished Lecture
Sergey Leonov, Russian Academy of Sciences

1400 hrs
Afternoon Technical Sessions
Hot Structures
Hypersonic Transition
Hypersonic Vehicle Analyses
Flight Control
Scramjet Analysis

For complete conference information, visit the Web site at *www.aiaa.org/events/hypersonics.*

50th AIAA Aerospace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition
Advancing the Science of Flight Technology

9–12 January 2012
Gaylord Opryland Resort & Convention Center
Nashville, TN

Abstract Deadline: 1 June 2011

AIAA Aerospace Sciences Meeting

The AIAA Aerospace Sciences Meeting is the first major multidisciplinary event of the year for aerospace scientists and engineers from around the world. It provides an ideal forum for scientists and engineers from industry, government, and academia to share and disseminate scientific knowledge and research results with a view toward new technologies for aerospace systems.

This meeting is built around excellent technical paper presentation sessions. Plenary sessions that focus attention on program areas of current interest will start some sessions, followed by technical papers providing additional discussion of these topics. Distinguished lectures and evening networking events fill out the remainder of the program throughout the week.

New Horizons Forum

The New Horizons Forum will be held in conjunction with the AIAA Aerospace Sciences Meeting. The New Horizons Forum will feature keynote speakers from industry and government who will share their perspectives on the new challenges, future opportunities, and emerging trends in aerospace education, research, and programs. The New Horizons Forum will also feature panel discussions in which leaders from industry, government, and academia will address current issues and trends in aerospace technology research and development.

Aerospace Exposition

The Aerospace Exposition will showcase exhibits from government, industry, and small businesses, allowing one-on-one discussions with exhibitors, hardware and software demonstrations, and opportunities for side meetings with these organizations throughout the week.

Abstract Submittal Guidelines

Abstract submissions will be accepted electronically through the AIAA Web site at **www.aiaa.org/events/asm**. The Web site will open for abstract submission on **18 January 2011**. The electronic submission process is as follows:

1) Access the AIAA Web site at **www.aiaa.org/events/asm**.
2) On the right-hand side, click the "Submit Paper" button.
3) To access the submission site, you must be logged in to the AIAA Web site.
a. If you already have an account with AIAA, enter your User Name and Password in the "Login" box on the left-hand side and hit the arrow button.
b. If you do not have an account with AIAA, complete the steps for "Create Account".
4) Once logged in, you will be provided an active link for "Begin a New Submission or View a Previous Draft/Submission". Click the link to be directed to the Welcome page of the submission site.
5) Click the Submission tab at the top of the page to begin your submission.
6) Once selected, you will be provided with general information on the conference's abstract submission requirements and policies. To begin the submission, click the "Create a New Submission" link on the left-hand side. ***Please 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.

STEP 1: Type or paste the title of your abstract into the Title field and the presenting author's biography into the Presenter Biography field. Upload your abstract/draft manuscript file. Accepted file types are .pdf (preferred), .doc and .docx
Scroll down to read through the Rules and Reminders section and check the box noting you agree. Click "Save & Continue" to proceed to the next step.
STEP 2: Select your Presentation Type and the Topic Area of your abstract.
STEP 3: In this system, affiliations are added before author information. The information will be filled in for the person logged in to the site. Add additional author affiliations, if necessary, by clicking the "Add" button after each new affiliation. Click "Save & Continue" to proceed to the next step.
STEP 4: To create a list of co-authors for this submission, click the "Add Author" button. Search for your co-authors with the boxes provided and click the "Add" button next to the correct person. If no record is found for your co-author, you may add that person by clicking the link at the bottom of the page. Click "Save" after entering each one and then associate each author with their respective affiliation by entering the appropriate reference number from the drop-down boxes to the right of each name. When you have finished entering all authors ***YOU MUST*** put them in the order they should appear on the abstract and program. Use the drop-down boxes in the far left column of the list to do this. Failure to order the authors properly will result in them being incorrectly listed when the submission is published. After you have reordered the authors, click the "Save" button at the bottom of the list. Click "Save & Continue" to proceed to the next step. The author designated as the presenter will be the only person given access to upload the final manuscript for accepted submissions.
STEP 5: Select at least one key word that best represents your work. While only one selection is required, you may list up to six for your submission. Click "Save & Continue" to proceed to the next step.
STEP 6 If you have no errors or omissions in your abstract a "Submit" button will appear at the end of the proof. If the Error Box appears you must correct all errors before the abstract can be submitted. Once the errors have been resolved, the "Submit" button will appear at the bottom. If you exit the system without submitting the abstract, it will be logged in the system as a draft and will appear in the "Draft" section of your "View Submissions" page when you reenter the system. After you submit the abstract, you will receive a confirmation e-mail.

Special Notes
1) If authors wish to revise an abstract which has already been submitted, they must go to "View Submissions" and select "Return to Draft" to make any corrections. This removes the abstract from the organizers' view. Authors then need to submit the abstract again for it to be considered. An abstract cannot be returned to draft if it has been reviewed.
2) Once the abstract submission deadline passes, authors will no longer be able to submit new submissions or return previous submissions to draft for revisions. Be sure that all of your submission data—authors, keywords, title, and abstract file—are accurate before finalizing your submission as no modifications can be made to this data after the submission site closes.
3) The author designated as the presenter at step 4 will be the only person given access to upload the final manuscript for accepted submissions.

Authors having trouble submitting abstracts electronically should e-mail AIAA technical support at **ts.acsupport@thomson.com**. Questions about the manual abstract submission or full draft manuscript themselves should be referred to the appropriate Technical Chair.

The deadline for receipt of abstracts via electronic submission is **1 June 2011 2359 Eastern Time, USA**.

Abstracts should have a total length of 5–10 pages including figures and tables. Draft papers are encouraged. The extended abstract or draft paper should clearly describe the purpose and scope of the work to be included in the final manuscript, methods used, key results, and contributions to the state of the art. The submittal should include illustrations and data that support the results and contributions asserted.

Both abstracts and final manuscripts must address the accuracy of results adequately. Abstracts will be reviewed and selected based on technical content, originality, importance to the field, clarity of presentation, accuracy validation, and the potential to result in a quality final manuscript. Note that all abstracts are chosen by a competitive process based on anonymous peer review using these criteria. The review and acceptance process will be weighted in favor of authors submitting more relevant documentation of their proposed papers. The length of the final manuscript should be appropriate for a conference paper, not a major project, final report, or final thesis.

The abstract should not be submitted to more than one technical topic. If an author is unsure which topic is most appropriate, it is the author's responsibility to communicate with the technical topic organizers in question well before the abstract deadline to determine the topic area under which the abstract best fits. There will be too little time in the review process for an abstract rejected by one topic to be considered for review under another.

Questions pertaining to the abstract or technical topics should be referred to the corresponding technical topic chair.

Authors will be notified of paper acceptance or rejection on or about **19 August 2011**. Instructions for preparation of final manuscripts will be provided by AIAA for accepted papers only.

"No Paper, No Podium" and "No Podium, No Paper" Policies

There will be "No Paper, No Podium" and "No Podium, No Paper" policies in effect. 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. 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.

Final Manuscript Guidelines

An Author's Kit containing 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 Web site no later than **20 December 2011**.

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.

General Chair
Mark Lewis
AIAA President 2010–2011

Aerospace Sciences Meeting Chair
Frank Coton
University of Glasgow

New Horizons Forum Chair
Name
Organization

Aerospace Exposition Chair
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Organization

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.

Call for Papers Procedure

The contributed papers for this meeting are chosen by a competitive selection process based on peer review. In addition, invited papers of the highest quality review major trends and accomplishments within or across various aerospace disciplines. To facilitate simultaneous sessions, papers will begin on the hour and half-hour. Six to eight 30-minute paper presentations per session are planned (20 minutes for presentation and 10 minutes for audience questions and discussion), but session organizers are encouraged to include one-hour survey papers where appropriate.

Listed in this call for papers are the AIAA Technical Committees sponsoring this meeting, the areas in which papers are being solicited, and the names and addresses of the topic organizers to whom questions should be addressed. Every effort will be made to provide uniformly rigorous evaluations and acceptance rates for all sessions.

