7 AEROSPACE AMERICA JULY-AUGUST 2012

July-August 2012

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The Dragon *roars*

Mars Science Laboratory: Going for a touchdown

A conversation with Norman R. Augustine

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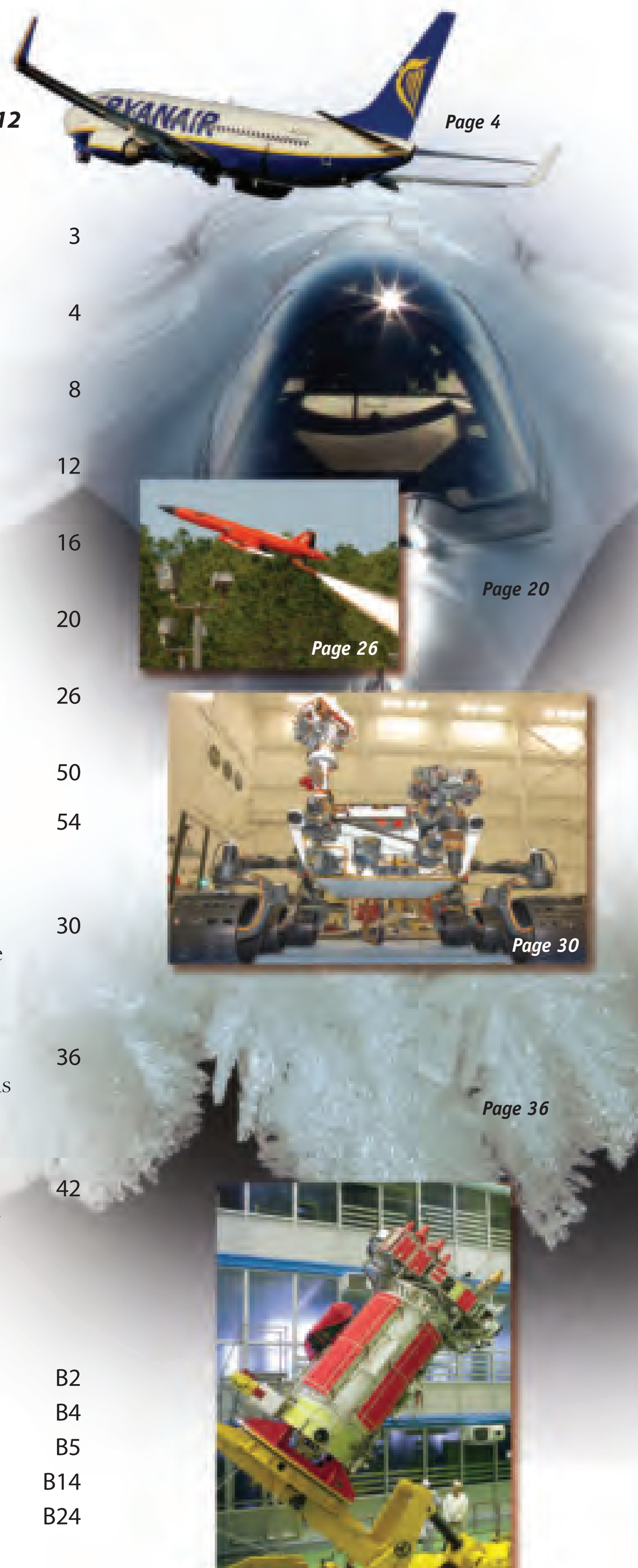

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Flight engineers Don Pettit and Andre Kuipers grappled the SpaceX Dragon with the Canadarm2 and used it to berth Dragon to the ISS. Find out about Dragon's remarkable mission by turning to page 16. NASA photo.

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Editorial

The year of the Dragon

"Houston, it looks like we've got us a Dragon by the tail."

Those words, uttered by astronaut Don Pettitt aboard the space station, signaling that the Canadarm had successfully grappled the SpaceX cargo capsule, marked the first visit by a private company to the ISS. This capture was followed by a flawless berthing and subsequent uploads and downloads of cargo. When the visit was over, Dragon decoupled from the station and returned to Earth, splashing into the Pacific.

The celebrations that followed were not confined to Elon Musk and his Space Exploration Technologies Corporation. This was good news for NASA, as the agency now had an additional—and homegrown—source for resupply missions to the station. And yes, Dragon has portholes, as it is meant one day to carry crew as well as cargo.

The events also brought a sigh of relief to supporters of NASA's Commercial Orbital Transportation Services, or COTS, program to coordinate the delivery of cargo to the ISS by private companies, as well as the related CCDev program for development of crew transportation services. Both of these efforts follow the retirement of the space shuttle, which has resulted in U.S. reliance on foreign entities for transport.

Other commercial ventures are also kicking into high gear. During the summer, Sierra Nevada will begin free flights of its Dream Chaser crew carrier, based on the old NASA HL-20 design, including autonomous approach and landing. Meant to be launched from a United Launch Alliance Atlas V, Dream Chaser is another beneficiary of the COTS program. Orbital Sciences has announced that in its COTS effort, a pressurized cargo module will fly a demonstration mission later this year, then begin cargo deliveries to the station, using its Cygnus advanced maneuvering spacecraft, launched by the company's Antares rocket.

Boeing is well on its way with the CST-100, a crew capsule it is developing with Bigelow Aerospace under NASA's CCDev program. Also for launch on Atlas V, the capsule completed drop tests in June. Other companies are also making progress, both with and without NASA support.

But for now, take a moment and reflect on SpaceX's remarkable accomplishment, carried out amidst the din of voices saying they couldn't, or shouldn't. Enjoy that moment; salute the hundreds of people who pulled together to pull this off.

Done?

Now that the hard part has been done, at least once, here comes another hard part. As noted, Dragon has portholes. So, too, do the CST-100 and the Dream Chaser. But NASA will be a lot less willing to use newcomers to carry astronauts than it will to deliver foodstuffs.

Human rating these vehicles, and the rockets to carry them, entails first defining what the criteria are, in terms of vehicles and rockets not built by NASA, then determining whether the competitors meet them.

Having these exercises go on simultaneously with testing would go a long way to getting the U.S. back to being a spacefaring nation, as will knowing that those who voyage so far will be able to safely find their way home.

Elaine Camhi
Editor-in-Chief

Eurozone crisis hits aircraft sales

THE WORSENING ECONOMIC PROBLEMS in the European eurozone have led to a sharp decrease in demand for new civil aircraft in the region.

According to the European Commission, Europe imports about €30 billion of civil aviation products a year, and according to Boeing's latest market predictions: "Sustained growth is expected to continue over the next 20 years, with European airlines forecasted to acquire a total of 7,550 new airplanes valued at $880 billion."

However, this optimistic forecast was made before the crisis in the eurozone economies. More recent predictions point to a rapid slowdown in demand for air travel and new aircraft, with an unclear pattern of recovery.

The Brussels-based air traffic management agency Eurocontrol suggests that by 2020 Europe will probably be handling 12.3 million flights a year—a mere 26% increase over 2011 (average annual air traffic growth rates in civil aviation had been running at nearly 5% since 1945). The first three months of 2012 saw a total of 2.12 million flights in Europe, a decrease of 3.3% on the first 3 months of 2011, after allowing for the leap year.

Says Jacques Dopagne, Eurocontrol's director of network management: "The decrease is bigger than the 1.3% decline forecast for 2012 as a whole. A weak start to the year was forecast, and indeed within Europe flights are very close to forecast, but the recovery of traffic to and from North Africa is slightly slower than expected, leaving traffic for the quarter slightly below forecast overall."

Norwegian Air Shuttle and Transaero are still shopping for new aircraft.

Airline woes impact orders

There has already been a marked slowdown in orders for new aircraft by European operators this year. By mid-May Boeing had received orders for aircraft from just two European airlines (Norwegian Air Shuttle and Russia's Transaero), while Airbus won a single order, also from Norwegian Air. The low-cost carrier ordered 100 Airbus A320neos and 100 Boeing 737Max and 22 current-generation 737-800s.

But even before the most recent economic problems, Europe's airlines were facing a perfect storm of crises. Weakening demand, high fuel costs, and the prospect of higher taxes—not the least from the EC's emissions trading scheme—have been short-term market pressures. Political unrest in North Africa during 2011 also severely cut tourist flights to this region.

But there are also longer term structural challenges. For the past four to five years, the continent's major carriers have been in a continual cycle of consolidation and restructuring in the face of low-fare carrier competition in the domestic markets and the emergence of powerful new rivals based in the gulf states for medium- and long-haul services.

For Europe's low-cost airlines the market has been equally troublesome. In 2011 these carriers saw an annual growth rate of just 3.9%, slower than full-fare airline traffic growth of 4.1%, as the long-term effects of deregulation finally dissipated and equilibrium was reached between them. Short-haul markets during 2011 began to decline as roads and fast-rail services were developed to cater for a growth in demand for regional travel on routes of less than 600 km.

While there was overall growth in 2011, much of it was due to increased traffic levels by European countries outside the eurozone.

"Europe has really become a two-speed aviation market," says Olivier Jankovec, director general of Airports Council International Europe, "with European Union airports only reporting a 1.7% average growth in the first quarter [of 2012], while non-EU airports in Russia, Turkey, Norway, Iceland, and elsewhere are surging ahead with 11.5% growth."

But growth looks to be an unlikely scenario for most of Europe in 2012.

Ryanair is one of the few European airlines to report record profits, boosted by fare increases and entry into new markets.

Declines, with a few exceptions

"The prospect of high external costs and depressed demand is not a good combination," explains Ulrich Schulte-Strathaus, secretary general of the Association of European Airlines. "AEA's membership is expected to post a €1-billion to €2-billion earnings before interest and tax (EBIT) loss for 2012. This forecast is heavily dependent on a swift and effective political solution to the sovereign debt crisis."

By the first three months of the year three major European airlines had declared bankruptcy—Cimber Air of Scandinavia, Hungary's national carrier Malev, and Spanair, Spain's regional airliner. And worse is expected, as banks become even more reluctant to lend.

"The recession and changing export credit agency conditions will combine to make it harder for airlines to finance deliveries, but probably not until late 2012 or early 2013," according to Ian Lowden of LowdexxAviation Consulting. "There have been a number of deferred deliveries this year but these are due to a lack of market rather than finance and this is likely to get worse next year as rising costs and falling traffic hit airlines even harder."

Not all European airlines are suffering. Low fare Ryanair reported record profits as fare increases helped to offset a sharp rise in fuel costs. Also, the airline capitalized on the failure of other airlines, building up a new base in Budapest and expanding bases in Spain, Scandinavia, and the U.K.

According to Ryanair CEO Michael O'Leary, during times of austerity people do not stop going on holiday—they switch to lower cost carriers.

In normal recessions this is true. In 2011, European countries with severe economic problems such as Ireland, Greece, Portugal, and Spain registered astonishing tourist increases of 13%, 14%, 10%, and 8%, respectively.

But the scale of the current economic problems suggests that many Europeans are severely cutting back their travel plans. According to the World Travel & Tourism Council, a tightening of consumer spending; uncertainty concerning the future of the eurozone and peripheral economies of Greece, Spain, Italy, and Portugal; and the impact of austerity measures will result in a 0.3% industry contraction this year.

For example, many Europeans are avoiding traveling to Greece this year, fearing unrest sparked by the debt crisis. The association of Greek tourism enterprises reported in mid-May that holiday bookings were 50% lower in 2012 over 2011.

According to the European Travel Commission's first quarterly report on *European Tourism in 2012—Trends and Prospects,* "European travel has exhibited resiliency in the early part of 2012 based on visitor data for the first few months of the year….However, there are signs of mixed performance and slowing throughout Europe. While Central and Eastern European destinations have been performing well, quite a number of Western European destinations have posted declines in hotel occupancy in the first two months of the year. Overall, a slowdown is evident in hotel occupancy rates in most European subregions. The global economy is being restrained by a mix of government austerity, household de-leveraging, corporate caution, and high commodity prices. Meanwhile, data on economic activity indicate that the eurozone is in mild recession and concerns are mounting regarding government debt."

Meanwhile business aircraft flights fell by 0.2% in the 12 months to May 2012 over the same period last year. Sales of business jets in Europe are about 10% below peak levels of 2007 and 2008. In 2011 there were more sales of corporate jets to Brazilian based customers than all of Europe.

The future for new aircraft

So what will be the ultimate impact of the decline in European airline business on the market for new aircraft?

That will depend to a large extent on the speed of the recovery. In May

New sales will focus on fuel-efficient single-engine types like the 737max and A320neo.

2012 the EC predicted gross domestic product—a key determinant of demand for air travel—will remain flat at 0.0% in the EU in 2012, before recovering to growth of 1.3% in 2013. For the 17-nation single-currency bloc, GDP is expected to contract 0.3% this year, then expand 1.0% in 2013.

Meanwhile, some key underlying trends for aircraft demand throughout the continent are developing.

First, near term demand will be focused on sales of single-aisle types from low-cost airlines aiming to take new business from ailing and bankrupt legacy carriers and exploit some of the unmet demand for new services in Eastern Europe, particularly Poland, Russia, and Turkey. Especially vulnerable will be smaller national carriers that can no longer call on state aid to prevent them from failing. But even when new carriers step in it is unlikely they will be offering the same capacity as the airlines they are replacing.

Second, carriers based in the Middle East with access to longer lines of finance than their European competitors will take greater shares in European network carriers. Etihad Airways has already taken a stake in Germany's airberlin and Ireland's Aer Lingus; other gulf carriers are reported to be looking for similar investments. While this will provide access to finance, it might also tie in fleet acquisition plans of European airlines to those of their major investors.

But the pressure will increase for large scheduled European carriers to reequip their short-haul fleets with more fuel-efficient types, not just to remain competitive with low-cost rivals but to ensure they will not be unduly penalized when the EC's emissions trading scheme comes into full force. An Airbus analysis of the market for new aircraft in Spain suggests that by 2030 the country will have to replace 203 of its current fleet of 244 aircraft by more environmentally efficient types.

The worry for many in Europe's airline industry is that even the most optimistic forecasts of economic improvement point to a very slow recovery in the airline market. The International Air Transport Association, the grouping of major scheduled airlines, "foresees a very difficult period, with annual losses of at least $600 million for the continent's airlines," says Tony Tyler, IATA director general and CEO. "The challenges facing European carriers were starkly illustrated by the demise of Malev and Spanair at the beginning of the year."

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Events Calendar

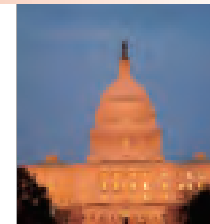
JULY 11-14
ICNPAA 2012 - Mathematical Problems in Engineering, Aerospace and Sciences, Vienna, Austria.
Contact: Prof. Seenith Sivasundaram, 386/761-9829; seenithi@aol.com

JULY 14-22
Thirty-ninth Scientific Assembly of the Committee on Space Research and Associated Events 2012, Mysore, India.
Contact: http://www.cospar-assembly.org

JULY 15-19
Forty-second International Conference on Environmental Systems, San Diego, California.
Contact: 703/264-7500

JULY 30-AUG. 1
Forty-eighth AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit: Future Propulsion—Innovative, Affordable, Sustainable, Atlanta, Georgia.
Contact: 703/264-7500

JULY 30-AUG. 1
Tenth International Energy Conversion Engineering Conference, Atlanta, Georgia.
Contact: 703/264-7500



Moving ahead despite constraints

IN THIS TIME OF LIMITATIONS, BOTH physical and budgetary, the push to move forward and upward with aerospace efforts was on display as the summer loomed in official Washington. Key developments included a milestone for commercial spaceflight, changes in Air Force leadership, and a balancing act for aviation safety.