General inquiries concerning the program, conference format, or policies, and suggestions for special high-interest sessions or presentations should be directed to:

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E-mail: frank.coton@glasgow.ac.uk

Aeroacoustics

Papers are solicited that address computational, experimental, and analytical results and techniques in all areas related to aeroacoustics and structural acoustics. Specific areas of interest include, but are not limited to:

- Jet noise (subsonic and supersonic, flight effects)
- Shock-associated noise (jet screech, broadband shock noise)
- Jet noise suppression
- Cavity tones and their suppression
- Computational aeroacoustics
- Turbomachinery noise; core noise
- Combustion noise
- Propeller noise
- Fan noise
- Open rotor noise
- Rotorcraft noise
- Airframe noise
- Sound-structure coupling, sonic fatigue
- Duct acoustics
- Atmospheric sound propagation/sonic boom
- Statistical energy analysis methods
- Modal analysis and synthesis
- Community noise and metrics
- Interior noise
- Active noise control
- Vibration control techniques

Please direct questions to:

Daniel L. Sutliff, Ph.D.
NASA Glenn Research Center
Aeroacoustics Branch
Bld 54 Rm 207, MS 54-3
21000 Brookpark Road
Cleveland, OH 44135
216.433.6290 • 216.433.3918 FAX
E-mail: Daniel.L.Sutliff@nasa.gov

Aerodynamic Measurement Technology

Papers are solicited on topics related to advanced and novel aerodynamic measurement techniques for ground-test or flight-test applications. Submissions are encouraged for all types of flows, including all speeds from incompressible to hypersonic, all thermodynamic conditions including plasmas and combustion, all scales from microfluidics to geophysical flows, and all diagnostic techniques from surface sensors to laser-based imaging. Topics of interest include, but are not limited to:

- Flow velocimetry
- Spectroscopic methods including laser-induced fluorescence, absorption, Rayleigh, and Raman techniques
- Planar and volume flow visualization and temporally-resolved imaging
- Surface measurements including boundary-layer transition, skin friction, heat transfer, and surface temperature and pressure (including temperature- and pressure-sensitive paint techniques)
- Techniques for microfluidics
- Sensors based upon microelectromechanical systems (MEMS) and sensor miniaturization
- Techniques for acquiring multiple properties, property correlations, or space-time derivatives
- Aeroacoustic diagnostics, including microphone arrays or pressure/density measurements
- Measurement of species concentration or thermodynamic state
- Aerodynamic data acquisition, processing, and display
- Diagnostics for harsh environments such as gas turbine engines, fires, cryogenic, high-G, or in-flight applications
- Application to production-scale testing
- Uncertainty quantification and error analysis of advanced diagnostics
- Novel calibration and data processing methodologies

To be included in an Aerodynamic Measurement Technology session, papers should emphasize advancements or innovations in the measurement technique itself or its implementation, rather than the particular fluid dynamic problem to which the technique is applied.

Please direct questions to:

Steven Beresh
Sandia National Laboratories
P.O. Box 5800, Mailstop 0825
Albuquerque, NM 87185
Phone: 505.844.4618 • 505.284.3250 FAX
E-mail: sjberes@sandia.gov

Air Breathing Propulsion Systems Integration

Papers are sought that discuss the science and technology of optimizing air vehicle propulsion, air vehicle power systems, and air vehicle interface integration. Of high interest this year are papers concerning:

- Hypersonic engine-vehicle integration and combined-cycle engines
- Supersonic inlet aerodynamics and integration
- Inlet-fan integration for subsonic and supersonic aircraft
- Integrated energy management for improved system-level efficiency and reduced fuel burn

Other topics of interest for these sessions include, but are not limited to, the following:

- Alternative fuel cycle and subsystem design and integration
- Open rotors/unducted fans
- Sonic boom-mitigating inlets and nozzles for supersonic aircraft
- Propulsion systems engineering: propulsion architecture definition; requirements, schedule, cost, and risk; total system performance responsibility
- Installed performance and controls: steady-state, dynamic, MDO, and real-time models; integrated flight/propulsion control; hardware/software integration
- Propulsion aerodynamics (experimental, computational, and flight test): inlet/nozzle analysis, integration, installed performance; engine/inlet compatibility; application of flow control to inlets and nozzles; thrust vectoring; secondary air systems and bay ventilation; throttle-dependent drag and jet effects
- Power/thermal management: integrated propulsion/power/thermal architecture; power/fluid systems integration; thermal management systems
- Engine physical integration: performance-based specification development, interface control, and associate contractor/supplier management
- Propulsion operations: reliability and maintainability; field support; removal and installation; overhaul and maintenance; prognostics and health maintenance
- Flight certification: validation and verification; FAA compliance/regulations
- Environmental factors: corrosion, icing, noise, bird strike, safety zone, etc.

- Full range of systems: V/STOL, UAV, commercial/transport, missile, lighter-than-air, propeller-driven, and non-turbine (reciprocating/rotating) systems

Please direct questions to:

Vance Dippold, III
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21000 Brookpark Rd., M.S. 5-12
Cleveland, OH 44135
216.433.8365
E-mail: Vance.F.Dippold@nasa.gov

Aircraft Design

Papers are sought on all aspects of aircraft airframe and systems design. Topics such as design methodologies and processes, design integration, technology developments, innovative designs, and case studies are welcome. Review papers on recent developments and trends in aircraft design are also sought. Design considerations, such as environmental issues, energy optimization, noise reduction, electric aircraft systems, etc., are also important topics of interest. Applications to aircraft of all types are welcome, including fixed and rotary wing, subsonic through hypersonic, micro air vehicles to jumbo jets, and manned or unmanned aircraft. Papers on design education are also solicited. Example categories of interest include:

- Design processes and tools
- Design for cost
- Environmental issues (e.g., noise, emissions, fuel consumption)
- Innovative aircraft design/design case studies
- Unmanned aircraft design
- Aircraft design education

Please direct questions to:

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Auburn, AL 36849
334.844.6843
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Applied Aerodynamics

The Applied Aerodynamics Technical Committee is soliciting papers on topics related to aerodynamic design, vehicle aerodynamics, and aerodynamic phenomena to include, but not limited to:

- Unsteady aerodynamics
- Vortical/vortex flow
- High angle-of-attack and high lift aerodynamics
- Transonic, supersonic, and hypersonic aerodynamics
- Low-speed, low-Reynolds number aerodynamics
- Bio-inspired aerodynamics
- Unmanned aerial vehicle designs/tests
- Airfoil/wing/configuration aerodynamics
- Weapons carriage and store separation
- Innovative aerodynamic concepts and designs
- Aerodynamic design methodologies
- Optimization methods in applied aerodynamics
- Wind tunnel and flight testing aerodynamics
- Ground-to-flight scaling methodology and wind tunnel correlations
- Active flow control
- Missile/projectile/guided-munition aerodynamics
- Aerodynamic-structural dynamics interaction
- Applied CFD with correlation to experimental data
- Propeller/rotorcraft/wind turbine aerodynamics
- VSTOL/STOL aerodynamics
- Icing or roughness effects on vehicle aerodynamics
- Sports-related aerodynamics
- Aerodynamic design and enabling technologies for environmentally friendly and efficient aircraft
- Special Session: Aerodynamics of supersonic inlets
- Special Session: Aerodynamics, aeronautics, and CFD in the undergraduate curriculum
- Special Session: Frequency domain/harmonic balance methods for rotorcraft flows
- Other topics in applied aerodynamics

A special session cosponsored by the Propulsion Integration TC will be held, entitled "Aerodynamics of Supersonic Inlets." This session will address the aerodynamic challenges of supersonic engine inlet design, where flow control is essential for success. A selection of invited presentations will provide a historical perspective of inlet research and an overview of the current status of inlet flow control research. Papers are sought that address fundamental research of supersonic inlet flowfields and associated three-dimensional shock/boundary-layer interactions as well as studies reporting on relevant flow control methods or inlet aerodynamic design and performance.

A second special session, entitled "Aerodynamics, Aeronautics and CFD in the Undergraduate Curriculum," is also being planned as a joint session with the Fluid Dynamics TC. Presentations and/or papers are solicited that address application of modern engineering education practice to Introduction to Aero/Flight, Aerodynamics, and CFD instruction in the undergraduate aerospace engineering curriculum. The goal is to provide a forum for an open exchange of ideas and ultimately to create a "Best Practice" document and make it available to the aerospace engineering education establishment as a whole.

A third special session, titled "Frequency Domain/Harmonic Balance Methods for Rotorcraft Flows," is also being planned. The goal of the session is to provide a forum to heighten the interest and accelerate the advancement of these methods for helicopter rotors.

Authors should indicate under which of the above topics they prefer their paper to be included. Please direct questions to:

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E-mail: siva.nadarajah@mcgill.ca

Atmospheric and Space Environments

Papers are sought that provide the aerospace community (ground operations, aviation, rockets, launch vehicles, and spacecraft) with scientific and technical information concerning interactions between aerospace systems and the atmospheric/space/planetary environment. In addition, new or refined information improving the basic understanding of the atmosphere, space, or their applications to aviation and aerospace vehicle design and operations issues is solicited. Atmospheric and Space Environments includes the areas of:

- Atmospheric environment
- Impacts of aerospace on the environment
- Aircraft wake vortex science, applications, and technology
- Aviation weather and atmospheric dynamics
- Meteorological applications to aerospace operations
- Satellite and ground-based measurement systems
- Environment standards

- Meteoroid and debris environment
- On-orbit spacecraft-environment interactions
- Space environment

Potential ASE contributors are reminded that these and additional topic areas, such as aircraft icing, will also be represented at the 4th Atmospheric and Space Environments Conference, planned for June 2012.

Please direct questions to:

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E-mail: Nelson.W.Green@jpl.nasa.gov

Atmospheric Flight Mechanics

Papers are solicited that present new theoretical, computational, or experimental results in atmospheric flight mechanics. Topics of interest include recent simulation and flight test evaluation of a variety of vehicle configurations, including X-vehicles, unmanned aerial vehicles, and missiles. Papers covering advanced technologies to meet challenging atmospheric flight problems during ascent/abort and reentry flight phases of launch vehicles are also welcome. Interesting and novel flight mechanics problems or lessons learned during the development and testing of these vehicles would be of particular interest as well. Specific areas of relevancy include, but are not limited to, the following.

Aerodynamic Prediction Methods: This technology area covers the prediction of aerodynamic forces and moments acting on all types of atmospheric flight vehicles. Of particular interest is the integration of a variety of methods such as computational aerodynamics, advanced dynamic testing techniques, and unique flow-field measurement methods into unified approaches for the prediction of aerodynamic loads. Also of interest is flight simulation in subsonic, transonic, supersonic, and hypersonic flight environments, at steady and unsteady conditions, and at low and high angles of attack.

Aircraft Flight Dynamics, Handling Qualities, and Performance: This topic area includes aircraft stability, control response, handling qualities, and response to atmospheric disturbances. Subtopics of interest include determination of stability and control derivatives, manned and unmanned vehicle handling qualities, high-angle-of-attack control, nonlinear modeling, rotorcraft handling qualities with and without slung loads, trajectory optimization, effects of icing and turbulence on flight dynamics and control, aeroelastic and aeroservoelastic dynamics, flow-field effects, departure prevention, and spin characteristics.

Launch Vehicle, Missile, and Projectile Flight Dynamics: This area pertains to the application of analytical or experimental methods for the analysis and prediction of the flight dynamics of expendable and reusable launch vehicles, missiles, and projectiles. The advanced technology areas include performance, stability, and control; adaptive guidance, control reallocation, and re-configurable flight control methods during ascent/abort and reentry phases of the mission to improve safety and operability of second-generation reusable launch vehicles. Topics of interest include high-angle-of-attack aerodynamics, determination of dynamic stability derivatives, component and store-to-store interference effects, projectile launch and flight dynamics, incorporation of predictions into trajectory simulations, trajectory flight dynamics affecting the impact accuracy of missiles and projectiles, and analysis of flight test data.

Small/Mini/Micro Aerial Vehicles: Currently, there is great interest in very small flight vehicles for a variety of purposes. Such small vehicles pose many new challenges for the design engineer. Low flight speeds, hovering flight, light-weight-low-inertia vehicles, and unconventional designs all present challenges for development. Papers are therefore requested relating to the unique flight mechanics and handling qualities of small/mini/micro aerial vehicles. Topics include low Reynolds number aerodynamic prediction methods, flight mechanics for low-inertia vehicles, effects of flexible vehicle structures, very low speed flight mechanics, and transition between forward and hovering flight. Additionally, topics relating to the flight mechanics of unconventional small/mini/ micro flight vehicles (e.g., ornithopters, flapping wing vehicles, rotorcraft, etc.) are welcome.

Planetary Entry and Aeroassist Technology: Papers are requested relating to the entry dynamics into the Earth's atmosphere as well as the atmosphere of other celestial bodies. Topics include hypersonic flight performance, optimization of reentry vehicle configurations, trajectory optimization, and trans-atmospheric vehicles. Papers are also requested in the area of aerogravity assist orbit transfer dynamics. Topics include planetary aero-braking and aerocapture, low-density atmospheric flight mechanics, and atmospheric maneuvering to effect orbital transfer. Papers in other areas related to very high speed reentry atmospheric flight mechanics are also welcome.

Please direct questions to:

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Computer Systems

Abstracts are solicited on in a wide range of topics in aerospace-related applications of computer systems. Areas of interest include different aspects of high-performance computing and computational simulation, visualization and graphics, performance benchmarking, parallel algorithm and optimization on multicore, distributed, network, and cloud architectures. HPC grand challenge problems in aerospace areas are of particular interest. Abstracts are also solicited in system and network architectures, embedded systems, real-time systems, mission critical systems, digital avionics, and aerospace-related information systems. Authors are also encouraged to submit their manuscripts, either before or after the meeting, to the *Journal of Aerospace Computing, Information, and Communication* for possible publication.

Please direct questions to:

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Design Engineering

Papers are solicited on current design engineering and design process activities. Design-oriented papers should focus on innovative, novel, or otherwise distinctive designs or concepts resulting in or leading toward products that effectively satisfy requirements or demonstrate design efficiency improvements. Emphasis on current aerospace programs such as commercial access to space, very light business jets, NASA Environmentally Responsible Aviation, ESTOL, satellites, missile systems, Unmanned Air Systems, and service life extension projects are encouraged. The definition, application, and implementation of emerging design tools that have resulted in significant design-cycle time reduction from tool integration, and the use of experi-

ments, simulation, or rapid synthesis and analysis tools that have resulted in the ability to analyze a large number of design configurations resulting in or leading toward reduced program cost and risk should be emphasized.

Process-oriented papers should focus on current design engineering process activities, such as process definition, analysis, architecture, and metrics, as applied to aerospace hardware products from the exploratory design phase through the detailed design phase. Papers on the advances in model-based design processes and related activities are especially encouraged. Other design engineering process-related activities that may be addressed are the interaction between processes and tools, impact of tool integration on a process, and risk reduction from the use of higher-fidelity tools earlier in the design process. Other enablers to reducing design cycle time and cost, while increasing the ability to meet all cost, schedule, and technical requirements, may also be addressed.

Education-oriented papers are solicited that emphasize design in curriculum development, class content, and student activities. Examples showing how to teach design are especially requested.

Please direct questions to:

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Raytheon Missile Systems
Tucson, AZ 85734-1337
520.545.9550
E-mail: eralthof@raytheon.com

Education

Aerospace engineering is both the most specialized and the most diversified of fields, thus challenging the aerospace community to educate engineering students effectively to meet a dynamic environment. As the complexity of our field continues to increase, the multidisciplinary aspects of the aerospace curriculum must be strengthened while maintaining or improving the more traditional fundamentals of engineering science. For this year's meeting, papers are especially encouraged that address these issues, including but not limited to:

- New, more effective pedagogies for improving understanding of the fundamentals of engineering science and subdisciplines such as aerodynamics and propulsion
- Curricular development addressing the multidisciplinary nature of aerospace system analysis and design
- Novel teaching approaches that incorporate nontraditional methods
- Best practices for ABET assessment
- Broader innovative collaboration of industry and academia in engineering education

Topics for papers and/or open forums are:

- Innovations on the horizon—new directions in research and development by industry and educational institutions
- Translating the effects of globalization and green engineering practices from industry to the classroom

- Better preparing graduates for a rapidly evolving work environment

Please direct questions to:

Dolores S. Krausche
Florida Center for Engineering Education
P.O. Box 271
Gainesville, FL 32602
352.378.1304
E-mail: dsk@atlantic.net

Energetic Components and Systems

The science of energetic materials is critical to the aerospace community. Energetic components, both explosive and pyrotechnic, provide critical performance attributes to aeronautical and astronautical missions. The successful engineering and application of the controlled use of energetic materials in these components is a result of fundamental understanding of scientific phenomena that govern the performance of these materials. Papers relating to the science of energetic materials and devices are sought for sessions at ASM 2012. Paper topics are solicited in the following, non-inclusive list of areas:

- Energetic materials synthesis/characterization
- Energetic materials compatibility/aging/surveillance
- Analytical method development for analysis of energetic materials
- Testing and diagnostics of energetic materials events
- Numerical simulation of energetic materials/components
- Nano-scale phenomena of energetic material performance
- Environmental initiatives relating to energetic materials and components
- Practical applications and novel uses of energetic materials

Please direct questions to:

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Fluid Dynamics

Papers are solicited in the areas of experimental, theoretical, and computational fluid dynamics relevant to aerospace applications, including basic research and development, applied research, and advanced technology development. Papers that present new insights into flow physics, introduce innovative applications, address emerging technical areas, or combine experimental, computational, and/or theoretical approaches are strongly encouraged. Authors who have recognized expertise in a particular area and are interested in writing a comprehensive review are encouraged to contact the track chair. Potential subject areas include, but are not limited to:

- Transition, including low- and high-speed flows, roughness effects and control methods
- Turbulence, including free-shear and wall-bounded flows
- Shock-dominated flows, including shock boundary-layer interactions
- Hypersonic and chemically-reacting flows
- Aerodynamics of low Reynolds number flows, including biologically-inspired flight, maneuvering and flow over flexible and deformable surfaces
- Fluid-dynamic aspects of aeroacoustic applications
- Turbomachinery, combustion and internal flows
- Flow control, including active, passive, and closed-loop flow control as well as flow control actuators
- Innovative flow measurement technologies and combined experimental-computational studies, including uncertainty quantification
- Higher-order unstructured CFD algorithm development, methodology, and validation
- Structured CFD algorithm development, methodology, and validation
- CFD applications, including case studies, modeling, optimization, and uncertainty quantification
- Cross-disciplinary fluid dynamics involving aero-optics, fluid/structure interactions, micro- and nano-fluidics, multi-material flows, and multiphase flows
- Extension of aerospace-related fluid dynamics concepts, tools, and processes to non-aerospace fields (e.g., automotive, biological, materials processing, and electronics cooling)
- Other areas of fluid dynamics