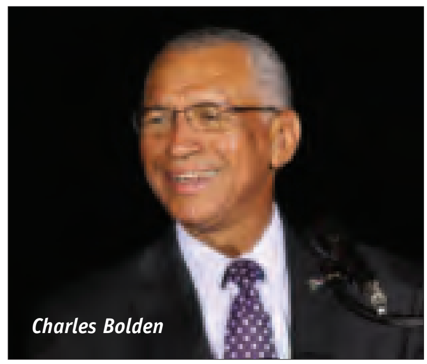
A critical step

Washington was watching closely when the SpaceX Dragon supply ship launched by a Falcon 9 rocket brought 1,000 lb of food, clothes, batteries, and other provisions to the ISS on May 26.

The SpaceX flight was "another critical step in the future of American spaceflight," said NASA Administrator Charles Bolden. SpaceX founder and CEO Elon Musk called it "the culmination of an incredible amount of work." *USA Today* said the normally low-profile Bolden had "earned the right to do a little gloating" over what seemed to be a spectacular success for NASA's Commercial Crew Program, a follow-on to the now-defunct space shuttle. The success occurred only after both SpaceX and NASA did their best to build low expectations for the flight, mindful of the enormous number of things that could go wrong.

After a successful splashdown and retrieval on May 31, Dragon completed the first commercial spaceflight of the kind traditionally carried out iby NASA. John Holdren, the presidential science advisor, said the SpaceX mission "is the cornerstone of President Barack Obama's vision for a key private sector role in spaceflight." Four days before the orbital docking, Holdren had acknowledged that the administration's plan to restructure the U.S. space program is not easy to explain or well understood.

Holdren said of the flight, "That is exactly what the president had in mind when he laid out a fresh course



Charles Bolden

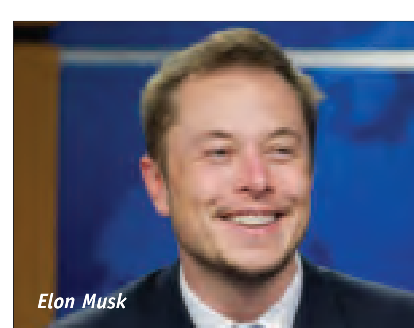
for NASA to explore new scientific frontiers and take Americans even deeper into our solar system while relying on private sector innovators—working in the competitive free market—to ferry astronauts and cargo to low Earth orbit and the international space station. It's essential we maintain such competition and fully support this burgeoning and capable industry to get U.S. astronauts back on American launch vehicles as soon as possible."

The nation currently has more private companies—at least eight—seeking to venture into orbit than it has major airlines. All of them are looking to capitalize on administration policy, which is to "let private industry do what it does best and let NASA tackle the challenging task of pushing the boundary further," as NASA Deputy Administrator Lori Garver put it. Some companies, such as Richard Branson's Virgin Galactic, are all but ignoring NASA as they underwrite their own space travel and tourism projects.

The Commercial Crew Program, which teams NASA with private companies to develop a new taxi to the space station, remains controversial. Congress is unlikely to give NASA the $830 million requested for the program in the administration's FY13 budget proposal. Even while remaining tight-fisted toward NASA, lawmakers want the agency to hurry up and pick one company from the four (SpaceX, Boeing, Sierra Nevada, and Blue Origin) vying to produce new crew transportation systems. Continuing the competition "presents a significant risk of costly, lengthy delays," according to language approved in the House. The Democratic-led Senate is less impatient with the program and unlikely to mandate a deadline.

Numerous space experts, including many astronauts, believe that the current policy focus on private industry is misguided and that NASA should resume its past role as creator, sponsor, and developer of government-financed spacecraft. But others are happy with the mix that defines current policy, with the private sector handling resupply of the station—including, eventually, transporting astronauts to and from the ISS—while NASA focuses its limited resources on grand ventures like exploration of the asteroids or a mission to Mars.

NASA is supposed to be doing exactly that. The Commercial Crew Program will support the ISS, and NASA will continue developing the Orion multipurpose crew vehicle and the Space Launch System to carry astronauts, as Bolden put it, "farther into deep space than we've ever been—to an asteroid by 2025 and Mars in the 2030s." None of this, according to Bolden, will detract from the agency's "facilitating the success of a strong commercial space sector."



Elon Musk

One group of critics does not care whether spaceflight is public or private. These are the skeptics who lack enthusiasm for any kind of space exploration and argue that even NASA's painfully modest budget of about $17 billion a year is too much when the government is drowning in debt.

Shortly before the SpaceX mission, Bolden told an audience, "The debate about the direction of NASA is over, and we are moving strongly into implementing our exciting plans with wide bipartisan agreement." That was at best an exaggeration at a time when the future of spaceflight looks both exciting and controversial.

New Air Force chief

As had long been expected, Defense Secretary Leon Panetta announced on May 10 that the president is nominating Gen. Mark A. Welsh III to become Air Force chief of staff. Welsh, who uses the flying callsign 'Boomer,' will replace Gen. Norton Schwartz, who has held the post since August 2008.

"I'm tremendously honored and deeply humbled," says Welsh, who is the current commander of U.S. Air Forces in Europe. His appointment will require the advice and consent of the Senate.

Welsh is an Air Force Academy graduate (class of 1976) and a former commandant at the academy (1999-2001). He has 3,400 pilot hours in his logbook, mostly in the F-16 Fighting Falcon and A-10 Thunderbolt II. He flew combat missions in Operation Desert Storm (1991) and performed military liaison duties for Panetta (from 2008 to 2010) when Panetta was head of the CIA.

Welsh will become the Air Force's service chief and its voice on the JCS at a time when Congress is reacting strongly to the administration's FY13 defense budget proposal.

Of special interest to lawmakers on both sides of the aisle are the proposal's cuts to the Air National Guard. Prompted by Republican objections to the measure, on the day of the Welsh announcement the House Armed Services Committee passed an amendment to the National Defense Authorization Act (NDAA) that would require the Air Force to maintain FY12 funding levels for the Guard. At issue is the section of the budget proposal that would reduce and transfer about 200 C-130 Hercules tactical airlifters, retire 102 A-10s, and cancel acquisition of 38 C-27J Spartans, which are also tactical airlift planes.


John Holdren

Lawmakers in both parties and many state governors, including Texas Gov. Rick Perry—a Republican and former C-130 pilot—reject not only the administration proposal but also a compromise that came close to being sealed during talks between Congress and the White House in recent weeks. Obama said he would veto the House version of the NDAA, and it is not expected to survive in its current form.

Some observers wonder if the administration will use the Welsh appointment as a reason to back away from its announced budget plan and agree to keep the C-130s, A-10s, and C-27Js in place. At least one Capitol Hill staffer has implied that unless there is a retreat from the budget proposal, hardliners in the Senate could hold up the nomination. None of this has anything to do with the personality of the general, who is regarded as low key and affable.

Schwartz acknowledged that the general will come to the job "at a different time" from that of Schwartz's own ascendancy in August 2008, after then-Defense Secretary Robert Gates fired Air Force Secretary Michael W. Wynne and Chief of Staff Gen. T. Michael 'Buzz' Moseley. The nominal reason for the firing was a series of mistakes in the handling of nuclear materials, but many in Washington believe Gates was displeased with the two for their activist role as advocates for the F-22 Raptor superfighter.

Because Schwartz is a C-130 pilot with experience in the special operations world, the change was seen as an end to decades of dominance by fighter pilots in top air leadership slots. Although Welsh, too, is a fighter pilot, he is viewed as a generalist with broad management and acquisitions experience.

"Gen. Welsh's proven performance, deep experience and leadership ability make him the ideal candidate to be the next chief of staff," stated Michael B. Donley, who is expected to remain as Air Force Secretary. "Pending his confirmation, I look forward to working with Mark to continue building on the outstanding accomplishments achieved by Gen. Schwartz."

No other changes within the Joint Chiefs of Staff are expected this summer; the chairman (Army Gen. Martin Dempsey) and the incumbent Army, Marine Corps, National Guard, and Navy leaders will remain on duty. Everyone on the JCS is expecting and preparing for new legislative cuts in personnel and hardware.

The current Air Force vice chief of staff, Gen. Phil Breedlove, has been named to replace Welsh at USAFE. This was something of a surprise, because the administration is planning to reduce the U.S. footprint in Europe, and that job was expected to go to a three- rather than a four-star officer.


Gen. Mark A. Welsh III

Air races proceed

Many in Washington are interested in air races and in the safety issues they create, but the federal government's role in oversight has been intentionally low key.

The national air racing championships in Reno, Nevada, held every year since 1964, will take place again this year. The races will be under scrutiny by the FAA and the National Transportation Safety Board (NTSB), but they are popularly recognized as important to the Reno economy. While some in the nation's capital are watching closely, no one in the federal government has suggested that the races should not go ahead.

Federal officials have been studying the crash of a modified WW II-era P-51 Mustang, the Galloping Ghost, that plunged nose-first into the apron in front of the grandstand last September 16, killing pilot Jimmy Leeward and 10 spectators and injuring 70.

A blue ribbon panel of experts issued recommendations to make the air races safer when the annual competition is held again in September. NTSB member Jim Hall sat on the panel. Some of the recommendations call for changes that the Reno Air Racing Association already has initiated, including appointing a safety director with the independent authority to halt the competition if necessary in the case of a safety concern.

Last year's tragedy, which would have killed far more people if it had happened just 50 ft farther west in the main bleachers, was caused by an elevator trim tab breaking off from the P-51's tail section, causing a 10-*g* pull-up and subsequent stall. The NTSB officially questioned whether the design of the trim tab was flawed, and whether the P-51 and other race aircraft were flying too fast. The race planes were designed for speeds of about 400 mph but are being routinely raced at 500. The board also raised the question of whether a limit should be placed on pilot age: Leeward passed the FAA pilot physical at age 74.

A P-51 Mustang crashed into the apron in front of the grandstand during the air race last September 16.

Michael B. Donley

Deborah A.P. Hersman

Since 1986, the U.S. has experienced 152 air show and air race accidents, 75 of them fatal, according to the NTSB. Except for the Reno race, none involved spectator deaths.

Altogether, the NTSB issued seven safety recommendations, focusing on racecourse design and layout, prerace technical inspections, aircraft modifications, and airworthiness. "We are not here to put a stop to air racing," said NTSB chair Deborah A.P. Hersman. "We are here to make it safer."

Many Americans think of the NTSB as a kind of accident police, ensuring that aviation is safe. In fact, the NTSB has no regulatory or enforcement power. It went as far as it could by participating on the four-person panel, and then only after being invited. The FAA is the main regulatory body for aviation safety and standards.

Acting FAA Administrator Manuel Huerta, who awaits Senate confirmation to hold his job on a permanent basis, says that air racing safety is "very important to us." The FAA has enforcement powers, as well as the ability to issue and revise regulations related to all aspects of air travel safety research, manufacture, and navigation. FAA spokesman Ian Gregor says race organizers are required to come up with a thorough race plan and demonstrate to the agency when they have done as much as they can to ensure the crowd's safety.

Last August, the FAA canceled a race in Camarillo, California, because of concerns about spectator safety.

Organizers of the national air racing championships secured $100 million in necessary insurance and say they will move the racecourse for the fastest planes to keep them farther from spectators. Changes will include the softening of some curves to ease the gravitational pull on pilots—including coming out of a stretch called the 'Valley of Speed,' where planes flying at 500 mph gain momentum on the high Sierra plateau north of Reno.

Oversight of the races is largely in the hands of the Reno-Tahoe Airport Authority, but race organizers say they will eventually implement all of the NTSB recommendations. Sen. Dean Heller (R-Nev.) says he hopes race officials can assure the safety of spectators. "If we can't protect spectators, I'd take a hard look at the future of the sport," he says. Sen. Harry Reid (D-Nev.) says the racing event has been an important part of the community for nearly a half-century and that he is "confident it will continue." Both Nevada lawmakers know that the races inject about $80 million annually into the local economy.

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Norman R. Augustine

You headed the Human Spaceflight Plans Committee—the Augustine committee—that was formed by the White House in 2009 to review and report on the U.S. human spaceflight program. How is that program doing? What's in store for it?

I would like to be more optimistic than I am. With regard to commercial space programs, I think the U.S. position is making reasonable progress. With regard to NASA's robotic space programs, I am pretty optimistic because the costs of individual missions are not as great as they are in the human spaceflight arena. But the human spaceflight program is a cause for great concern.

Why do you think so?

There is not enough money being put into the budget to carry out the human spaceflight program the president has proposed, and there probably won't be enough money in the future, either. About five years from now, that budget shortfall will put us in the very same spot that the Constellation program was in when our committee did its study and report. There is a lot of contention about what the target of the human spaceflight program should be.

Where do you stand on all that?

I think President Obama made a good proposal, but I am deeply concerned about the lack of resources. And the Congress is going to have to decide whether it wants a jobs program or a space program. Budget cuts are especially painful to NASA because NASA's fixed costs are so high. If the fixed costs are off limits for reductions, all the cuts come out of the flesh of space programs. That is a significant problem. In essence, it is what happened to Constellation.

Do you see the situation improving at all?

As I said, I wish I were more optimistic. We are in danger of falling behind. When you look at programs throughout the world, the Europeans are building a good space launch business, the Russians are working with us in space launch and doing pretty well, and China is coming along.

What do you see ahead for China in space?

I think China should place a human on an asteroid.

Oh?

Remember when the Russians put Sputnik up, some people argued that the U.S. ought to put up a bigger Sput-

Norman R. Augustine retired as president and CEO of Lockheed Martin in 1997 to become a lecturer with the rank of professor at Princeton University, his alma mater. He previously served as the president and CEO of Martin Marietta, and became president of Lockheed Martin when the merged company was formed in 1995.

He began his career in 1958 as a research engineer and program manager and then as chief engineer of Douglas Aircraft. Beginning in 1965, he served in the Office of the Secretary of Defense as assistant director of research and engineering. He joined LTV Missiles and Space in 1970, serving as vice president, programs and marketing. In 1973 he became assistant secretary of the Army for research and development and then served as undersecretary and acting secretary of the Army.

Augustine was raised in Colorado and graduated magna cum laude from Princeton with a BSE and then an MSE in aeronautical engineering. He was elected to Phi Beta Kappa, Tau Beta Phi, and Sigma Xi.

He has served on the boards of many companies, including Procter and Gamble and Conoco Phillips. He was chairman and principal officer of the American Red Cross, chairman of the National Academy of Engineering, president and chairman of the Association of the United States Army, chairman of the Aerospace Industries Association, president of the Boy Scouts of America, and chairman of the Defense Science Board. He is a regent of the University System of Maryland, a former member of the Princeton board of trustees, and a trustee emeritus of Johns Hopkins University.

Augustine was awarded the National Medal of Technology by the president of the United States, and received the Joint Chiefs of Staff Distinguished Public Service award. He has five times received the Defense Department's highest civilian decoration, the Distinguished Service Medal. He is coauthor of The Defense Revolution *and* Shakespeare In Charge, *and the author of* Augustine's Laws *and* Augustine's Travels.