In addition, special sessions are planned in the following areas of emerging interest:

- Turbulence in high-speed flows
- Three-dimensional flow separation
- Wind turbine aerodynamics: Overcoming modeling and deployment barriers
- Aerodynamics, aeronautics, and CFD in the undergraduate curriculum

Authors should indicate under which of the above topics they prefer their paper to be included. Please direct questions to:

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E-mail: ktc@illinois.edu

Gas Turbine Engines

Papers are solicited in the disciplines of thermodynamics, aerodynamics, aeroelasticity, mechanical design and fabrication, combustion, heat transfer, icing, and controls as related to the science, research, technology development, and testing of gas turbine engines and related components for air vehicles in the subsonic and transonic flight regimes. Topics areas include but are not limited to the following:

- Experimental and computational efforts related to inlets, fans, compressors, combustors, turbines, augmentors, transmissions, bearings, seals, and nozzles
- Techniques for the advancement of engine component technologies, including design and manufacturing methods, materials, testing, diagnostics, and instrumentation
- Improved analytical/computational methodologies for fluid, thermal, and structural analysis of engine components
- Analytical and computational models for engine-level analysis/simulation
- Advances in turbine engine systems and components
- Advanced engine cycles and game-changing component technologies
- Engine preliminary and detailed design methodologies
- Variable cycle engines
- Turbomachinery noise
- Engine icing
- Electric power generation

- Comparisons of engine flight test with ground test data and simulation results
- Auxiliary systems and structures, and their interaction with the primary engine system
- Open rotor
- "Green"/environmentally friendly aviation
- Engine inlet compatibility
- Geared turbofan engines

Please direct questions to:

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Ground Testing

Ground Testing papers are solicited on unclassified topics related to all aspects of aerodynamics, propulsion, and space systems ground testing and related facilities. Topics of interest include, but are not limited to:

- Test simulations for all aerodynamic flow regimes, propulsion (including propellant conditioning), and space environments
- Design, development, and performance of new, modified, or unique ground test facilities, subsystems, and components thereof
- Advances in test techniques, experimental uncertainty, and integration of computation with experiment, for reduced risk in predicted flight characteristics
- Emerging requirements for aerospace ground testing that exceed current capabilities
- Issues focused on computational fluid dynamic comparisons with wind tunnel and flight test data, including code development, validation, and verification
- Integration and use of computing equipment for real-time test control, data acquisition, processing, validation, and presentation
- Development, application, and validation of flow diagnostics in ground testing facilities, with special emphasis on pressure sensitive paints, temperature sensitive paints, video model deformation, infrared imaging, and optical diagnostics
- All aspects of increasing "knowledge per test," including new test techniques, instrumentation, automation, design of experiments, and experimental uncertainty
- Unique or innovative uses of existing facilities
- Improvements in the quality of wind tunnel testing and reduction of the cost and cycle times for these tests, with emphasis on test article design, fabrication, and usage; testing productivity; and test program management
- Ground and flight test integration
- Expert systems, artificial intelligence, and neural networks related to ground test issues
- Knowledge capture for ground test related facilities, systems, and techniques
- Development of educational and continuing education/career path opportunities in experimental testing for new students, technicians, and engineers

In addition, timely surveys and reviews of these topics are sought. The Ground Test Technical Committee will also conduct a program to recognize "Outstanding Papers" presented in the Ground Test sessions. Please direct questions to:

Sheri Smith-Brito
The Boeing Company
206.769.4473
E-mail: sheri.l.smith-brito@boeing.com

High Speed Air Breathing Propulsion

Papers are solicited that address the design, analysis, testing, and evaluation of technologies and systems that enable supersonic and hypersonic air vehicle propulsion. Topic areas include, but are not limited to:

- Advances in propulsion systems including ramjets, scramjets, pulse detonation engines, and combined cycles (including rocket and turbine based)
- Experimental and/or numerical results pertaining to high-speed inlets, isolators, combustors, injectors, nozzles, and integrated flowpaths
- Instrumentation and diagnostics techniques
- Engine component materials and manufacturing
- Analytical/computational methods involving fluid, thermal, structural, or multidisciplinary analysis
- Comparison of numerical simulation with flight or ground engine test data

Papers on other topics related to high speed air breathing propulsion technologies and systems are also invited. Please direct questions to:

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911 Oval Drive-3268 EBIII.
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History

In 2012, we celebrate the 100th anniversary of Marine Corps Aviation, the first American west-to-east cross country flight, and French Naval Aviation, as well as the 50th anniversary of the first manned American spacecraft to orbit the Earth, the first flight of the Boeing 727, and the first successful planetary flyby (Mariner 2–Venus). This year's history sessions will remind us of the early accomplishments of AIAA, its members, and the industry. Papers are sought covering significant advancements of flight, both in air and in space. All papers on the history of aeronautics and space flight will be considered.

Please direct questions to:

Kevin Burns
CSC
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619.225.2568
E-mail: kburns8@csc.com

Homeland Security

Homeland security depends critically on a number of research areas, encompassing the full range of AIAA technical com-

mittees and beyond. We strongly encourage submission of abstracts for the relevant sessions, including examples such as:

- Fluid dynamics and multi-phase flow relating to atmospheric dynamics, climate, oceans, and water supplies
- Unmanned sensor platforms
- Space assets and capabilities/limitations
- Sensors and intelligent systems
- Manned assets/operations
- C2I, communications, and interoperability
- Human factors and dynamics
- Biometrics
- Economic and legal considerations/impact
- Air traffic and operations
- Energy, lasers, directed energy, and non-lethal counter-asset/counter-personnel technologies
- Modeling/simulation in any pertinent areas

The above list is simply to suggest possibilities. All papers relating to homeland security will be considered. Please direct questions to:

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775.849.2157 • 775.849.3701 FAX
E-mail: jsomers@orgstrategies.com

Intelligent Systems

Papers are sought that illustrate the relevance of Intelligent System (IS) technologies to aerospace sciences. Topics of interest include, but are not limited to:

- Autonomous systems
- Data fusion and reasoning
- Evolutionary (genetic) algorithms
- Expert systems
- Fuzzy logic
- Human–machine interaction
- Intelligent and adaptive control
- Intelligent data/image processing
- Knowledge-based systems and knowledge engineering
- Machine learning techniques
- Model-based reasoning
- Neural networks
- Planning and scheduling algorithms
- Qualitative simulation

Please direct questions to:

Chris Tschan
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719.375.6324
E-mail: chris.tschan@aero.org

Kevin Kochersberger
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Meshing, Visualization, and Computational Environments

The Meshing, Visualization, and Computational Environments TC solicits papers describing tools and techniques that facilitate simulation of real-world problems in all areas of computational field simulation, including computational fluid dynamics (CFD), computational aeroacoustics (CAA), computational solid mechanics (CSM), and computational electromagnetics (CEM). Although not limited to these topics, papers that describe advanced techniques and extreme applications in the following areas are particularly encouraged:

- A priori and a posteriori grid quality metrics related to solution accuracy involving real-world configurations such as the Drag Prediction Workshop, Shock Wave Boundary Layer Interaction Workshop, High Lift Prediction Workshop, and large-eddy simulation
- Collaborative environments, including user interfaces, Internet technology, virtual reality, and linkages to design optimization and advanced engineering environments
- Post processing, including multidimensional and transient visualization of very large data sets, feature detection, knowledge capture, and engineering animation
- Geometry modeling for meshing and simulation, including CAD-CAE interoperability
- Meshing techniques, including surface and volume grids, grid adaptation, overset grid techniques, and moving/deforming meshes
- Applied meshing for real-world engineering applications

Authors are encouraged to submit their manuscripts, either before or after the meeting, to the *Journal of Aerospace Computing, Information, and Communication* for possible publication. Please direct questions to:

Eric Blades
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Multidisciplinary Design Optimization

Multidisciplinary Design Optimization (MDO) is a computational technology for the discovery and exploitation of interactions among disparate disciplines to improve performance, lower cost, and shorten the product/system design cycle through the application of optimization algorithms. The influence of MDO reaches diverse phases of a product or system life, including manufacturability, operability, and serviceability.

We seek papers discussing applications of MDO methods toward a wide variety aerospace engineering design problems. Additionally, we seek papers discussing: 1) the development of MDO frameworks (including framework elements such as environments, visualization techniques and interfaces to CAD); 2) the development of general purpose MDO principles (including strategies to decompose design problems and modeling and simulation strategies); 3) the development of general purpose MDO algorithms (including uncertainty quantification and robust design); and 4) shape and topology optimization challenges both abstract and applied. Papers incorporating more than one discipline or technology should explain the nature and benefit of interdisciplinary synergies at the system level. Papers limited to single discipline optimization should emphasize aspects of the optimization process such as sensitivity analysis, approximation, or visualization. MDO applications of interest address aeronautical and mechanical systems that may incorporate any number of enabling technologies.