He has been elected to membership in the American Philosophical Society, National Academy of Science, American Academy of Arts and Sciences, Explorers Club, and Tau Beta Phi. He holds 29 honorary degrees and was selected to Who's Who in America and the Library of Congress as one of "Fifty Great Americans" on the occasion of the 50th anniversary of Who's Who.

Interview by James W. Canan

"We don't seem to be able to make decisions very well, and not waking up is a very real possibility."

nik. President Kennedy said no, let's do something more challenging; let's put a man on the Moon. Now, if the Chinese go to the Moon, it's a big deal for them, but the U.S. has already done that. So if I were China I'd put a human on an asteroid, which is probably not all that much more difficult.

But there is a counterargument. The Chinese may decide not to do anything dramatic in space because it will wake up the Americans just like Sputnik did. Sputnik motivated the Americans to invest more in research, fix our school system, create ARPA [Advanced Research Projects Agency], and do other things to advance the nation. So the Chinese may decide they don't want that to happen again.

I wonder if we would respond in the same way today even if we did wake up. Are we politically equipped to do that?

That's a good question. We don't seem to be able to make decisions very well, and not waking up is a very real possibility. But my guess is that the Chinese will do in space what they are able to do without worrying too much about our response. After all, they shot down one of their satellites and sent a lot of debris into space and didn't seem to much care what the world had to say about that.

Some say it's too bad NASA doesn't exert more independent leadership when it comes to shaping and executing our space policy. NASA clearly has to do what the White House and Congress tell it to do, but that seems to be taking us nowhere nowadays. Do you have any ideas on how NASA could be more of a leader at the front end of space policy?

NASA has a problem with that because it's part of the administration—of every administration—and Congress seems to go its own way every year in considering space policy. This makes it awfully hard to make progress. There is such divisiveness among highly credible people. But I do have an idea of how we could face up to some of the tough questions confronting our nation, including space policy.

Tell us about it.

About five years ago, I cochaired a committee with Gov. Ray Romer and David Walker, a former comptroller general of the U.S., that was set up under the Center for the Study of the Presidency. Our group recommended the creation of a permanent body led by a senior board of perhaps 10 highly regarded people of all political persuasions, people who were not locked into their views, not extreme. The board would have a permanent staff of maybe 30, 40, or 50 outside experts and the authority to write legislation on any topic its members felt was important to the health of the country. They would send that proposed legislation to Capitol Hill, and Congress would have to vote it down or vote it up, but would not be able to amend it or filibuster.

What was the reasoning behind that recommendation?

The idea was to force Congress to face some of our toughest issues—for example, it might consider what our space program should be—and also give the individual members of Congress some political cover in voting, just as they have in voting on closing military bases.

The problem now is that when Congress faces tough issues, the members vote their constituencies, so they put this piece and that piece into the proposed legislation until it becomes unrecognizable.

Space programs are particularly well suited to benefit from our proposal. A space program takes 20 years and is susceptible to a lot of political buffeting and changing in that period. Twenty years covers five presidencies, 10 Congresses, and 20 budgets.

Who would create this permanent board?

It would be established by legislation, approved by Congress and signed by the president. It would be a public-private organization, totally independent, with the authority to convene studies and write legislation and send it to Congress for a mandatory up or down vote.

Seems like it would attract high-quality people who are anxious to get things going.

That's the idea. We wouldn't want to take away or detract from the authority of the Congress, but this would take policymaking out of an arena where the political heat is now so great that we seem unable to accomplish anything. Congress might even welcome this approach. It might turn the tide. Our space program would benefit from it, I think. Solving the space challenge would be pretty easy

"The problem now is that when Congress faces tough issues, the members vote their constituencies, so they put this piece and that piece into the proposed legislation until it becomes unrecognizable."

in comparison to solving Social Security, for example. But we surely ought to be able to do both.

Let's go back to the Augustine committee. Have you been gratified or disappointed by its effect or lack of effect on space policymaking?

Our report was carefully considered by the White House and the Congress. We were specifically asked not to make recommendations but to offer options. We never even discussed among ourselves what our individual favorite options were. My own favorite was fairly close to what the president recommended, so I thought what he proposed was reasonable.

My disappointment would have to be that our policy and our budget process are still not connected. That was a disappointment not only with the result of our work but with the way our system itself works—or does not work. The main thing we said was that we would like to see a strong human spaceflight program with adequate funds. That isn't projected in the budget to happen. No corporation would ever announce that it is going to build something and then fail to put in place the money needed to do it.

So how would you rate the impact of your committee's report?

I think the jury is still out. I think it has had some impact; time will tell how much it will have. I certainly don't think we wasted our time. I have no regrets. I wouldn't change a word of what we said.

What now?

If we can't afford the exciting space program we all would like, we should have a smaller space program that we can fully fund. Let's be sure that the funds match the goals, even if it means a smaller program. That is our advice.

What could we do with a smaller space program? What would it be? Would we still have human spaceflight and develop a heavy lifter?

I suspect we would develop a heavy lifter and capsule at a more leisurely pace and shift a lot of money to technology development—begin working on things like refueling in space, making space safer, protecting crews against deep-space radiation. There's also the possibility of major breakthroughs in terms of things we could do in technology and what it would cost to do them.

Is there enough money for research and technology in the present NASA program?

I think we need more money for that. And if it turns out there is not enough money to keep pursuing the human spaceflight program we're now pursuing, then I say go ahead and develop the heavy lifter and the capsule and take most of the rest of the money and put it into technology, even if this means the space program would slip by 10 years. I would not be happy with that, but I would prefer it to starting out with some grandiose program and not having enough money for it. It would be a stretched but fundamentally sound program, with emphasis on technology and research.

"I don't want to cut the space program back, but it is a better thing to do than to cut corners, which is too risky. Space is very unforgiving."

We need to do whatever is the best of all possible worlds. If it is not possible to have an aggressive space program, let's have a lesser but sensible space program.

The austerity mode we seem to be in may drive us to do that. But it also could make the space program fall apart, couldn't it?

That's a real danger. I don't want to cut the space program back, but it is a better thing to do than to cut corners, which is too risky. Space is very unforgiving.

Have our leaders lost the capacity to come to grips with reality?

I think our country is facing so many problems right now in the economy, education, energy, security, research, the environment, space, and other arenas that it is just very hard for us to recognize and accept the great difficulty we're in on the whole. It's hard to marshal the public's attention and sustain it long enough to solve the problems.

The energy situation is a great example of all that. The price of oil and gasoline goes way up and everybody gets up in arms and we say we're going to put more money into developing alternative energy sources, and then the oil-producing countries cut the price of oil and we all go back to sleep. There is no event like September 11 or Pearl Harbor or Sputnik to wake us up.

Maybe the best thing that could happen to our space program would be China having rousing success at putting humans into space.

I have thought of that. The Russian launch of Sputnik was clearly a net gain for America. If the Chinese were to put a human on an asteroid, for example, I think it might be a net gain for America.

Let's turn to the national security scene, to the defense budget. Will we be able to sustain an adequate national defense with less money?

The threat of sequestration hangs over the defense budget and over our heads. It's an embarrassment that our

"It's an embarrassment that our Congress puts our nation in a position where national security is held hostage because of its inability to make decisions."

Congress puts our nation in a position where national security is held hostage because of its inability to make decisions. If Congress consciously wishes to cut defense, so be it, but to do what they've done [in letting things slide toward sequestration] is a great disappointment. Trying to predict the outcome on Capitol Hill is like trying to read the mind of someone who hasn't made up their mind yet.

But my guess is that they will come together at the last minute and put together a budget that's not as onerous as sequestration but will make further cuts below the 'going-in' position. And then they will kick the can down the road and say we will revisit this issue in six months.

"We simply have to be able to produce manned aircraft that don't cost so much."

There is a school of thought that we spend too much on defense as it is.

Yes, one of the comments I hear on Capitol Hill is that the United States spends more on defense than the next 14 countries combined. That's a very specious measure. The proper measure is the combat capability that we get for what we and they spend. Our nation has properly seen fit to pay our soldiers a reasonable wage. China and India and many other countries pay their soldiers a pittance in comparison to the U.S. What would it cost the U.S. to own their military? At what we pay our soldiers, I doubt that we could afford to own China's army.

The real measure of merit is how much combat capability we have in comparison to what others have. Combat capability is what counts, not dollar equivalents.

What about the aerospace industry in all this?

I think we're looking at a difficult time. I don't think it will be as difficult as it was right after the Cold War ended, when we lost three-fourths of our companies or parts of companies and 40% of employment in the aerospace business. But it will be difficult.

How will the military be affected overall by funding cuts?

I think we'll see more change in missions and in the combat units, toward smaller and more adaptable units. I think that's appropriate. But I worry that we may swing the pendulum too far and have a military force made up of too many special forces type units. We shouldn't forget that there are still large armored forces in the Middle East, North Korea, China. There are plenty of places in the world where we might need to fight with conventional forces, and so I fear we may go too far with our change of emphasis on small units. We have to be broadly prepared so we can fight wherever we have to.

Are you concerned that we're cutting our fighter force too much?

I think it's a serious danger that we may be doing that. We probably don't need the huge numbers of fighters that we had many years ago, but we'd better have enough fighter capability to be able to control the air wherever we fight.

Modern fighters have become awfully expensive, though, haven't they?

We simply have to be able to produce manned aircraft that don't cost so much. Remember *Augustine's Laws*? I put them together in 1967 and into a book in 1982. I wrote back then that if we kept going the way we were going, military aircraft would wind up costing so much that we would be able to afford only one aircraft, and the services would have to share it. Last year, *The Economist* updated my work with new data that showed my trend was right on the money, that we are now a little more than halfway to where I said we were going to go—being able to afford only one airplane.

Why haven't we been able to reverse that trend?

The big problem is the defense acquisition process. We've been talking about reforming it ever since I worked for David Packard when he was deputy secretary of defense back in the early '70s. He had it right on how to do acquisition. Somehow we have lost our way since then.

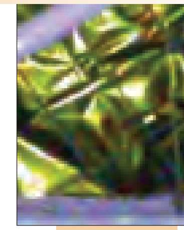
All things considered, where do you come out? How do you see the future shaping up for our country?

We are a nation in trouble. But there have been many periods in our history where we faced enormous problems and where there was a question of whether the nation would even survive. I'm optimistic about our ability to work through our problems.

The thing that's different this time is that we have a broader variety of major problems, as opposed to just one or two. We know what our problems are and what needs to be done. I think if we can show political courage and statesmanship, we can do it.

"We know what our problems are and what needs to be done. I think if we can show political courage and statesmanship, we can do it."

If we can't show those qualities, I think we're in the first stage of a serious decline as a country. The good news is that most of the things you and I have talked about—space, national defense, energy, the environment—are all things we can control. We don't have to ask China's permission or anyone else's to fix our schools and find new energy sources and have a sound space program. We control our destiny. As long as we can say that I think we're going to be fine.



The Dragon roars

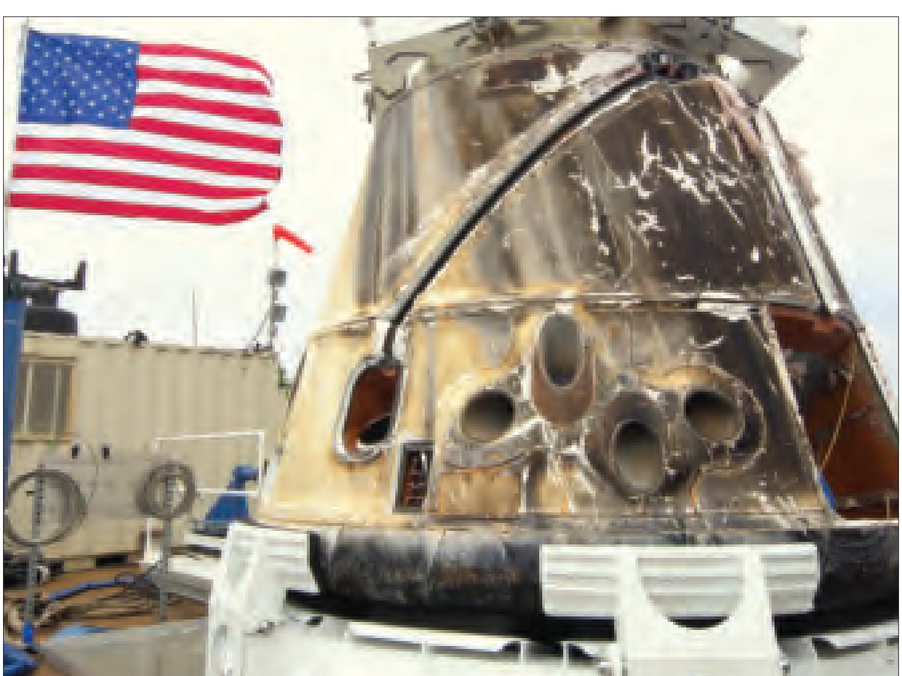
WHEN THE SHIPS FOUND DRAGON, bobbing on Pacific waves off Baja Mexico,the scars of its journey were evident. Blackened and scorched, torn by parachute deployment, the spacecraft's polished white skin had been sacrificed to the demands of survival. Dragon had ripped down through the atmosphere from 230 miles up, fending off temperatures of 3,000 F in the battle between heat shield and white-hot blowtorch of reentry.

Superheated reentry shock plasma is a hungry beast, always seeking weakness and the chance to devour the structure of a spaceship. On each of my four shuttle reentries, I glanced up from checklists and instruments in half-amazement, half-fear. Outside, a neon orange-pink glow licked across our windows, then wrapped itself into a flashing, incandescent vortex in our wake. In a grim foreshadowing of Columbia, one of my orbiter crewmates watched the spray of fire outside and joked, "I wonder what color aluminum makes when it burns."

Dragon survived its own hypersonic ordeal, its blunt PICA heat shield battering at the atmosphere until drag finally slowed it below the peak heating zone. The ionized plume enveloping the capsule had cut off telemetry; on Earth we had to wait and watch, fascinated to see if the ship had come safely through the fire.

The Falcon 9 rocket's engines ignite on the SpaceX launch pad at Cape Canaveral Air Force Station on May 22. Credit: SpaceX.

A NASA airborne camera finally caught Dragon's infrared glow. When three parachutes billowed and slowed the spacecraft, it was all over except the rapid-fire popping of champagne corks at SpaceX headquarters in Hawthorne, California.



Dragon rests on the barge after being retrieved from the Pacific Ocean after splashdown. Credit: SpaceX.

Launching a new era

When Dragon slipped safely into the Pacific and recovery teams hoisted the capsule and its return cargo aboard a waiting barge, the SpaceX team could celebrate a remarkable achievement. The May 31 splashdown and recovery marked the end of a nearly perfect voyage to the ISS, notching a long list of accomplishments. The Dragon C2+ flight was the third consecutive successful launch of the company's Falcon 9 booster, which roared aloft on 854,000 lb of thrust in the predawn hours of May 22.

The mission's first launch attempt on May 19 was inauspicious. A predawn countdown led to a last-second pad shutdown when one of Falcon 9's engine purge valves stuck open, causing the number 5 combustion chamber pressure to exceed redline limits. Engineers replaced the valve, and three days later Falcon 9 lifted Dragon from Cape Canaveral's Launch Complex 40 on a brilliant pillar of flame reminiscent of Atlas or Saturn launches. A single Merlin engine on the second stage, also burning RP-1 and liquid oxygen, placed Dragon precisely onto its rendezvous trajectory.