Core topics of interest include:

- Multidisciplinary analysis and optimization methods and applications

- Computational design frameworks
- Modeling and simulation methods
- Uncertainty quantification and nondeterministic design optimization
- Shape and topology optimization

Please direct questions to:

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Plasmadynamics and Lasers

Papers describing basic and/or applied research and development results in the areas of plasmadynamics and lasers and related topics are solicited. Efforts combining contemporary theoretical/computational analyses with experimental verification/validation and that represent notable advancements in the aerospace sciences are especially encouraged. Special consideration will be given to works reporting milestone R&D and/or engineering achievements related to aerospace system application of plasma and laser technologies. Survey papers on the current state of the art and historical perspectives are also desired. Specific topics of interest include, but are not limited to:

- Plasma and laser physics: Including fundamental processes, laboratory plasma generation and characterization, experimental research or methods, plasma chemistry and kinetics, non-equilibrium reacting flows, properties, and advances in theory and/or computational simulation methods
- Space plasma physics and applications: Including spacecraft-plasma interactions, space laser applications, and space experiments
- Laser devices and systems: Including the physics, engineering, and application of high-energy lasers, chemical lasers, electric lasers, laser material interaction, laser optics, and fluid-optic interactions
- Highly energetic plasma systems: Including the physics, engineering, and application of high-power gas discharge and plasma generation devices, arc-heater technology, explosively generated plasma applications, compact pulse power, and high temperature systems and environments
- Magnetohydrodynamics (MHD): Including MHD power generation and propulsion technologies, terrestrial and aerospace systems applications, combustion plasma methods, innovative non-equilibrium plasma techniques, nuclear MHD systems, electromagnetic-fluid interaction and characterization, fundamental processes, and theoretical and/or computational simulation methods
- Plasma and laser propulsion: Including innovative and efficient plasma formation and acceleration approaches, high power thruster concepts, electrode erosion issues, electrodeless discharge mechanisms, modeling of fundamental processes, experimental performance characterization, and beamed energy propulsion
- Plasma materials processing and environmental applications: Including exhaust gas treatment, remediation, and hazardous materials disposal
- Advanced diagnostics: Including the development and utilization of laser-based diagnostics, flow field characterization methods, and plasma diagnostics
- Weakly ionized plasma physics and aerospace applications: Including plasma actuators for aerodynamic flow control
- Fluid-optics interactions: Including the propagation of laser beams through the atmosphere and the effects of aerodynamics on the transmission of laser beams
- Fusion energy science: Including emerging confinement concepts for terrestrial or in-space power or propulsion, experimental programs, enabling technologies, instrumentation and diagnostic development, computational or theoretical modeling, and mission analysis.

Papers concerning dual-use technologies that address non-aerospace issues of major public concern, such as energy, environment, and medicine are strongly encouraged. Suggestions for invited papers and joint sessions are also welcome.

Students are strongly encouraged to present papers on their research at this meeting. There will be a student paper competition for those papers where the student is the primary author. Papers submitted and accepted for the PDL session, whose principal author is a student and which are delivered by that student will be considered for a “Best Student Paper Award.” Please identify the principal author as a student (graduate or undergraduate student) at the time the abstract is submitted.

Comprehensive abstracts of several pages that state the purpose and scope of the work, methods used, and relevant contributions including figures and preliminary results are recommended for accurate evaluation. Please direct questions to:

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Propellants and Combustion

Papers are sought from all areas of propellants and combustion relevant to aerospace sciences, technologies, and applications. New developments, as well as review papers, are of interest. Potential topics include the following:

- Rocket and air-breathing combustion: design and analysis issues for practical combustors such as rockets, gas turbines, turbojets, ramjets, and other hybrid engines; related topics of interest include combustion instabilities, thermo-acoustic interactions, active and passive combustion control, plume characteristics, fuel flexibility, and other fundamental combustion processes related to conventional propulsion systems
- Detonations, explosions, and supersonic combustion: fundamental research in detonation and supersonic combustion as well as combustion dynamics involving scramjets, pulse detonation engines, oblique detonation engines, ram accelerators, and other unconventional propulsion systems
- Spray and droplet combustion: liquid-jet break-up processes, atomization, vaporization, mixing, and their impact on spray flame characteristics as well as droplet combustion, supercritical combustion, and other related topics
- Combustion chemistry: development and application of reduced kinetic mechanisms, surrogate fuels, NOx and SOx chemistry, soot formation and oxidation, flow-chemistry interaction, and other related physical and chemical processes affecting reaction kinetics
- Micro-combustion and micro-propulsion: micro-scale combustion for power generation, micro-IC engines, micro-propulsion engines, and micro-thrusters
- Combustion diagnostics: development and application of advanced diagnostic or sensing techniques for understanding and controlling the combustion phenomena.

- Heterogeneous combustion and propellants: fundamental aspects of combustion of solid fuels, propellants, and fuel additives, as well as propellant synthesis and related topics
- Turbulent combustion: fundamental aspects of turbulent reacting flows and combustion dynamics involving premixed, partially-premixed, and non-premixed turbulent flames linked to rockets, air-breathing combustors, etc.
- Laminar flames: fundamental aspects of laminar flame behavior along with their ignition, extinction, stabilization, instabilities, and interactions with laminar flow processes
- Advanced combustion concepts, fuel technology, and environmental impact: fundamental aspects of flameless combustion, alternative fuels, bio-fuels, hydrogen technologies, and other combustion-related environmental technologies as well as papers on associated environmental impact
- Other topics in combustion and propellant research, such as fire research, high-energy fuels, endothermic fuels, novel propellants, and in situ propellant production for planetary missions

Please direct questions to:

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Sensor Systems Technology

Papers are solicited on topics related to sensor systems technologies for airborne, space-based, and ground-based applications. Topics of particular interest include:

- Sensors, sensing systems, and sensing technologies utilized for acquisition and interpretation of remote sensing data
- Detection and evaluation of physical parameters and fields associated with terrestrial, oceanographic, atmospheric, or extraterrestrial phenomena and effects
- Detection and evaluation of environmental parameters associated with aerospace vehicles, their parts and components, as well as with the media in which they operate
- Detection, recognition, tracking, and remote control of airborne objects
- Measurement and evaluation of the environmental impact of airborne vehicles
- In-flight measurement and definition of aerospace vehicle airflow parameters
- In-flight measurements for evaluation and improvement of vehicle performance
- In-flight vehicle health monitoring
- In-flight vehicle control
- Airborne applications of measurement techniques used at ground test facilities
- Measurement and acquisition of inertial sensing data
- Novel applications of advanced MEMS devices as primary sensors in the sensor systems defined above and in other related technology areas

Please direct questions to:

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Society and Aerospace Technology

The Society and Aerospace Technology Technical Committee examines societal benefits of aerospace technologies as well as the relationship between aerospace and society, culture, and the arts. Abstracts are solicited that address these and related issues. Areas of interest include, but are not limited to:

- Aerospace and terrorism
- Aerospace and public safety
- Astrosociology
- Benefits and examples of aerospace technology spin-offs
- Utilization of aerospace assets to address social problems
- Space medicine and medical astrosociology
- Group dynamics and societal institutions in isolated communities (space settlements, Antarctica, etc.)
- Discussion of aerospace topics and programs from the perspective of disciplines such as psychology, social psychology, sociology, and anthropology

Please direct questions to:

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R. J. Kohl & Associates
Jefferson, MD
301.874.3509
E-mail: rjkohl@prodigy.net

Software Systems

Abstracts are solicited on a wide range of topics in aerospace-related applications of software engineering and software systems. Areas of interest include, but are not limited to:

- COTS and open-source software
- Knowledge management and collaborative software
- Autogeneration of software
- Software agents
- Requirements
- Validation and verification
- Testing
- Software education and training
- Real-time software
- Parallel computing software issues
- Object-oriented programming
- Safety-, mission-, or security-critical software
- Formal methods
- Software standards and certification
- Plug-and-play software

Authors are encouraged to submit their manuscripts, either before or after the meeting, to the *Journal of Aerospace Computing, Information, and Communication* for possible publication. Please direct questions to:

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Space Exploration and Colonization

The Vision for Space Exploration encompasses robust robotic and human exploration missions beyond low Earth orbit leading to a robust civil space program and the eventual development of space settlements on the moon and Mars. The goals of exploring space include learning about our past, improving life on Earth, and shaping our future through discovery, scientific scrutiny, and sound judgment, planning, and management. The Apollo era was shaped by the space race and was widely popular and

successful. The present environment presents unique challenges for the space program to be relevant and to captivate the next generation. Experience in space has shown that operations outside Earth's atmosphere and on the surfaces of extraterrestrial moons, planets, and asteroids frequently encounter serious and unique challenges. These challenges include the effects of radiation and microgravity on materials and humans, electrical charging and arcing, pervasiveness of abrasive lunar dust, effects of hard vacuum, atomic oxygen, and rarefied gases, and significant thermal loads. New exploration strategies and technologies must be developed to address these challenges and support mission logistics for human and robotic exploration, power generation, and resource utilization. The yearning of people to travel into space, even in short sub-orbital flights, is an important first step toward future space colonization by humans. Space tourism represents an important commercial aspect of this endeavor as we mature the technologies, achieve measurable successes, and develop the strong advocacy needed to enable us to move permanently to new residences elsewhere in the solar system, hopefully within this century. Papers are invited that address the following specific topics within the broad portfolio of Space Exploration and Colonization. Submissions should contain sufficient detail for the program committee to evaluate the technical content of the final presentation and paper. Topics include:

- Value proposition for space exploration and colonization
- Space, lunar, and planetary environmental challenges
- Applied space research tailored to present and future problems
- Space exploration strategies and mission logistics
- Space transportation and lander vehicle/architecture design
- Design concepts for surface mobility, power, and space colonies
- Design concepts for space tourism/adventure
- Lunar, planetary, and asteroid commercialization
- Legal issues including sovereignty and land rights

Please direct questions to:

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Space Operations and Support

The AIAA Space Operations and Support Technical Committee (SOSTC) is soliciting papers in all areas of space operations and ground support. Topics include, but are not limited to, original space operations research and reports in the areas of new technology, technology trends, operations procedures, standards and practices. Areas of interest include:

- Human factors
- Space policy and law factors
- Human and robotic space exploration operations
- Space operations tools and technologies
- Space operations policies
- Ground support in space operations
- Public safety for launch and reentry planning and operations
- Commercial space operations
- Error reduction (command file error reduction, process improvement, etc.)

Please direct questions to:

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Systems Engineering

Papers in all areas of systems engineering (SE) are encouraged. All types of papers will be considered, including case studies, developmental work and technical analysis. Topics include but are not limited to systems engineering applications, integrated disciplines and technology, future trends and predictions in systems engineering, systems engineering education and research, and systems engineering life-cycle processes and systems effectiveness.

Please direct questions to:

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714.349.6810
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Terrestrial Energy Applications of Aerospace Technology

The Terrestrial Energy Systems Technical Committee is sponsoring sessions on the use of aerospace technology in ground-power systems. Papers are solicited on development and application of technology common to the aerospace and terrestrial energy communities. Experimental, computational, and theoretical papers dealing with fundamental and applied energy conversion technologies will be considered for presentation. Topics include, but are not limited to:

- Combustion modeling and measurements
- Alternative fuels, bio-fuels, and their blends with JP fuels
- Active and passive combustion control
- Nano-energetic materials
- Clean and high energy density fuels
- Unwanted combustion, fires and explosions, control of liquid and gaseous environmental pollution
- Energy-power system efficiency and economics
- Micro-scale combustion and power generation
- Waste minimization and treatment including materials recovery and thermal destruction of solid and liquid waste
- Alternative energy sources, such as solar, wind, fuel cells, batteries, heat pumps, thermionic and thermoelectric devices
- CO2 issues for land-based systems
- Green energy, and global energy and environmental issues

Please direct questions to:

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Thermophysics

The Thermophysics Technical Committee solicits abstracts of proposed papers on topics in thermophysics and heat transfer. Papers are solicited on topics related to all aspects of thermal energy transfer and aerospace applications therein. Contributions based on analytical, numerical, and/or experimental studies are welcomed. Scientific and technical contributions are emphasized, rather than status reports on work in progress. Areas of specific interest include, but are not limited to:

- Aircraft/spacecraft thermal management
- Ablation
- Aerothermodynamics
- Cryogenics and cryogenic systems
- Direct simulation Monte Carlo methods
- Electronic and microelectronic avionics cooling
- Electronic thermal management
- Heat pipes, loop heat pipes, and innovative heat pipe designs
- Heat exchangers
- Heat transfer: Computational, conduction, convection (free and forced), phase change, and radiation
- Heat transfer and cooling in turbomachinery
- High-speed flows
- Historical perspectives in thermophysics research
- Hypersonic and low-density facilities
- Microgravity effects on high power two-phase thermal management systems
- Microgravity testing for aerospace applications
- Micro-scale heat transfer and micro-fluidics
- Missiles thermal management
- Non-equilibrium flows
- Non-equilibrium radiation
- Non-intrusive diagnostics
- Particle-laden flow modeling and measurement
- Rocket plumes
- Propulsion
- Power systems
- Radiation analyses (surface properties)
- Radiators and heat rejection systems
- Spacecraft contamination
- Space environmental effects
- Spacecraft thermal management and modular spacecraft
- Surface catalysis
- Thermal contact conductance
- Thermal control
- Thermal protection systems
- Thermophysical properties

Emerging Topics:

- Advanced thermoelectrics
- Integrated and multidisciplinary modeling and simulation
- Minimization of entropy production
- Nano-scale heat transfer and nano-fluidics
- MEMS and nanotechnologies
- Multiphase flows and heat transfer continuum methods for transition-to-rarefied flows
- Plasma actuated heat transfer
- Wireless thermal measurements

Authors are requested to address a single subject area from the above list. Each year, the Thermophysics Technical Committee has offered a best paper award for both the professional and student categories (with the student receiving a monetary award). Student submissions are strongly encouraged. Also, timely survey and review articles on the above topics are solicited. Authors are encouraged to submit their manuscripts, either before or after the meeting, to the *Journal of Thermophysics and Heat Transfer* for possible publication.

Please direct questions to:

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5th Symposium on Space Resource Utilization

The 5th Symposium on Space Resource Utilization is soliciting papers on research and development of processes, technologies, and hardware that demonstrate the utilization of space resources in support of human or robotic exploration and science missions to the moon, Mars, the moons of Mars, and near-Earth objects. Papers including analytical and hardware development results in the following areas are of particular interest:

- Production of mission critical consumables including oxygen, hydrogen, water, and propellants
- Acquisition and conditioning of planetary atmospheres in preparation for processing
- Physical processing of surface regolith, rocks, and dust including drilling, excavation, beneficiation, dust mitigation, and surface transportation
- Production of metals, glasses, ceramics, and plastics from natural resources and from recycled hardware and consumables

Additional areas of interest include:

- Concepts for making use of natural thermal gradients, radiation, particle fluxes, vacuum and pressure differentials, atmospheric gases, and other aspects of the space environment that reduce the mass launched from Earth to further exploration and science objectives
- Integration of ISRU systems with other surface systems including joint-use technologies such as electrolysis or cryogenic storage systems
- Utilization of in situ derived propellants to supply propellant depots in support of missions to various destinations (including mass and cost-benefit comparisons)

Where possible, papers should include performance of hardware or hardware concepts in the space environment at the component, sub-system, or system levels.

Please direct questions to:

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14th Weakly Ionized Gases Workshop

The 14th Weakly Ionized Gases (WIG) Workshop will be held concurrently with the 50th AIAA Aerospace Sciences Meeting. The workshop will consist of technical papers and invited presentations. Technical papers will be integrated into a series of 8 to 12 workshop sessions to be held throughout the week.

Papers are solicited on a broad range of topics related to the study of flight interactions with weakly ionized gases. Subject material for papers can range from basic R&D to applied and advanced technology. Papers regarding contemporary experiments, analytical and computational methods, new theory, results, test data, and conclusions are desired. Interdisciplinary

papers and those that combine theory and analysis with experimental validation, with results and conclusions that can be directly applied, are of special interest. Survey papers and those that are of an historical perspective are also sought.

Topics of interest include:

- Air/fuel plasma properties and interactions
- Internal and external plasma aerodynamics
- Non-equilibrium thermal and chemically reacting flows, including combustion
- Methods of on-board plasma generation
- Plasma-based drag reduction and flow control
- Shock attenuation in plasma flows
- Electromagnetic (EM) and magnetohydrodynamic (MHD) interactions and applications, including flow control and energy extraction
- Systems applications

Please direct questions to:

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26th Microgravity Symposium on Gravity-Related Phenomena in Space Exploration.

The 26th Symposium on Gravity-Related Phenomena in Space Exploration is being organized for January 2012 to investigate scientific and technological possibilities actively in gravity-dependent research and to support strategic research and technology enabling space exploration. As such, papers are solicited from academic, commercial, and governmental institutions in the following areas:

- Acceleration environment: measurements of microgravity, sensitivity of physical phenomena to acceleration environment including disturbances
- Biotechnology: bio-fluids, protein crystals
- Combustion science and chemically reacting flows: fundamental and applied research in flames, fire detection and suppression, heterogeneous combustion, micro-combustion systems, and reacting systems for in situ space resource utilization such as propellant production and life support systems
- Fluid physics and transport phenomena: fundamental and applied research related to biological systems, in-space propulsion, in situ space resource utilization, and space-based power and life support systems
- Materials science: fundamental and applied research in electronic materials, metals and alloys, ceramics, glasses, polymers, radiation shielding, advanced materials for propulsion systems, space manufacturing
- Special session: technological applications from research in reduced gravity, including examples from the scientific, commercial, and educational realms

Papers in related topics not cited are strongly encouraged. Papers describing space-flight hardware will be considered where specific innovations in functionality, performance, or hardware development processes are the focus.

Abstract submissions should be sufficiently detailed to survive competitive peer review for selection into the symposium. Summaries of the research or study activity, results, and applications should be highlighted, keeping background information to a minimum. Important references, graphs, or pictures may be included.