Shortly after orbital insertion, Dragon deployed a pair of rectangular solar array wings. The solar arrays unfolded on fairings on the flanks of an unpressurized cylindrical trunk, the capsule's lower half. SpaceX founder and chief executive Elon Musk said the start of the cargo delivery demonstration flight was "like winning the Super Bowl."

The original Commercial Orbital Transportation System 2 (COTS 2) mission was to demonstrate Dragon orbital operations, including orbit adjustments, initial rendezvous maneuvers, communications with ISS, sensor operations, extended systems operation in the space environment, and tests of spacecraft avionics and software. The COTS 3 flight was to rehearse a safe approach to ISS, then close for proximity operations directly below the station. Once in a stable position just 10 m below the ISS, Dragon would demonstrate free drift (thrusters off) mode and await capture by the station crew. After berthing, cargo transfer would continue for about a week, followed by separation, deorbit, and recovery. NASA and SpaceX combined these objectives in the C2+ mission.

Impressive orbital debut

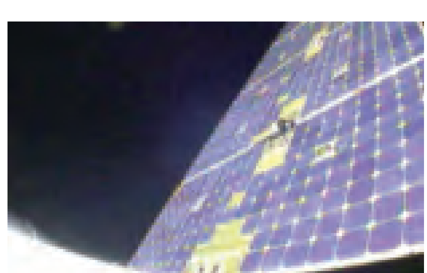
Many space observers and policy specialists were skeptical that SpaceX could pull off this ambitious agenda in a single mission. Software problems had delayed the launch repeatedly and led to several NASA reviews. Prior to launch, I gave SpaceX just 50/50 odds of a complete mission success. I thought the launch would succeed, but that the spacecraft was unlikely to make it all the way to the station. After all, Dragon had only flown once before, on a two-orbit flight in December 2010. That mission had not demonstrated any of the power, propulsion, and avionics capabilities needed for ISS rendezvous and berthing. For the C2+ flight, NASA had hedged its bets,

From the ISS, Dragon can be seen on May 25 as the station's robotic arm moves it into place for attachment. Photo: NASA

loading Dragon with only 1,146 lb of nonessential cargo: food, clothing, batteries, laptops and computer gear, and 46 lb of NanoRack/CubeLabs science experiments and packaging.

But once in orbit, Dragon began demonstrating remarkable maturity. Eighteen Draco 90-lb thrusters conducted a series of orbit control and rendezvous burns, closing to within 1.6 mi. of the ISS while showing safe sensor, communications, and maneuvering capability.

On May 25, Dragon cautiously approached ISS along the R-bar, the imaginary line between the center of the Earth and the station. Expedition 31 crewmembers Don Pettit and Andre Kuipers monitored the spacecraft using a UHF communications link. From the ISS cupola, they spotted Dragon against Earth's spectacular landscapes by day, and tracked the capsule's flashing strobe light by night. Flying close formation just 33 ft beneath the station's Harmony module (Node 2), Dragon stabilized and went to free drift on command.



Two solar arrays power Dragon as it begins its travels. Credit: SpaceX.

Few situations give astronaut crews greater pause than a multiton vehicle drifting close to their own spacecraft. I had heard colleague Mike Foale describe firsthand the terrifying 1997 Progress collision with the Mir station, and had worked on the space shuttle during satellite retrievals and ISS docking operations. On STS-80 Columbia, my crew had deployed the Wake Shield 3 satellite; as that 4-ton spacecraft performed its separation maneuver, we sweated bullets as it glided by, barely 2 ft above our cabin windows.

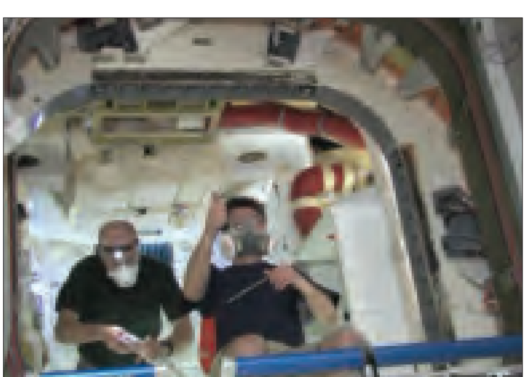
Pettit and Kuipers took no chances with Dragon, which hovered in darkness, lit eerily by station work lights. A planned grapple in direct sunlight would have forced a wait for another half-orbit; during that time, Dragon's avionics and software might receive some false sensor input and initiate an automatic abort. The crew decided to move in immediately with Canadarm II. The pair closed the end effector snares over Dragon's grapple pin at 0956 EDT on May 25. "Houston, looks like we've got a Dragon by the tail," quipped Pettit. Two hours later, the astronauts swung the first private craft to visit ISS into berthing position against Harmony's Earth-facing port.

Completing the sweep

Aboard ISS, the 24-ft-tall, 12-ft-wide Dragon drew power and conditioned air from the station's systems as the crew unloaded the welcome cargo. Pettit reported no debris visible inside the pressurized volume, and observed that the internal environment looked inviting for future astronaut crews who might ride Dragon to orbit. The station crew packed Dragon for return with 1,455 lb of used equipment, scientific samples, and spacesuit hardware no longer needed aboard. Early on May 31, Pettit and Kuipers activated the ISS common berthing mechanism, unberthed Dragon, and released it into orbit.

The spacecraft performed a series of separation burns, departing safely from ISS, then positioning itself for deorbit. The capsule closed its guidance, navigation, and control systems compartment door, fired thrusters for reentry, then jettisoned the unpressurized trunk and solar arrays.

Dragon followed a guided, lifting reentry profile, targeting a splashdown point about 560 mi. southwest of Los Angeles. After deploying its trio of 116-ft main parachutes at about 10,000 ft, Dragon hit the water at 16-18 ft/sec, ending its voyage at 11:42 a.m. EDT. Recovery crews soon had the spacecraft on deck and on its way to the port of Los Angeles, to be trucked to SpaceX's McGregor, Texas, facility.



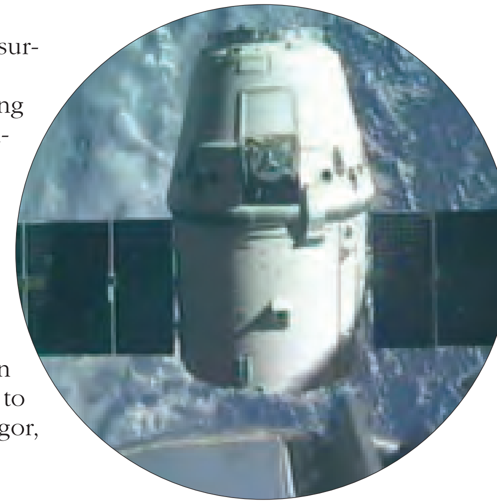
U.S. astronauts Don Pettit and Joe Acaba collect air samples from inside Dragon. As with all visiting cargo vehicles, the astronauts wear breathing and eye protection to guard against any stray material. Photo: NASA.

Six-year saga

Dragon's return marked the first operational success of NASA's COTS program, inaugurated in 2006 under the Bush administration to supplant the space shuttle's massive cargo capacity to and from ISS. Commercial cargo services were to have been in place by 2009, but delays with SpaceX and Orbital Sciences' Antares/Cygnus vehicle left NASA with no domestic upmass capability. Even with shipments by Russia's Progress, ESA's ATV, and JAXA's HTV, NASA would still face an upmass shortfall of roughly 40 metric tons through 2015. The shuttle's retirement also cut off return of so-called downmass, so Dragon's recovery was doubly welcome.

"I just don't think it's going to take us very long to make the determination this was an extremely successful mission, and [SpaceX] should be well on the way to starting services," declared Alan Lindenmoyer, the manager of NASA's commercial cargo development program.

The $800-million COTS program, funding private development and testing milestones, is now materially closer to enabling regular cargo runs to ISS. SpaceX and NASA signed a $1.6-billion commercial resupply services contract in December 2008 for 12 flights to the station through 2015. Orbital Sciences will receive about $1.9 billion for eight cargo flights during the same interval. The flight rate is expected to be about three or four missions per year.



After six days at the ISS, Dragon departs for its return to Earth, carrying a load of cargo for NASA. It carries a high-tech, high-performance heat shield to protect it during the return through the atmosphere. All other cargo resupply vehicles burn up during reentry. Photo: NASA.

SpaceX plans the next Dragon flight, the first in its operational cargo runs, for late September. Orbital hopes to fly its first Antares booster from NASA Wallops in early autumn, with a Cygnus demonstration flight to ISS before the close of the year.

Boost for commercial crew

The Dragon success is widely perceived as a boost to NASA's execution of a crucial 2010 Obama administration policy shift that canceled the government's Ares I and Orion crew transport plan for ISS and replaced it with private, contract transportation. SpaceX has designed its Dragon from the ground up for astronaut transport. The dramatic C2+ success is a step toward what the company hopes is a contract to carry NASA crews to ISS.

NASA's commercial crew development (CCDev) program funds several other competitors to SpaceX, in a strategy to produce economical, safe crew transport. Those companies are Blue Origin, Boeing, and Sierra Nevada. NASA is predicting that, under current funding assumptions, the first astronauts may launch on a private vehicle to the station in 2017.

Major obstacles remain. To create a successful crew transport capability, private firms must demonstrate a reliable booster; ground egress and safety systems; a robust, flight-tested launch escape system; reliable, failure-tolerant avionics and life support systems; and a recovery system capable of landing a crew safely on land or sea. NASA may also want industry to provide an ISS crew lifeboat, which would remain docked at the station for up to six months to provide a means for rapid departure in case of emergency.

With Dragon, SpaceX is certainly closer than any of its competitors to meeting most of those requirements. But Sierra Nevada has begun aerodynamic flight tests of its Dream Chaser lifting body vehicle based on the old HL-20, and Boeing recently tested recovery parachutes for its CST-100, designed to launch atop the existing Atlas V. Blue Origin limits information about its orbital Space Vehicle, but in May the company completed a system requirements review, a milestone on the way to an ISS-capable vehicle. ATK, with its shuttle-booster-based Liberty rocket and capsule concept, is eager to compete in the next round of CCDev competition.

The biggest challenge NASA faces is how to fund all these competitors through preliminary design review, when the agency can assess the technical and cost performance of each firm and select a design for orbital transportation services. Congress gave NASA only half the CCDev funds the White House wanted this year, and the House of Representatives has again proposed cuts to this year's $800-million administration request.

Much attention in April followed a letter from Apollo commanders Neil Armstrong, Jim Lovell, and Gene Cernan backing a House appropriations bill that called for NASA to select a single private CCDev firm. The rationale was that a downselect would speed progress, restore to NASA the needed oversight of crew transport vehicle design, and better match the limited funding Congress is likely to provide through 2017.

Reaction came quickly from the Commercial Spaceflight Federation, which represents many of the 'new space' companies. Federation president and former astronaut Michael Lopez-Alegria stated that it was vital for Congress to preserve "competition in the program, as the vehicles are not sufficiently mature to enable NASA to confidently select a single vehicle at this time. The next phase of the program should also maintain the use of Space Act agreements, which require meaningful investment by the competing companies to augment NASA funding." In this election year, with the House opposing administration policy and a continuing budget resolution likely, the agency will probably see funding for CCDev again fall short.

Dragon lands in the Pacific. Credit: NASA/U.S. Navy.

Restoring a national capability

I have little doubt, based on the SpaceX success and continuing progress from the other CCDev partners, that private firms will meet the technical challenges of orbital flight. NASA is providing them with appropriate engineering and safety advice, based on its half-century of orbital flight experience. I do worry, however, about how long it will take the agency to realize a private crew transport capability.

We will be depending on Russia to meet our crew transport needs for at least another five years—longer, if the private firms experience a serious failure in flight testing, or if congressional funding fails to materialize. The presidential election may also lead to another space policy review, which could further slow progress in 2013.

These delays put the ISS, representing a $100-billion U.S. taxpayer investment, at heightened risk. With shuttle retirement, NASA lost its ability to mount an extensive orbital repair campaign to deal with an emergency at the outpost. We have neither the domestic crew transport nor a quick-response cargo system to get vital repair equipment and trained crews into orbit. Today, a serious orbital crisis could force NASA to abandon ISS.

With the current 2017 target for resuming U.S. crew launches, our government is taking a gamble: that the station will face no serious emergency until private firms eventually restore our human launch capability. The White House and Congress seem content to let the bet ride indefinitely.

Political leaders and technical managers should move now to protect our investment. Build on SpaceX's success, but go it one better: Accelerate the funding pace, let NASA decide on the right rocket, and advance the date when the U.S. can once again put its own citizens into space.

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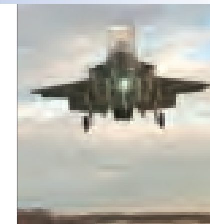


F-35 faces cost-sensitive export market

IN APRIL, CANADA'S PLANNED PROcurement of Lockheed Martin's F-35 Joint Strike Fighter took an unexpected and unprecedented turn. After an auditor found that Dept. of National Defence officials withheld key F-35 cost information from Canada's Parliament, the government created a new F-35 secretariat with power over the proposed buy. The government also agreed to commission an independent report of F-35 acquisition and costs before making any purchase. In addition, it capped total funds for acquiring 65 F-35s at $9 billion Canadian ($8.9 billion), including weapons, support infrastructure, initial spares, and simulators.

Canada's new approach to buying the plane is not unique. Other F-35 international partner countries, such as Norway and Australia, are making it clear that their participation depends on the aircraft being sold at an affordable price. This speaks to a much broader concern about the F-35: Its price tag may simply be too high for a cost-sensitive international market.

The growing but small top end

The current unit price for the F-35A is approximately $118 million. Even if that figure is reduced to the current goal of $71.5 million (in 2012 dollars), it is still high relative to the traditional behavior of the world fighter market. A look at past customers for fighter aircraft with a URF (unit recurring flyaway) price tag higher than $65 million reveals a small and slowly growing club.

The first export customer to operate high-end fighters was Saudi Arabia, which in 1967 took delivery of its first English Electric Lightnings (Kuwait also ordered 14 Lightnings, but they proved too expensive and difficult for the country to operate and were quickly phased out).

In the 1970s, Australia purchased F-111s. Just after that, Israel, Japan, and Saudi Arabia bought F-15s. This elite group remained at just four countries until the 2000s, when Singapore

F-35

and South Korea also ordered F-15s. Technically, Austria took Eurofighter Typhoons in this time frame and could be counted too; but those 15 planes are operated with extensive logistical and training support from Germany's air force and thus do not really represent a commitment to purchase and operate high-end fighters.

The latest development in this high-end market is the India Air Force's (IAF) 2011 selection of Dassault's Rafale for its Medium Multirole Combat Aircraft competition. While this has yet to result in a firm contract, the current plan is to purchase 126 aircraft—a record export fighter buy—worth over $10 billion (in aircraft URF costs alone). That would represent a major breakthrough. But if Indian government cost concerns prevent the IAF from executing its plan, that will be evidence that the high-end fighter market is a difficult club to join.

Also noteworthy is that the only firm and semifirm F-35 customers as of this year come from this top-end user group. In December 2011 Japan selected the F-35A for its latest F-X fighter requirement. The Japan Air Self Defense Force will buy 42 F-35As, with a unit price of about $123 million. In October 2010 Israel requested an initial batch of 19-20 planes for an estimated $2.7 billion. A firm contract could be signed before year's end.