A Best Paper and Best Student Presentation will be selected by the Microgravity and Space Processes Technical Committee from among the participants in the Symposium.

Please direct questions to:

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30th ASME Wind Energy Symposium

Papers are solicited for a broad range of topics related to wind energy conversion, both land-based and offshore. Topics of interest include, but are not limited to:

- Acoustics
- Airfoil, blade, and wake aerodynamics
- Atmospheric physics and inflow
- Wind farm and turbine-wake interactions
- Offshore wind systems and environment
- Hybrid and off-grid systems
- Testing: Non-destructive testing, inspection and QA, field test results, laboratory testing techniques
- Controls: Energy capture enhancement, load attenuation, sensors and actuators, generator and power electronics
- Structural dynamics
- Reliability
- Fatigue and failure
- Innovative components and subsystems
- Materials and manufacturing processes
- Turbine design and development: Design loads and certification, site specific design and optimization
- Drivetrains
- Health monitoring
- Electrical systems and machines
- Utility and grid integration
- Radar interference

This conference will follow the abstract/manuscript submission and approval process used by the AIAA as outlined in this call for papers. Please direct questions to:

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Upcoming AIAA Professional Development Courses

8–9 January 2010
Free Conference Registration to the 49th AIAA Aerospace Sciences Meeting, in Orlando, Florida, when you sign up for this Course!
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Basic Measurement Uncertainty, Methods and Applications (Instructor: Ronald Dieck)

This course is intended for scientists and engineers interested in evaluating experimental accuracy. It is in complete harmony with national and international standards. Included are the basics of the measurement uncertainty model; statistical considerations; the concepts of systematic and random error sources; comparison of US and ISO approaches; use of correlation; uncertainty propagation; calibration errors and more.

After this two-day course, the students will be able to apply uncertainty analysis techniques to many basic experimental test problems in order to help achieve the test objectives more productively and at lower cost. This course assumes students have least BS degrees in engineering or science. Students need to bring calculators or laptops.

C++ in Aerospace Simulations—Hands-On Workshop (Instructor: Peter Zipfel)

This two-day workshop introduces engineers and programmers to object-oriented programming of aerospace vehicle simulations. C++ constructs like polymorphism, inheritance, and encapsulation will be applied, while a multi-object UAV simulation is being built. To provide hands-on experience, the course alternates between lectures and experiments. The instructor introduces C++ features together with modeling of aerodynamics, propulsion, and autopilot, while the trainee executes and modifies the simulation. All source code and plotting programs will be provided as well as the textbook *Modeling and Simulation of Aerospace Vehicles*, authored by the instructor. Participants should bring an IBM PC compatible laptop computer with Microsoft Visual C++ 2007 (free download from MS). As prerequisites, facility with C++ and familiarity with flight dynamics is desirable. This course highlights C++ architectures of aerospace simulations and culminates in a multi-object simulation of interacting UAVs, satellites and targets, which can serve as the basis for further development.

CFD for Combustion Modeling (Instructors: Suresh Menon and Heinz Pitsch)

The objective of the course is to provide the interested combustion engineer or researcher with the fundamentals of combustion modeling to assess a combustion problem and to decide on the adequate models to be used in numerical simulations. The course is designed to also provide the knowledge to implement certain models into CFD codes. The course starts with fundamentals of combustion chemistry and includes a hands-on introduction to a 0D/1D combustion code. This is followed by a brief introduction to statistical models and turbulence modeling. A comparative overview of the most commonly used combustion models will be given next. Implementation issues and application examples will be discussed. Special topics include combustion instabilities, combustion in aircraft engines, and high-speed combustion.

Modern Design of Experiments (Instructor: Richard DeLoach)

Aerospace researchers with considerable subject-matter expertise who have had relatively little formal training in the design of experiments are often unaware that research quality and productivity can be substantially improved through the design of an experiment. Reductions in cycle time by factors of two or more in real-world aerospace research programs, with quality improvements of that same order, have resulted from the application of fundamental experiment design techniques taught in this course. Examples drawn from specific studies will quantitatively illustrate resource savings, quality improvements, and enhanced insights that well-designed experiments have delivered in various university, government, and industry aerospace programs. Computer software CDs included with the course (Design Expert) will be demonstrated.

Perturbation Methods in Science and Engineering (Instructor: Joe Majdalani)

Perturbation Methods in Science and Engineering is a must for all engineers and scientists aspiring to develop theoretical solutions to accompany their numerical and/or experimental work, irrespective of their research discipline. The majority of problems confronting engineers, physicists, and applied mathematicians encompass nonlinear differential/integral equations, transcendental relations, equations with singularities/variable coefficients, and complex boundary conditions that cannot be solved exactly. For such problems, only approximate solutions may be obtained using either numerical and/or analytical techniques. Foremost amongst analytical approximation techniques are the systematic methods of asymptotic perturbation theory. Unlike numerical solutions that can be acquired using canned packages and/or commercial solvers, the ability to derive closed-form analytical approximations to complex problems is becoming a lost art. Numerical solvers are routinely relied on to the extent that mastery of approximation methods is becoming not only a desirable tool, but rather a must among engineers and scientists, especially those aspiring to establish new theories and/or achieve deeper physical insight than may be gained on the basis of numerical modeling alone.

Sustainable (Green) Aviation (Instructor: Ramesh K. Agarwal)

The titles "Sustainable Aviation" or "Green Aviation" are recently being used with increasing frequency to address the technological and socioeconomic issues facing the aviation industry to meet the environmental challenges of twenty-first century. Air travel continues to experience the fastest growth among all modes of transportation, especially due to many-fold increase in demand in major developing nations of Asia and Africa. It is forecasted that by 2025, 27,200 new airplanes worth $2.7 trillion would be needed. As a result of threefold increase in air travel by 2025, it is estimated that the total CO2 emission due to commercial aviation may reach between 1.2 billion tonnes to 1.5 billion tonnes annually by 2025 from its current level of 670 million tonnes.

Systems Requirements Engineering (Instructor: John C. Hsu)

Requirements analysis and specification development are the most important contribution at the onset of a program/project. It will set a corrective direction to guide the program/project, preventing the later-on redesign and rework. This course will help familiarize you with an effective method for defining a set of requirements of a system. The focus is on the initial problem space definition, defining user needs, concept of operations, systems, segment, subsystem requirements, and architecture. Gain an understanding of the following requirements of engineering activities: elicitation of requirements, system requirements analysis, requirements integration, interface requirements and control, functional analysis and architecture, requirements management, and verification and validation of requirements. Learn about the principles and characteristics of organizing a well-written requirements and specifications.

Verification and Validation in Scientific Computing (Instructors: William Oberkampf and Christopher Roy)

The performance, reliability, and safety of engineering systems are becoming increasingly reliant on scientific computing. This short course follows closely the instructors' new book *Verification and Validation in Scientific Computing* to be published by Cambridge University Press in 2010. The course deals with techniques and practical procedures for assessing the credibility of scientific computing simulations. It presents modern terminology and effective procedures for verification of numerical simulations and validation of mathematical models that are described by partial differential or integral equations. The approaches presented are applicable to commercial, corporate, government, and research computer codes. While the focus is on scientific computing, experimentalists will benefit from the discussion of techniques for designing and conducting validation experiments. A framework is provided for incorporating various error sources identified during the verification and validation process into the total simulation prediction uncertainty. Application examples are primarily taken from fluid dynamics, solid mechanics, and heat transfer.

Distance Learning Courses
1 February–31 July 2011

Introduction to Spaceflight (Instructor: Francis J. Hale)
The emphasis throughout the course will be on fundamental concepts and analytical expressions rather than on "cookbook" and detailed numerical solutions. Upon conclusion of the course, participants will be able to plan a geocentric or interplanetary mission to include the determination of suitable trajectories, the approximate velocity budget (the energy required), the approximate weight (mass) and number of stages of the booster, and the problems and options associated with the terminal phase(s) of the mission.

Fundamentals of Aircraft Performance and Design (Instructor: Francis J. Hale)
This course will give participants an introduction to the major performance and design characteristics of conventional, primarily subsonic, aircraft. At the end of the course, participants will be able to use the physical characteristics of an existing aircraft to determine both its performance for specified flight conditions and the flight conditions for best performance. Participants will also be able to take a set of operational requirements and constraints and perform a feasibility design of an aircraft that should satisfy both the requirements and constraints. This course is ideal for anyone who is interested in or has any involvement with aircraft (and uninhabited aerial vehicles [UAVs]) to include such people as pilots, flight planners, operations personnel, air traffic controllers and supervisors, aircraft designers, fixed base operators, maintenance people, and other aviation aficionados.