The only other purchases have been for test aircraft, but again it is noteworthy that the largest batch of these has been for a high-end fighter user. In November 2009 Australia decided to buy an initial batch of 14 aircraft. These will cost $3 billion U.S., including support and infrastructure.

Therefore, going just by what we know about the history of the fighter market, only six export countries have ever purchased aircraft in the F-35 price class, with a seventh about to sign on.

Sources of high-end growth

There are four reasons that this high-end market could grow.

First, there is an upper middle segment that is just as large as the high end. Seven export countries have purchased aircraft in the $50 million-$65 million class, and in terms of purchasing and operating economics, it would not be a difficult stretch for them to move upward. However, not all of the countries in this segment—Canada, Finland, Kuwait, Malaysia, Spain, Switzerland, and the United Arab Emirates—can be counted on to make this leap. Switzerland, for example, in November 2011 rejected the top price tier Rafale in favor of the Saab Gripen NG, largely because of cost.


Rafale

The second possible reason the top end could grow is that some countries are currently not top-tier export customers, but do purchase domestically produced planes in this class. There are five countries in this category. Italy, Spain, and the U.K. will likely have no problem making the jump from Eurofighter to the F-35 price tag. Italy has even taken the step of lining up an F-35 FACO (final assembly and checkout) facility to replace its still-active Eurofighter production assembly line.

Germany, however, faces a very difficult budget environment and has relatively limited defense requirements. Purchasing an imported aircraft as costly as the F-35 might prove difficult, even if the country is currently buying 140 Eurofighters for a similar price. The fifth country in this class, France, will likely stay with the Rafale as its long-term fighter, with production extended by India's decision to become a second major customer.

The third possible trend that could help grow the top tier is that, for reasons of economics, countries are buying fewer fighters. Labor costs are expensive and fast inflating because of indirect costs such as health care and retirement funding. Air power, along with most other forms of defense, is becoming less labor intensive. There are fewer but more capable planes, using fewer pilots, fewer maintenance specialists, and smaller ground crews. Opting for lower numbers of more capable jets is a good way to keep labor costs under control.

Also, in most countries the cost of infrastructure, pilot training, and air base construction has risen faster than airplane prices. As with higher labor

THE TOP END FIGHTER MARKET ($65+ M URF)
By price point

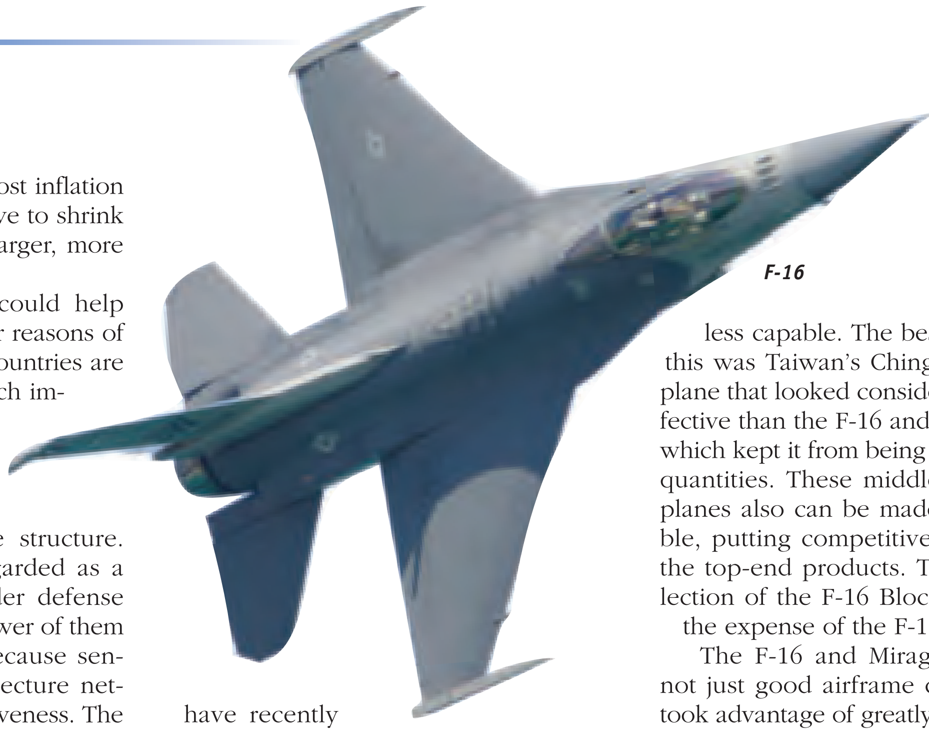
1960s	1970s - 90s	2000s	2010s
Saudi Arabia	Australia	Australia	Australia
	Israel	Israel	Israel
	Japan	Japan	Japan
	Saudi Arabia	Saudi Arabia	Saudi Arabia
		Singapore	Singapore
		South Korea	South Korea
			India?

prices, this infrastructure cost inflation has created a fiscal incentive to shrink force structures and buy larger, more capable aircraft.

The final trend that could help grow the top tier is that for reasons of strategy and technology, countries are buying fewer fighters, which implies a need for more capable models. Fighter aircraft have become a less important part of the overall military force structure. They are increasingly regarded as a 'node,' a part of a broader defense system. That means that fewer of them need to be purchased, because sensors and battlefield architecture networks multiply their effectiveness. The entire point of network-centric warfare systems is exactly that: to provide a 'force multiplier.'

When forces shrink, countries will likely opt for more effective aircraft. These larger and more capable jets can take advantage of the full range of external targeting and tracking data. They have the onboard physical space and electrical power needed for advanced avionics and systems. The larger aircraft also have the range and operational flexibility to compensate for reduced numbers.

As part of the same process, countries are also shifting their defense funds away from large numbers of platforms such as fighter planes and toward sensors such as satellites and airborne early warning (AEW) aircraft. South Korea and Turkey, for example, recently acquired their first AEW aircraft, joining many other countries that have recently decided to do the same, such as Greece and Taiwan. These AEW planes also serve as force multipliers, and again increase the incentive for countries to acquire more capable planes that can use the increased air battle information.



F-16

The unappreciated middle

The middle segment of the world export fighter market—encompassing aircraft with $35 million-$50 million URF price tags—includes 30 countries. That is more than the other three segments combined. This is the segment that determines the success of most global fighter programs, and is therefore the segment that will determine whether the F-35 has broad market appeal.

The key driver in this middle market segment is value for money. It is not just that the countries in this part of the market are seeking good value. It is also because this segment's offerings—Lockheed Martin's F-16, and to a lesser extent Dassault's Mirage 2000—provide a very good value for the money. The F-20, the final incarnation of Northrop's F-5, the best light jet fighter of all time, was basically destroyed by a head-to-head competition with the F-16. Although the F-16 was more expensive, it was much more effective and offered excellent value for the money.

In terms of combat effectiveness, these aircraft make lighter, less expensive planes look inefficient and much less capable. The best example of this was Taiwan's Ching Kuo, a light plane that looked considerably less effective than the F-16 and Mirage 2000, which kept it from being built in larger quantities. These middle market airplanes also can be made more capable, putting competitive pressure on the top-end products. The UAE's selection of the F-16 Block 60 came at the expense of the F-15.

The F-16 and Mirage 2000 were not just good airframe designs; both took advantage of greatly improved jet engine technology. Thanks to advances in gas turbine design and materials, single-engine medium fighters came to have the power, range, speed, payload, and reliability previously found only in high-end craft. This gave new single-engine fighters very good value. In fact, the F-35 will take further advantage of this trend, being the most capable and expensive single-engine jet ever built, by a wide margin.

Electronics system miniaturization also allowed these midmarket planes to carry sophisticated integrated electronic warfare packages, also previously reserved for larger classes of fighters. The F-16 Block 60's Northrop Grumman Falcon Edge, for example, is one of the most capable and expensive EW systems built.

The trend toward larger and more capable planes also follows advances in radar, airframe, and software tech-

Mirage

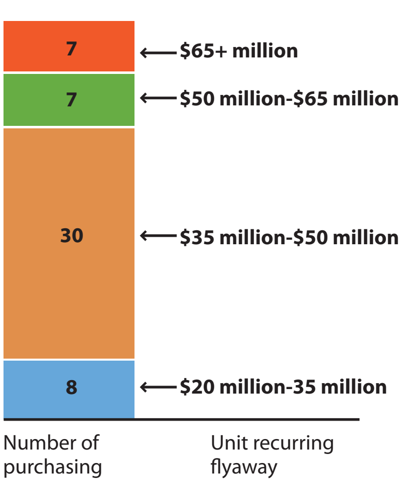
F-15

nology. These improvements have made aircraft more multirole, allowing countries to replace multiple types of single-mission aircraft with single types of flexible planes. Singapore, for example, was able to replace its F-5 fighters and A-4 attack aircraft with heavier F-16s, which play both roles equally well. The F-15s, purchased by Singapore more than a decade after the F-16s arrived, offered a completely new capability.

The biggest problem with the middle market is a failure of the supply side. There are no fewer than three Western export fighters competing in that small high-end size class. By contrast, the F-16 and the Saab Gripen are the only middle market competitors. When the Mirage 2000 ended production, Dassault effectively abandoned this segment. The company's Mirage III/V, Mirage F1, and Mirage 2000 all had one thing in common: They derived two-thirds of their sales from exports. Until India, Rafale received no export orders at all.

While the Gripen is a good product, it suffers from a very weak home market. Sweden has procured the type at only a very low rate, and plans on operating a fleet of just 100 Gripens over the coming decades.

WORLD EXPORT FIGHTER MARKET STRUCTURE
By price point



That leaves the F-16. At the February 2012 Singapore Air Show, Lockheed Martin announced a new updated version, the F-16V. While there are no announced orders thus far, the new aircraft represents a significant change in the company's approach to the market. Until the announcement, the company seemed to be downplaying the F-16, in order to avoid competing with its own F-35. But the F-16V represents an effort to update the aircraft with such modern features as an airborne electronically scanned array radar, while keeping the product at a reasonable middle market price.

Clearly, Lockheed needs to walk a line in its approach to this market. Competing with itself is bad. But losing a big part of the export market because its F-35 remains too expensive for many users is a worse alternative.

The vanishing low end

While the top and middle segments remain strong, the bottom segment—nations that are only able to import aircraft in the $20 million-$35 million class—has shrunk considerably and now consists of just eight countries. The primary reason for this shrinkage is global economic bifurcation: What was once called the third world is now splitting into 'developed countries' and 'marginal countries.'

For example, in the 1960s, South Korea and Kenya were both part of the third world. Both bought imported entry-level fighter aircraft such as the F-5. But many third-world countries went on to either advance or stagnate. Korea is now a developed country, and its air force acquired F-4s, F-16s, and F-15s as its buying power increased. Kenya has stagnated, both economically and in terms of global strategic relevance. It still operates aging F-5s as its sole fighter force.

In short, thanks to this split between 'haves' and 'have nots,' many countries that once bought light fighters like F-5s now fall into one of two camps. If, like Korea, they have developed, they now operate much more capable planes such as F-16s or Mirage 2000s. Another good example is Saudi Arabia. Once one of the biggest


Gripen

F-5 customers, it now exclusively operates twin-engine heavy combat aircraft (F-15s, Tornados, and Eurofighters). Even Malaysia, one of the least wealthy fast-growth Asian economies, has moved from F-5s to F/A-18s and Su-30s.

At the other end of the spectrum, countries that have stagnated, like Kenya and many other African countries, have almost disappeared from the marketplace. If they buy planes, they are either used or relatively inexpensive and unreliable Chinese-built aircraft.

This split has been worsened by increased oversight from international financial organizations, particularly the World Bank and International Monetary Fund. Even when the poorer or distressed countries have wanted to spend their money on fighters, these financial organizations have threatened to withhold funds or loans. In the 1990s and 2000s, this factor hurt the low-end fighter market, even for such relatively successful countries as Indonesia.

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The world export fighter market, in short, is limited in size at both the low end and the high end. The high end may experience growth, but the only certainty is that the middle market continues to prosper. Thus an examination of the world export fighter market indicates that the F-35 may be in for a difficult time.

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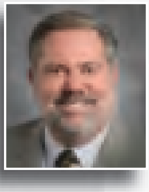

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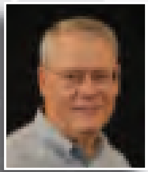

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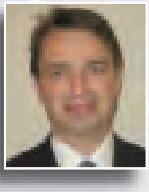

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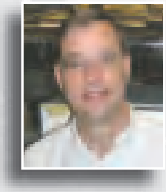

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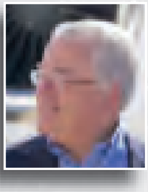

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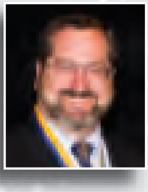

AIAA Survivability Award
Joel Williamsen
Task Leader, Live Fire Test and Evaluation
Institute for Defense Analyses
Alexandria, Virginia

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Honoring and awarding such achievement is an important AIAA tradition. Every quarter, award recipients are showcased through our Honors and Awards Program, so that all members have the opportunity to recognize and congratulate their peers.

April 2012 and June 2012 include:

AIAA Thermophysics Award

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Award Nomination Process Streamlined!

The Honors and Awards Committee is pleased to announce that the award nomination process has been streamlined to reduce the paperwork burden upon nominators and to better communicate award guidelines.

New to the process is a limit of seven pages for the nomination package, whether submitted online or hard copy. In addition to the nomination form, supporting materials include a one-page basis for award, one-page resume, one-page public contributions, and a minimum of three one-page signed letters of endorsement from AIAA members. Five letters of endorsement (including the three required letters from AIAA members) may be submitted, and increasing the page limit to nine pages.

Any AIAA member in good standing may serve as a nominator. Nominators are strongly encouraged to begin using the streamlined award nomination process, and are reminded that the quality of information is most important. Full implementation of the new process including the page limits will begin on 1 January 2013.

AIAA members may log into www.aiaa.org, MY AIAA, with their email address and password to submit a nomination online or to download the nomination form.

For further information, contact AIAA Honors and Awards at **carols@aiaa.org** or **703.264.7623.**

Thank You Nominators!

AIAA extends a sincere Thank You to those who devoted their time and effort to preparing and submitting the nomination packages.

Robin Beck	*Mireille Gerard*	*Lt Gen Michael Hamel (Ret.)*	*John Schmisseur*
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AIAA
The World's Forum for Aerospace Leadership

Acquisitions reshape aerospace and defense industry

U.S. AEROSPACE AND DEFENSE COMPAnies are preparing for a rapidly changing market by spinning off businesses and buying new enterprises in related areas. Up and down the supply chain, mergers and acquisitions promise to reshape the U.S. industry during the next few years.

Acquisition and divestiture activities in recent years have been extremely numerous and varied, ranging from spinoffs to hostile bids. For example, the planned $16.5-billion purchase of Goodrich by United Technologies is the largest acquisition in the industry for more than a decade. Assuming it moves ahead, it will set off shock waves throughout the sector. L-3 Communications is on the verge of spinning off a $2-billion portion of its defense business. ITT broke up into three companies, spinning off its defense division in late 2011.

GeoEye, a satellite imagery firm, made a hostile $792-million bid for DigitalGlobe in early May. The move is a rarity in the industry and reflects an increasingly aggressive acquisition environment. Cutbacks in government budgets are already having ripple effects and forcing consolidation.

Another potentially hostile bid by U.K.-based Cobham for satellite communications equipment manufacturer Thrane & Thrane in Denmark was narrowly averted when Cobham raised its offer to a level the Danish company's board of directors would support.

In both defense and commercial aerospace, the prime contractors have large cash reserves they want to put to work. And acquisitions provide much more attractive returns than simply holding the cash at low interest rates.

Rocketdyne is now on the market, since it lost a large part of its business with the end of the space shuttle program.

Seeking expansion

Defense prime contractors are facing a dilemma. They have been achieving record profit levels in recent years. At the same time, however, there are few new programs, so investing heavily in R&D offers very uncertain returns. This, combined with the low return on cash, creates considerable pressure to invest by acquiring other companies that have already won work.

Defense firms are going after businesses in potential military growth niches such as UAVs and ISR (intelligence, surveillance, and reconnaissance). They are also pursuing adjacent areas such as homeland security, cyber security, health information technology, alternative energy, and even commercial aerospace. To avoid past problems with diversification, they are sticking closely to technologies and markets they understand, selling primarily to the federal government.

In commercial aerospace, different dynamics are at work in the acquisition drive. As manufacturers attempt to build up production to meet the boom in demand for commercial airliners, they may choose to integrate vertically. A company may find that by taking over selected suppliers it can make them stronger and thus ensure it can meet its own ambitious production ramp-ups.

The pressure for subcontractors to become larger is undeniable. Prime contractors are looking for more capable subcontractors who can provide more complete systems and require less supervision. Primes also are seeking subs that can offer risk-sharing capital on many commercial aerospace programs. Efforts to achieve scale, as well as a desire to spread overhead to reduce costs, further push companies to grow. Clearly, both primes and subs have strong incentives to expand their businesses through acquisitions.

Far-reaching effects

United Technologies' planned acquisition of Goodrich, if it proceeds, will force many competitors and subcontractors to come to grips with the industry's changing environment. The largest merger in years, it promises to reshape the aeroengine supply chain. Combined, these companies would be able to design more complete systems that would integrate engines, nacelles, thrust reversers, and other subsystems. This might then provide a competitive boost that would lead other engine manufacturers to expand their capabilities as well.

The planned acquisition will also have a secondary impact. To preserve its credit rating, United Technologies plans to raise $3 billion by spinning off businesses that include Rocketdyne and three Hamilton Sundstrand industrial components divisions. Rocketdyne, which had $750 million in sales last year, built engines for NASA's shuttle program. Although it will not have as much work as it had when the shuttle was operating, it will continue to work on Air Force ELVs and future engines for NASA.

There may be further divestitures required as a condition for allowing the acquisition to move ahead. European antitrust regulators have opened an in-depth review of the merger's competitive implications. "The aviation equipment industry is already concentrated and is characterized by high barriers to entry," noted Joaquin Almunia, the European Commission's antitrust commissioner, in a March 27 statement. "We need to make sure that competition is preserved and incentives to innovate remain. We must also prevent a rise in input prices for aircraft and engine manufacturers as well as other aviation equipment suppliers."

The EC expressed concern specifically about engine controls and aircraft power generators, areas in which United Technologies and Goodrich have large combined market shares. Another concern involved the potential to eliminate Goodrich as an independent supplier of engine controls and fuel nozzles. In addition, there were worries about Goodrich's supply of aftermarket services.

More restructuring

Assuming those concerns can be addressed and the acquisition moves ahead, UT's management is likely to go through Goodrich's businesses to identify any that do not fit in the combined company. For example, United Technologies sold Italy's Microtechnica in a management buyout in July 2008. Goodrich bought it in April 2011. Microtechnica provides flight control actuation systems for helicopter, regional, and business aircraft, and aircraft thermal and environmental control systems. Now UT must decide again whether the business fits within its future strategy.

Defense companies are actively involved in reshaping their portfolios as well. L-3 Communications is on the verge of spinning off Engility, which groups L-3's systems engineering and technical assistance (SETA), training, and operational support businesses. L-3 maintains that keeping such businesses independent will improve their growth opportunities because it will remove concerns about organizational conflict of interest. It will also enable creation of a low-cost operator in the field. The new company will have about $2 billion in sales, with approximately 10,000 employees.

In recent years, Northrop Grumman and Lockheed Martin have also made divestitures of businesses because of concerns about the tightening of Pentagon regulations on organizational conflict of interest. Weapons manufacturers have been concerned that retaining businesses that provide systems, engineering, and technical evaluation work could bar them from working on more lucrative contracts to develop and manufacture systems. The L-3 divestitures of SETA businesses imply that it may not be finished with this process yet.

Finmeccanica, which has been struggling with a $2.3-billion loss in 2011, plans to make €1 billion worth of divestitures of noncore businesses to reduce its debt by the end of the year. It is expected to include energy and transport holdings and possibly some noncore portions of DRS Technologies. Finmeccanica purchased DRS Technologies, a U.S. defense electronics firm, in 2008 for $5.2 billion.

As companies seek to provide better value to shareholders, other types of divestitures may be ahead. In response to activist investors who viewed the defense business as holding down the value of the overall company, ITT did a spinoff in October 2011 that separated the conglomerate into three standalone businesses, one of which groups the company's defense work. ITT Exelis, the defense unit, reported $5.8 billion of business last year in areas such as electronic, geospatial, information, and mission systems. In March Northrop Grumman spun off its troubled shipbuilding division as Huntington Ingalls, a naval giant with $6.6 billion in revenue.

Growth niches

Defense companies are also in pursuit of acquisitions in growth market niches such as intelligence, surveillance, and reconnaissance. Raytheon, in its largest acquisition in 15 years, purchased Applied Signal for $490 million in January 2011. Applied Signal works in secure broadband network communications and in cyber intelligence systems, software, and analytics to address sophisticated cyberspace threats.

The manufacturer of target systems such as this BQM-167A has been acquired by Kratos, indicating the desirability of defense niche companies.

UAV businesses are in hot demand, but it is hard to find companies with active programs that are up for sale. In January, Lockheed Martin acquired Procerus Technologies, which manufactures micro air vehicle avionics. Then in May, Kratos Defense announced that it had reached a definitive agreement to acquire privately held Composite Engineering, which develops and manufactures unmanned aerial target systems and provides the BQM-167A/I, BQM-177A/I, and Firejet target systems.

Homeland security is attractive for both defense and commercial aerospace companies because it offers cycles that are different from their primary businesses. For example, Safran, which is chiefly a commercial aerospace manufacturer, has been particularly active in making U.S. homeland security acquisitions. In its largest purchase it acquired the L-1 Identity Solutions homeland security business for $1.19 billion.

The related field of cyber security has been an extremely hot area for acquisitions because of an expected boom in government spending in the field. In the past two years, many large and small defense companies have made acquisitions in this highly fragmented market, including General Dynamics, ManTech, Ultra Electronics, Raytheon, and CACI International.

Increasing diversification

Also of great interest to both defense and commercial manufacturers is the services sector. Because services tend to be more predictable, they can enable manufacturing companies to develop more stability and balance in their business. EADS has been particularly active in this area, having purchased six U.S. and European small and medium businesses in 2011 for over $2 billion. The $960-million purchase of Vizada, a U.S. mobile satellite communications services company, was the largest of those acquisitions.

With the boom in commercial aerospace, even defense companies appear interested in diversifying to build up their presence in the growth market. Lockheed Martin purchased Sim-Industries, a commercial aviation simulation firm based in the Netherlands. Sim-Industries builds flight simulators for the 737 and A320. The company also is finalizing development and certification of its first twin-aisle simulator for the Airbus 330.

"This acquisition demonstrates Lockheed Martin's commitment to expand in adjacent markets with strong, long-term growth prospects that build on our core capabilities," said Bob Stevens, chairman and CEO, in a November 3, 2011, statement. "The combination of Sim-Industries with our military simulation business will provide airlines, civil pilot training centers, and military customers access to training systems that can be provided more quickly and with lower operating costs."

Health care information technology also is attracting considerable interest among defense companies, which see the demands of health care reform as a potential boost for automated medical records and other changes within the sector. In September 2011, Lockheed Martin made the $420-million acquisition of QTC Holdings, a major provider of medical evaluation services for the federal government and the Dept. of Veterans Affairs. That same month, General Dynamics paid $960 million for Vangent, which provides electronic health record services and health informatics.

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The pressures of growth in commercial aerospace and budgetary pressures in defense have combined to push a continuing reshaping of the aerospace and defense industries. Increasingly, management recognizes that an active acquisition program will better prepare their companies for upcoming market shifts and give them greater long-term stability.

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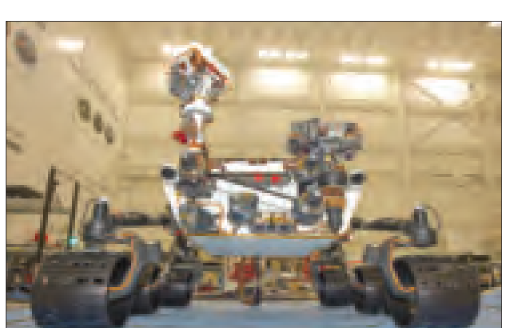
Mars Science Laboratory

Going for a touchdown

NASA's Mars Science Laboratory, launched last November, carries Curiosity, a large Mars rover with equipment more advanced than any that has reached the planet before. The program has faced major challenges, but by far the greatest will be the scorching entry, descent, and landing, scheduled for early August. Whether it succeeds or fails, the mission will have far-reaching ramifications for the U.S. planetary exploration program.

Mars is soon to receive a visitor from afar—space machinery sent from Earth to probe the planet with instruments far more capable than any previously launched to the forbidding Martian landscape.

Sent aloft on November 26, 2011, the Mars Science Laboratory (MSL) totes a car-sized rover called Curiosity, slated to land in early August at Gale Crater on the planet's south equator. The nuclear powered megarover is fully equipped to assess whether Mars ever was—or might be—an ecofriendly environment capable of supporting microbial life, and to determine the planet's habitability.



Curiosity underwent mobility testing inside the Spacecraft Assembly Facility at Jet Propulsion Laboratory.

The process of getting the MSL program off the ground was a saga in itself. Cash infusions were needed during both the mission's difficult birth and years of development and testing. Technical snags delayed its sendoff in 2009. Meanwhile, its cost skyrocketed to some $2.5 billion, including $1.8 billion for spacecraft development and science investigations, plus additional dollars for launch and operations.

MSL morphed into a 'flagship' mission at a time of tightening NASA budgets and a

Curiosity touches down on the Martian surface. The MSL mission's EDL phase will begin when the spacecraft reaches the Martian atmosphere, about 81 mi. above the surface of the Gale Crater landing area, and ends with the rover safe on the surface of Mars. Credit: NASA/JPL-Caltech.

restructuring of the agency's entire Mars exploration enterprise.

Scientifically, the mission continues the thematic sequence of 'follow the water' and 'follow the minerals' on Mars. Now, however, it has become part of an unfolding bureaucratic tale of 'follow the money' and 'follow the confusion' as NASA determines how best to proceed with post-MSL exploration of the planet.

The high-profile adventure could end in a smashing success...or a smash-up on the Martian surface. Either way, it may set in motion a new chapter in exploration of that enigmatic world.

Down and sound

Curiosity's wheels-down meeting with Mars is set for the night of August 5 PDT, when its two-year primary mission of scrutinizing the planet will begin. The mobile laboratory will head for Gale Crater to probe that area's present and past environments, conducting 10 science investigations. Its robotic arm will drill into rocks, scoop up soil, and ingest samples into internal analytical instruments.

Getting down and sound on Mars will entail using active guidance for improved accuracy. Then, in the first Martian 'soft landing,' a Sky Crane will reel out Curiosity for touchdown. MSL's great mass prevented engineers from using airbags for delivery.

Using steerable engines, MSL's descent stage will slow the nested rover down, to eliminate the effects of any horizontal winds. When it has been slowed to nearly zero velocity over the Martian landscape, the rover will be released from the descent stage. A Sky Crane bridle system made of

by Leonard David
Contributing writer

This Mars Descent Imager (MARDI) downward-looking camera will take about four frames per second at nearly 1,600 by 1,200 pixels per frame for about the final two minutes before Curiosity touches down on Mars. Malin Space Science Systems supplied MARDI and two other camera instruments for the mission.

nylon cords will spool out the rover to the ground. Curiosity's wheels and suspension system, which double as the landing gear, pop into place just before touchdown. The metric-ton rover is to be set down at a velocity of roughly 1.7 mph.

When the spacecraft senses touchdown, the connecting cords between rover and Sky Crane will be severed, with the descent stage rocketing out of the way and crashing some distance away.

Unknown unknowns

Following a very complete development cycle, MSL went through an extremely inclusive test program as well. The EDL (entry, descent, and landing) was more in-depth and broader in scope than previous Mars missions, says MSL's project manager, Peter Theisinger, at NASA JPL. "We're pretty confident with respect to EDL," he says.

"I think landing on Mars is, of course, in a class by itself," he adds. "MSL is clearly much more complex [than earlier vehicles] and can carry out much more ambitious science. We're confident in what we have done. The thing that will catch us, of course, will be the unknown unknowns… or if we have a one-off problem."

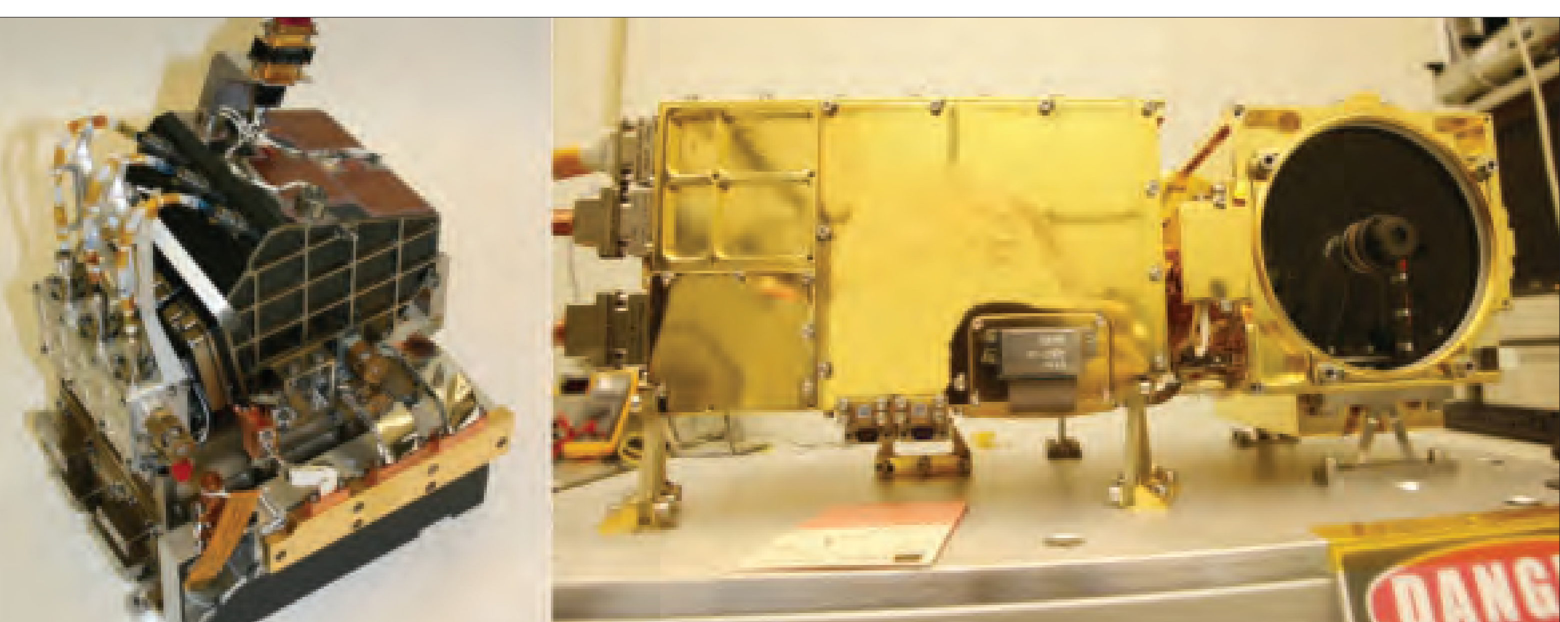
EDL testing on Earth, Theisinger admits, can go only so far. The ultimate EDL will be at Mars itself and will take place there in its entirety for the first time.