27–28 March 2011
Free Conference Registration to the AIAA Infotech@Aerospace Conference, in St. Louis, Missouri, when you sign up for this Course!
http://www.aiaa.org/content.cfm?pageid=161&lumeetingid=2325

Electro-Optical Systems For Aerospace Sensing Applications (Instructor: Tim Howard)
This course will provide an introduction to electro-optical systems for practicing aerospace engineers. It is oriented toward non-specialists in electro-optics (EO), such as systems engineers, specialists in related disciplines (such as computer/software, electrical, and mission planning), as well as others who must integrate and interact with EO payloads. It will cover basic EO design principles, methods for predicting and assessing performance, current topics in airborne, ground-based, and space-based EO systems, and applications to unmanned and networked systems including unmanned sensor networks. Systems engineers, program managers, payload specialists, mission planners, and subsystem design engineers who must work with and interface to EO systems will benefit from this course. The course assumes that attendees will have a basic undergraduate degree in a technical field but does not require specialization in any optics-related field.

2-3 April 2011
Free Conference Registration to the 52st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference; 19th AIAA/ASME/AHS Adaptive Structures Conference; 13th AIAA Non-Deterministic Approaches Conference; 12th AIAA Gossamer Systems Forum; 7th AIAA Multidisciplinary Design Optimization Specialist Conference; Including AIAA Dynamics Specialists Conference in Denver, Colorado, when you sign up for one of these Courses!

Design of Aircraft Structures (Instructor: Michael Mohaghegh)
An examination into the latest concepts and lessons learned in design of aircraft metal and composite structures, including evolution of design criteria, structural design concepts, evolution of advanced materials, static strength, buckling, durability and damage tolerance, practical design considerations, validation, and certification. Design and analysis exercises are included to involve students in the learning process.

Fundamentals of Composite Structure Design (Instructor: Rikard Benton Heslehurst)
Receive a fundamental understanding the structural design requirements for composites. Key Topics discussed in this course include structural design requirements; laminate configuration sizing and distribution; structural performance estimation and understanding; other structural considerations—holes, joints, ply termination; and operational environment issues.

Computational Methods in Aeroelasticity (Instructors: Gautam SenGupta and J. Castro)
This course provides an introduction to numerical methods used in aeroelasticity. Topics include introduction of basic concepts; interpolating structural modes to an aerodynamic mesh; linear unsteady aerodynamic tools: Strip Theory, Vortex Lattice, and Doublet Lattice methods; application of CFD for transonic nonlinear flow; model reduction methods used in aeroelastic formulation; and nonlinearity and uncertainty analysis in aeroelasticity.

Structural Dynamics in Mechanical Design (Instructor: Dennis Philpot)
This course is designed to provide the student with a good theoretical—as well as practical—knowledge of the methodologies for performing dynamic analysis on a wide range of structural and mechanical systems. Throughout the course, equal attention will be given to both the methods of classical analysis techniques and the theories on which the methods are based. Key topics include dynamic loads and boundary conditions; foundational topics in energy methods; Newtonian Dynamics: first- and second-order systems; Multiple-Degree-of-Freedom (MDOF) Systems; dynamic response of MDOF Systems; and dynamics in the mechanical design process.

AIAA Courses and Training Program Registration Form

The World's Forum for Aerospace Leadership

REGISTRATION FORM (or register online at www.aiaa.org)

B0111

All registrants please complete the information below.

1

Conference Badge Name First/Given Name M.I. Last/Family Name

Organization Name/Division/Mailstop

Address

City State Country/Zip/Postal Code

E-mail Address Daytime Phone Number

Fax Number (include country code) Job Title/Rank

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AIAA MEMBERSHIP: If you are registering for one of the collocated professional development short courses at the nonmember rate, included with your registration fee is one year of AIAA membership.

Included in your AIAA membership will be periodic communications about AIAA benefits, products, and services. Check here ☐ if you prefer not to receive membership information via e-mail.

From time to time, we make member information available to companies whose products or services may be of interest to you. Check here ☐ if you prefer not to have your name and address used for non-AIAA mailings.

Signature_____Date_____

Check here ☐ if you are renewing or reinstating your membership. (You must pay the full nonmember conference fee.)

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RETURN FORM TO:

1) For fastest, easiest service, register online at **www.aiaa.org/courses**

2) By mail: return completed form with payment to AIAA, Professional Development 1801 Alexander Bell Dr., Ste 500 Reston, VA, 20191

3) By fax: send the signed, completed form with credit card payment to 703.264.7657

Cancellations Substitutions may be made at any time. Cancellations must be postmarked four weeks before the course start date and are subject to a $100 cancellation fee to cover administrative overhead. AIAA reserves the right to cancel any program due to insufficient registration or any situation beyond its control. Each course will be reviewed three weeks prior to the start date and may be canceled if a minimum enrollment has not been reached. Participants will be notified immediately and a full refund will be issued. AIAA cannot be responsible for expenses incurred because of course cancellation. AIAA reserves the right to substitute speakers in the event of unusual circumstances. For additional information, call Chris Brown at 703.264.7504 or 800.639.2422; FAX 703.264.7657; E-mail: chrisb@aiaa.org.

5

☐ Check here if you need to make special arrangements due to a disability. Attach requirements on a separate sheet of paper.

6

FORM OF PAYMENT:

AIAA Member Number: _____

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

5% Group Discounts
Deduct 5% for three or more students from the same organization, if registered simultaneously, prepaid, and postmarked four weeks before the first day of the course. Please register each person on a separate form. Photocopies are acceptable.

2

Select your registration options below. Payment by check, credit card, or money order—payable to AIAA—must accompany registration. To pay the member rate, your membership must be in good standing.

—REGISTRATION OPTIONS—

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Attend any professional development course and receive "free" registration to the conference sessions only

Early Bird by 19 Nov10 Advance (20 Nov–23 Dec) After 24 Dec 10

	AIAA Member	Non-Member	AIAA Member	Non-Member	AIAA Member	Non-Member
Basic Measurement Uncertainty, Methods and Applications	☐$895	☐$1020	☐$995	☐$1120	☐$1095	☐$1220
Modern Design of Experiments	☐$895	☐$1020	☐$995	☐$1120	☐$1095	☐$1220
C++ in Aerospace Simulations—Hands-On Workshop	☐$895	☐$1020	☐$995	☐$1120	☐$1095	☐$1220
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Verification and Validation in Scientific Computing	☐$875	☐$1000	☐$975	☐$1100	☐$1075	☐$1175

DISTANCE LEARNING COURSES (1 FEB–31 JUL)

Early Bird by 1 Jan 2011 From 2 Jan–1 Feb 2011

Introduction to Spaceflight	☐$1075	☐$1195	☐$1180	☐$1300
Fundamentals of Aircraft Performance and Design	☐$1075	☐$1195	☐$1180	☐$1300

COURSE OFFERED AT INFOTECH@AEROSPACE CONFERENCE

Attend any professional development course and receive "free" registration to the conference sessions only

Early Bird by 18 Feb 2011 Advance (19 Feb–18 Mar) After 18 Mar 2011

Electro-Optical Systems for Aerospace Sensing Applications	☐$900	☐$1050	☐$1100	☐$1250	☐$1200	☐$1350

COURSES OFFERED AT SDM CONFERENCES

Attend any professional development course and receive "free" registration to the conference sessions only

Early Bird by 25 Feb 2011 Advance (26 Feb–25 Mar) After 25 Mar 2011

Design of Aircraft Structures	☐$895	☐$1045	☐$1095	☐$1245	☐$1250	☐$1395
Fundamentals of Composite Structure Design	☐$895	☐$1045	☐$1095	☐$1245	☐$1250	☐$1395
Computational Methods of Aeroelasticity	☐$895	☐$1045	☐$1095	☐$1245	☐$1250	☐$1395
Structural Dynamics in Mechanical Design	☐$895	☐$1045	☐$1095	☐$1245	☐$1250	☐$1395

Please indicate if you qualify for the:

__ Prepaid Group Discount (One 5% discount per registrant)

TOTAL DUE: $ _____

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.

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*. The transition from WriteTrack to ScholarOne Manuscripts (Thomson Reuters) will be completed in 2010. Information about the transition is available on the WriteTrack home page.

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.

Department of Defense Approval

The DoD Public Affairs Office has determined that, for purposes of accepting a gift of reduced or free attendance, these events are widely attended gatherings pursuant to 5 CFR 2635.204(g). This determination is not a DoD endorsement of the events nor approval for widespread attendance. If individual DoD Component commands or organizations determine that attendance by particular personnel is in DoD interest, those personnel may accept the gift of free or reduced attendance. As other exceptions under 5 CFR 2635.204 may allow the acceptance of gifts, DoD personnel are urged to consult their Ethics Counselor.

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.

STRATEGY FOR SUCCESS

In today's dynamic business environment,
effective outreach and customer interface are vital to successfully capturing new partnership opportunities.

If your company is looking for a mechanism to heighten visibility, expand networking capabilities among industry leaders, and demonstrate your unique value to thousands of aerospace professionals, AIAA can help to achieve your objectives.

With over 75 years' experience, and a distinguished roster of legendary aerospace policymakers and pioneers, AIAA's Sponsorship Program can provide access to key industry, government, and academia contacts all in one location.

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For more information on sponsorship opportunities with AIAA, contact **Cecilia Capece**, AIAA Sponsorship Program Manager, at **703.264.7570** or **ceciliac@aiaa.org.**

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