"You cannot test as you fly the EDL environment at Mars. We did separation tests and drop tests, too, and we flew MSL's radar on helicopters and F-18s. We tried to simulate cable cutter events," Theisinger notes. But the new environment of Mars is "much more dynamic in reality" than what can be approximated on the ground, he says. "So flying through for the first time will be the proof of the pudding for sure."

MSL's Doppler radar system was fabricated specifically for the mission. Mounted on the descent stage, the radar has six disk-shaped antennas oriented at different angles. It measures vertical and horizontal velocity as well as altitude. Compared with the altitude range radars flown to Mars in the past, "it's a completely different beast," says Theisinger.

Curiosity is powered by a multimission radioisotope thermoelectric generator (MMRTG) supplied by the Dept. of Energy. The MMRTG uses a heat source that contains plutonium-238 dioxide—a non-weapons-grade form of the radioisotope—and a set of solid-state thermocouples that convert the plutonium's heat energy to electricity.

The MMRTG is loaded with 10.6 lb of plutonium dioxide, the source of the steady supply of heat used to produce onboard electricity and warm the rover's systems during the frigid Martian nights. Heat emitted by the MMRTG will circulate throughout the rover system to keep instruments, computers, mechanical devices, and communications systems within their operating temperature ranges.



The two main parts of the ChemCam laser instrument are the body unit, left, which goes inside the body of the rover, and the mast unit, which goes onto the rover's remote-sensing mast. The mast unit, 14.5 in. long, contains ChemCam's laser, imager, and telescope.

"It's an RTG/battery system," explains Theisinger. "We charge up the battery and use it for peak loads during the daylight hours, and then we go to sleep. But we're fully capable when we land, and we will rely on that capability."

The electrical output from the MMRTG charges two lithium ion rechargeable batteries. This enables the power subsystem to meet peak power demands of rover activities when the demand temporarily exceeds the generator's steady output level. The batteries, each with a roughly 42-amp-hr capacity, are expected to go through multiple charge-discharge cycles per Martian day.

At top speed, Curiosity can move across flat, hard ground at about 1.5 in./sec. However, under autonomous control with hazard avoidance, the vehicle achieves less than half that speed on average. The rover was designed and built to be capable of driving more than 12 mi. during the prime mission.

Cross-coupled complexities

"The mass and the size of MSL created cross-coupled complexities," says Matt Wallace, MSL's flight system manager at JPL. "As a result, you get to a point in all of these projects where you kind of scratch your head and ask: Are we really going to get there? But there is a feeling around here that…if it doesn't look impossible, we don't want to do it. And sometimes it's hard to know. You just have to plow forward and see where you go."

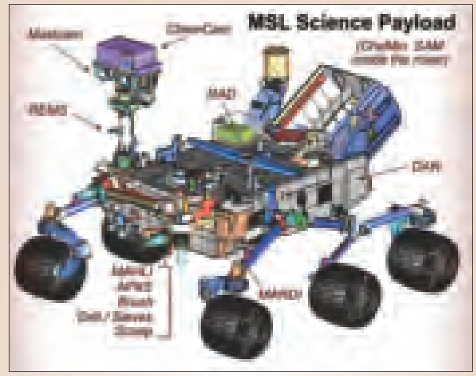
Wallace says that moving from the Mars Exploration Rovers (successfully landed in 2004) to MSL was "unquestionably more difficult than we thought."

Indeed, in early December 2008, NASA announced a slip of MSL's launch from 2009 to 2011. A host of technical issues involving devices such as mechanisms and actuators were plaguing the project, so the agency delayed the mission until the next Mars window of opportunity, to avoid a mad dash to launch.

Curiosity's drive actuators—each combining an electric motor and gearbox—are geared for torque, not speed. The Mars-cold-tolerant actuators were built for the wheels and other moving parts of Curiosity.

The two-year slip evoked a mixed response from the MSL team, Wallace recollects. "The initial response for most of the team members was disappointment. We're used to taking on aggressive tasks, getting them done, and hitting the targets. But there's also a very strong thread of quality in the product…so an element of relief that [the delay] allowed diving in deeper, penetrating the issues that were bothersome. So it was a balancing act, a mixture of feelings for sure."

ROVER BASICS



Science instruments and other tools are placed at various locations on the car-size Mars rover, Curiosity. They are (clockwise, from upper left):

Mastcam, the mast camera instrument.
ChemCam, the chemistry and camera instrument.
RAD, the radiation assessment detector.
CheMin, the chemistry and mineralogy instrument.
SAM, the sample analysis at Mars instrument.
DAN, the dynamic albedo of neutrons instrument.
MARDI, the Mars descent imager.
MAHLI, the Mars hand lens imager.
APXS, the alpha particle X-ray spectrometer.
The brush, drill, sieves, and scoop are tools on the rover's robotic arm.
REMS, the rover environmental monitoring station.

End-to-end simulation

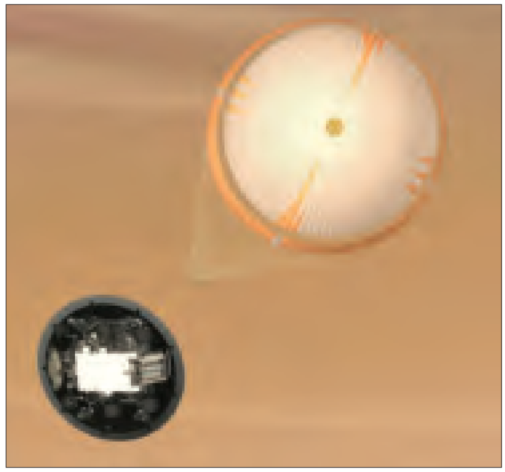
In terms of EDL, how different is MSL from past spacecraft?

"Size matters. That's the biggest thing," is the response from JPL's Al Chen, flight dynamics and operations lead for the program's EDL team. "This wasn't reinventing for the sake of reinventing. We're trying to do something fundamentally different."

"There's the 'test as you fly, fly as you test' philosophy," Chen says. "We tried to follow that with 'simulate as you fly and fly as you simulate.' Everything is heavily test based," he adds. "The key is to stitch it together with an end-to-end simulation that you believe in."

Chen says his team has confidence in the performance of the system. "Part of our job is to minimize the maximum risk. We've gotten everything down to acceptable levels." But there is, of course, risk involved in flying to Mars. "I'm going to feel a lot better when we see that parachute deploy…it's got to work, and I have a hard time analyz-

Curiosity will land in August near the foot of a mountain inside Gale Crater. Credit: NASA/JPL-Caltech/ESA/DLR/FU Berlin/MSSS.



An artist's concept depicts Curiosity's parachute, the largest ever built to fly on a planetary mission. Credit: NASA/JPL-Caltech.

ing it. Parachutes by their nature are an empirical thing…hard to prove they'll work from a pen and paper standpoint."

MSL's 165-ft-long parachute, the largest ever built for a planetary mission, uses a configuration called disk-gap-band. It has 80 suspension lines and opens to a diameter of nearly 51 ft. The parachute is designed to survive deployment at Mach 2.2 in the Martian atmosphere, where it will generate up to 65,000 lb of drag force.

Beating the heat

As Curiosity makes its fiery entry into the Martian atmosphere, it will be cocooned within the largest 'beat the heat' system ever hurled to Mars—an aeroshell comprising a protective heat shield and back shell. The heat shield includes an MSL EDL instrument, or MEDLI, a set of sensors that will record atmospheric conditions and judge how well the shield thwarts the searing temperatures that greet it.

This intense period begins when the spacecraft reaches the Martian atmosphere, traveling at about 13,200 mph, and ends about 7 min later with Curiosity stationary on the surface.

The heat shield for NASA's Mars Science Laboratory is the largest ever built for a planetary mission. Credit: NASA/JPL-Caltech/ Lockheed Martin.

More than nine-tenths of the deceleration before landing results from friction with the planet's atmosphere prior to the parachute's opening. Peak heating occurs about 80 sec after atmospheric entry, when the temperature at the external surface of MSL's heat shield will be about 3,800 F. Peak deceleration occurs about 10 sec later.

MSL will make a guided entry, controlled by small rockets during its blazing fall through the atmosphere. The angle of attack will employ the highest lift-to-drag ratio ever flown at Mars. The flow around the MSL spacecraft is expected to become turbulent early in the entry. The resulting heat flux and shear stress on the heat shield will be the highest ever encountered at Mars, researchers say.

Before atmospheric entry, tungsten ballast will be tossed off the spinning spacecraft, changing its center of gravity. More ballast will be ejected to give the craft the desired angle of attack, and still more once the vehicle is through most of its hot entry, to realign it for parachute deployment.

The ballast is a set of six weights—known as entry balance mass devices (or 'the six shooter')—each weighing about 55 lb. Shedding them rebalances the spacecraft for the parachute phase of the descent.

Convergence of firsts

MSL's aeroshell/heat shield, designed by Lockheed Martin, is the largest ever built for a planetary mission, nearly 15 ft in diameter. By comparison, Apollo's heat shield measured just under 13 ft.

Using MEDLI meant drilling holes into a perfectly good heat shield. But a series of high-energy arcjet tests ensured that the sensors would not compromise its integrity and create a runaway condition, says Bill Willcockson, a senior staff member and heat shield expert at Lockheed Martin Space Systems (LMSS) near Denver.

Predictive models of MSL's entry are one thing, but MEDLI is expected to provide "real data" from the real Martian atmosphere, notes Willcockson. That information, he says, will give those designing future Mars missions added confidence in their predictions. Demonstrating guided entry onto the Martian surface is also a key to future Mars missions, one that will enable spacecraft to fly toward smaller landing zones of high scientific interest.

Spacecraft engineers stand with three generations of Mars rovers developed at JPL: Front and center is the Sojourner flight spare; at left is a rover akin to Spirit and Opportunity; to its right is a Curiosity-size test rover. Credit: NASA/JPL-Caltech.

MEDLI was developed at NASA Langley and NASA Ames. As the name suggests, its purpose is to snag a medley of engineering data from the entry sensors. The instrument suite consists of seven integrated sensor plugs and seven Mars entry atmospheric data system pressure sensors, all located on the heat shield's exterior. Mounted inside is a sensor support electronics box that provides power, signal conditioning, and analog-to-digital conversion.

The sensors' placement on the heat shield puts them right in the heart of the fire, says Rich Hund, MSL program manager at Space Systems. During the heat shield's development, he recalls, the toughest issue came late in the game. That was the decision to use a phenolic impregnated carbon ablator (PICA) thermal protection system instead of the heritage SLA-561V—the type that had flown on all of NASA's successful Mars entry missions. PICA was invented at Ames, and MSL's mission will be the material's first flight to Mars.

Ripple effects

Whether it succeeds or fails, MSL's mission will have far-reaching implications, according to Mars exploration expert Philip Christensen, regents professor of geological sciences in the School of Earth and Space Exploration at Arizona State University.

"I think that a successful landing will put Mars back in the limelight and keep the focus on sample return. So I think the ripple effect will be positive," Christensen suggests. Alternatively, an MSL crash might not be the end of the program, he says.

"Historically, failures in the Mars program have not ended it, but have led to a renewed interest in Mars and a renewed commitment by the U.S. to succeed there," notes Christensen. Examples are the U.S. Mars Observer and the Russian Mars 98 missions. "Both failures led to follow-on missions to recover the lost science. I think that the same could occur if MSL were to fail. This would be particularly true if it failed for a known, fixable cause. So much has been invested in developing the rover and the Sky Crane that I believe rational thinking would prevail, and there might likely be an investment by NASA in a second attempt to get the technology to work."

Christensen believes the public and NASA are committed over the long term to Mars activities. The program may slow down due to budget limitations, but given the investment to date, and such interesting and compelling science, the exploration will likely continue, he says.

Paving the way

Scott Hubbard, a professor in the Dept. of Aeronautics and Astronautics at Stanford University, has also considered the implications of the MSL mission. Back in 2000, Hubbard did a stint as NASA's 'Mars czar' to pick up the pieces after the back-to-back failures of the Mars Climate Orbiter (MCO) and Mars Polar Lander (MPL) in 1999.

"MSL will carry the most sophisticated scientific lab ever placed on another world. If the mission is successful it may finally allows us to detect the complex carbon compounds which are the fingerprints of life," says Hubbard. Once on Mars, Curiosity will study the planet's early history, a time when there was probably abundant water on the surface and a thicker, warmer atmosphere, he adds.

"The mission was designed to provide intensive 'ground truth' investigations that follow the very high resolution observa-

(Continued on page 49)

Uncovering the

by J.R. Wilson
Contributing writer

A growing number of aircraft mishaps have been attributed to unseen ice crystals whose origins are poorly understood. Their occurrence appears to defy long-held beliefs about how and where ice forms, and under some circumstances, their presence can wreak havoc.

For the past two decades, reports of ice forming in the engines of jet aircraft—from small business jets to jumbo jetliners-—have been on the increase, with pilots becoming more aware of what one investigator calls "a very hard event to wrap your head around."

What has been termed 'ice crystal icing,' or simply 'mystery ice,' has been the subject of extensive international investigation since a National Transportation Safety Board (NTSB) report on the probe of an unrelated plane crash in 1994, recalls Tom Ratvasky, an icing flight research engineer and lead investigator from NASA Glenn.

"After the Roselawn [Indiana] crash of an ATR-72, the NTSB recommended reexamining the icing envelope not only for what are now known as supercooled water droplets, but also for mixed-phase condi-

tions—clouds composed of both liquid water and ice crystals and highly glaciated (all ice crystals) clouds," says Ratvasky.

A panel called the Engine Harmonization Working Group (EHWG) studied engine incidents from 1988-2003 and "identified engine power loss events that were likely highly glaciated events—an effect about which little was understood," he says. "NASA became involved in the EHWG, as did Environment Canada, as research organizations that could help out. The FAA also had a large role in that effort. But it was not just government; it also included Boeing and all the engine manufacturers."

Beyond technology

According to Ratvasky, the engine icing problem involves a complex combination of factors, including:

- Aviation safety—engine and air data system failures in flight.
- Regulations—new standards and means of compliance being put in place to address the aviation safety issue.
- Atmospheric science—conditions that cause engine power loss, and where and how they develop.
- Engine operability—what can be done in existing engines and new designs to manage or eliminate the engine icing threat.
- Flight operations—what information pilots can use to detect and avoid the conditions that cause engine icing.
- Icing research—how ice builds up inside an engine.
- Engine research—how ice buildup affects engine performance.

"It's not just a technology solution. We've had an ad hoc group of international

secrets of 'mystery ice'

aviation specialists addressing these issues, conducting pilot interviews," John Fisher, a propulsion standards engineer at the FAA Aircraft Engineering Division, tells *Aerospace America*. "We work with the airline operators to develop training tools to let pilots know what these conditions are, how to look for them in flight, and what to do to remediate or mitigate the problem and move out of the conditions."

Ice crystal sensors have also been developed "to identify those conditions as the aircraft flies into them and notify the aircrew, who would take actions to avoid them," says Fisher. "I don't believe any of those devices are yet approved for operation by the FAA; but there has been a significant amount of research done, and a number of them will be tested in the flight research program. At that point, we will have a much better idea of their performance and how marketable they may be."

Current sensors provide some information but are not fully reliable in all situations, Fisher adds. Ice detectors used on aircraft today were designed to measure liquid water content for ice/no ice conditions. The crystals involved in these situations tend to bounce off the sensors and so are not measured, while others may block some sensors. One constant appears to be rain on the windscreen, even flying at temperatures well below where water can maintain a liquid state.

Recognition, safety, and redundancy

"Part of the problem is that sometimes these events happen and it is unclear to the pilots that they have occurred. Ice crystals are not as good reflectors as raindrops; even though there are a lot of crystals in front of the aircraft, they are not registering on radar. So a pilot looks ahead and perhaps sees a thunderstorm at 10 o'clock and steers around it, thinking this has avoided the storm, but they could be flying into a higher concentration of ice crystals," Fisher continues. "As Boeing has talked to more pilots about the problem, this has raised awareness.

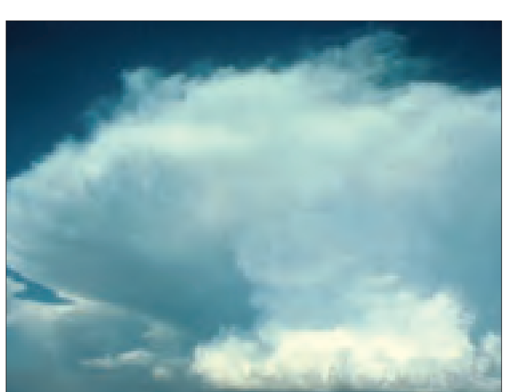
"It has been a challenge throughout this effort to justify why we need to go to a tropical place for an icing problem, but basically we are talking about very-high-altitude flight, where it is very cold. We'll be taking data from about 40,000 ft, where temperatures are -50 C. We believe the reason for that is the warm, humid air above high surface temperatures gives more fuel for the fire, so to speak."

Jeanne Mason, a Boeing senior propulsion engineer whose EHWG colleagues say has been a key contributor to the research, emphasizes that there have been no crashes or loss of life clearly linked to any highly glaciated events.

"It's important to note that, by regulation, all modern large-transport airplanes have redundancy in all critical systems. Every system vital to the safe operation of the airplane has a backup and, in some cases, two. For example, twin-engine jets are designed to safely take off, fly, and land even if one engine fails," she says.

"In any case, engine failures are rare events. Engine manufacturers must thoroughly test and validate an engine to earn certification by regulatory authorities. All modern large-transport airplanes are specifically designed to withstand an engine failure and continue safe flight. This is a requirement for airplane certification, and it applies regardless of the number of engines on the plane. Operators also define procedures for their flight crews and train them on how to safely handle the loss of an engine in flight."

Nonetheless, both Boeing and Airbus, which have manufactured the vast majority of commercial jetliners in operation today, are in full pursuit of a solution to the mystery ice problem.



This cloud has grown into a severe thunderstorm of the type that can produce tornadoes and destructive hail. Ice particles are being spewed into the upper atmosphere, producing the typical anvil shape at the top of the cloud. Copyright: University Corporation for Atmospheric Research.

Mix of extremes

In previous reports on findings to date, Mason has confirmed the odd mixture of extreme cold temperatures at high-altitude flight—usually over hot, tropical climes—and peak engine core temperatures.

"Commercial airplane power-loss events associated with ice crystals have occurred at altitudes of 9,000-39,000 ft, with a median of 26,800 ft, and at ambient temperatures from -5 to -55 C, with a median of

-27 C. The engine power-loss events generally occur on days when the ambient temperature is warmer than the standard atmosphere," she says. "Convective weather of all sizes, from isolated cumulonimbus or thunderstorms to squall lines and tropical storms, can contain ice crystals.

"Convective clouds can contain deep updraft cores that can lift high concentrations of water thousands of feet into the atmosphere, during which [time] water vapor is continually condensed and frozen as the temperature drops. In doing so, these updraft cores may produce localized regions of high ice water content which spread downwind. Researchers believe these clouds can contain up to 8 grams per cubic meter of ice water content; by contrast, the design standard for supercooled liquid water for engines is 2 grams per cubic meter."

According to Mason, engine icing under these conditions has resulted in three primary adverse conditions:

- Surge/stall. Ice shed into the compressor drives the engine to surge; then stall causes rotor speeds to decay, reducing airflow while the combustor remains lit. This results in thrust loss and a high exhaust gas temperature.
- Flameout. Ice shed into the combustor quenches the flame. The result is thrust loss and all parameters dropping.
- Engine damage. Engine blades become damaged as shed ice impacts them. Typically there is no effect at the time of initial damage, but damaged blades may fail later, causing vibration or engine stall.

While no crashes have been conclusively linked to this type of engine icing, it is part of the investigation BEA (France's FAA) is conducting into the June 2009 crash of an Airbus A330, Air France Flight 447. The aircraft went down into the South Atlantic off the coast of Brazil on a flight from Rio de Janeiro to Paris, killing all 228 passengers and crew. A final report on that accident is expected at midyear.

The most serious event that has been directly connected to high glaciation was a dead-stick landing by a Beechjet 400 business jet in Jacksonville, Florida, in 2005. The pilot reported loss of power in both engines, which could not be restarted, at 38,000 ft. He was able to glide the aircraft down through stormy weather and make a safe emergency landing.

"That was the only event we know of where the pilots could not restart the engines," Fisher notes.

Engine icing is part of the investigation into the June 2009 crash of Air France Flight 447.

Elusive knowledge

Those studying these events and the circumstances surrounding them say they still have limited knowledge of how the ice crystals form, so it is difficult to predict when or where this might happen. As a result, attempting to understand all the ice properties in the clouds is a major part of flight tests being conducted worldwide.

But being able to understand and detect ice crystals is very different from reducing an engine's susceptibility to them, says Tom Bond, chief scientist of the FAA Aircraft Certification Service and technology advisor on environmental icing. The two problems require completely different strategies, he says.

"We have a team of atmospheric scientists in the U.S. and Canada—as well as France now—spending a lot of time developing cloud resolving models, trying to get a better handle on how ice crystals are formed. Once that is done, however, the ability to develop forecast and diagnostic

Water sprayers are installed in the jet engine icing test chamber at NASA Glenn. The sprayers will produce tiny ice crystals that can clog or damage engines.

tools to accurately predict where those crystal events are and warn pilots in advance is a number of years away. A lot more work will be required before they are robust enough for a reasonable confidence level," says Bond.

Bond's team has been investigating "how ice crystals actually get ingested, impact engine surfaces, build up, and are released," he explains. "We've spent nearly four years developing the first studies that represent flow conditions similar to the internal flow in an engine and looking at the impact dynamics." The goal is "to better understand those issues so we can, in coordination with the engine manufacturers, develop engines that are not sensitive to ice crystals."

Meanwhile both Boeing and Airbus are studying improvements to radar equipment aboard their aircraft to aid identification of ice crystals ahead of the airplane.

"That might lead to a more near-term onboard system, so we are working on how to improve weather radar and let the pilot make a better tactical decision," Bond points out. "The final strategy, in terms of ground testing, is work the FAA is doing with ground facilities developers to promote the capability for generating ice crystal sprays." This will enable the team "to test conditions for ice crystal ingestion, to prove new designs are not sensitive to those."

Rewriting the rulebooks

Developing new sensors, radars, and technologies that can detect what have been invisible ice clouds is one key to resolving the issue. Another is understanding how such conditions manifest within engines operating at full speed in flight.

"It used to be standard methodology used by engine manufacturers that ice just can't form at temperatures above 35 F. It's just not obvious ice crystals coming into an engine could do this," Fisher says.

Computer rendering shows how researchers believe ice builds up on blades in the interior of a jet engine. Image courtesy NASA/Eric Mindek.

Ratvasky acknowledges that "it's difficult to wrap your mind around—how does ice form within the core of the engine? Most engines today are very large bypass, with air going into the fan; but behind the fan is another inlet going into the jet section. So ice is going through the bypass and also into the core, where air is compressed before going into the combustor. We think these ice crystals are hitting the compressor components, creating a moment where [ice] is present on the metal surface and cooling those down.

"But the ice crystals are also melting, so when the surface is cooled to the freezing point, that liquid is then able to refreeze. That continues to build, blocking airflow into the engine, possibly preventing enough air reaching the engine core that the engine software drives it down to a subidle speed. In other cases, ice builds up and goes through the compressor, where it can knock out the flame of the combustor due to the level of moisture, thus disabling the plane."

With the effects ranging from minor to full power loss, it is difficult, especially retroactively, to fully identify what was or was not an ice crystal event.

"I'm not sure we have enough data to really give a substantive answer [about frequency]," Bond says. "But it became quite evident, working with Airbus, Boeing, and other manufacturers, that these events were not uncommon and occurred to such an extent that we all became concerned and felt this needed to be addressed as a safety event. And even with the remediations that have been done, they still occur.

"Not all engines are sensitive to the ice crystal environment. For those that are, we have worked with the manufacturers on design changes, such as changes to FADEC [full authority digital engine control] software, to fleet schedules and fueling schedules, as well as airworthiness directives on the operation of aircraft that have indicated susceptibility.

"We hope to publish a rule in early 2013, an historic regulation that includes small droplet icing. We also have added large droplets, mixed phase, and ice crystal conditions to the rule that defines the icing environment, as the new certification requirements for icing. It also talks about compliance, so it is a phased-in approach."

In 2013 NASA Glenn will fly a modified Gulfstream 2 research aircraft in the air over Darwin, Australia, an area known for ice storms with high levels of ice crystals. More than 20 meteorological instruments on the aircraft will collect data. Image credit: NASA/Eric Mindek.

DOD aircraft

So far, the investigation—publicly, at least—has been strictly for commercial aircraft, despite the large number of military planes flying in the same environmental envelope.

"DOD is aware of the issue, and there is a group at the Arnold Engineering Development Center in Tennessee that we've worked with for years on propulsion issues. They have an icing capability in one of their engine test facilities for supercooled liquid, but not crystals. We've talked to them about this issue, but they currently do not have any requirements to test," says Ratvasky.

"In terms of whether military aircraft have had these types of problems, we've asked that question and the response has been negative, to their knowledge. But one thing we noted is it took a while for the EHWG to see a connection between ice crystals and these power loss events in which pilots reported nothing of substance on the radar. There is so little we understand right now, to extend it to supersonic or hypersonic flight is just too far out there for me to comment on it."

Current approaches

Pilot interviews, aircraft incident reports, and studies of flight computer data on these icing events continue, as do improvements in weather radar and other detectors—airborne, ground- and satellite-based. All of these efforts, along with environmental flight condition studies at test and simulation facilities in the U.S., France, Canada, and Australia, have significantly improved what is known about mystery ice and its impact on engines up to cruise altitudes.

A NASA study on high ice water content flight is evaluating new technologies, including enhanced radar, that are adapted to identify ice crystals at high altitudes. Reviews will include an assessment of the technology maturity, compatibility with existing airplane systems, and overall benefit.

Some NASA centers have joined the effort, especially addressing analytical issues such as how to utilize a code called Blue Ice, which has become a standard for predicting icing on external airframe surfaces.

"We are taking that capability from predicting ice on external surfaces to predicting it within the engine. We are looking to develop an analytical ice predicting capability for engines—where it is taking place and how it impacts engine performance. That is one of the major efforts at our center," Ratvasky explains.

At NASA Glenn another project involves "using a very modern weather radar to record the raw data, with researchers at NASA Langley then working to identify where ice crystals are occurring and passing that onto radar manufacturers, so future radars can have that capability within them. Langley also is pushing technology to provide that information to pilots. NASA Goddard, meanwhile, has a team of scientists assigned to us looking at cloud resolving models, using our collected data to determine what is happening in the atmosphere out to 10 km."

But it will take further exploration, advancement of aircraft and sensor technologies, and increased pilot awareness before all the mystery is removed from internal jet engine icing.

"After it became apparent in the original working group that we had a problem, I think we had more support from the research community and manufacturers than I'd seen in a long time," Bond adds. "There has been a real effort to promote a path forward, put rules in effect for safe operations, develop research to promote means of compliance and an ability to certify these conditions, and devise weather tools to help keep people out of these conditions.

"We didn't understand all the conditions, but we knew how to fly. So I've been very happy with the relationships among those involved in this, and I think they have provided a great benefit to aviation safety in general."

Russian space

The Soyuz TMA-04M rocket launches from the Baikonur Cosmodrome on May 15, 2012, carrying Gennady Padalka, Joseph Acaba, and Sergei Revin to the ISS. Photo credit: NASA/Bill Ingalls.

by James Oberg
Contributing writer

program recovers

Russia's space enterprise has been on a roller-coaster ride since a string of major failures began last year. The resulting shock and chaos led to high-level investigations that have uncovered serious problems, both technical and managerial, of long standing. Recommended remedies have begun to turn a disastrous situation around, but fully addressing the root causes will take time, modernization, and money.

Between July and December 2011, the Russian space program took a wild ride from exultation and exuberance to despair, then back to determination. Marking the end of the U.S. space shuttle program, the Russian Federal Space Agency, or Roscosmos, boasted on its website, "The Age of Soyuz has arrived—the era of reliability." Within a month came the shock and dismay at the first-ever failure in the 30-year-long Progress space station resupply series. This was followed by gradual restoration of confidence leading to the successful resumption of both unmanned Progress and crewed Soyuz launches.

That recovery, however, was buffeted by embarrassing failures in other major programs: A new generation of communications satellites suffered a launch mishap; and what was intended to be the flagship of Russia's return to interplanetary exploration, the Phobos-Grunt mission, ignominiously tripped and fell on its face right out of the starting gate on November 9, 2011.

Then, despite the resumption of full staffing aboard the ISS in late December, the year ended on a glum note when another unmanned Soyuz booster failed to launch a Meridian military communications satellite. The booster broke down, apparently coincidentally, during the same third-stage firing sequence that had doomed the Progress mission in August. The Soyuz failure, which showered fragments near the Siberian city of Novosibirsk, was followed by the fiery crash to Earth of the stranded Phobos-Grunt probe in mid-January.

Addressing the crisis

Vladimir Popovkin, the recently appointed head of Roscosmos, grimly admitted at a news conference on December 23 that Russia's space program was indeed in a deep crisis. The issue was elevated to the level of Deputy Prime Minister Dmitry Rogozin, who was tasked with alleviating the reliability and quality-control problems throughout the military industry. The widening of the assignment threatened to bump spaceflight to a level of secondary importance.

The loss of specific focus on the space industry has direct ramifications beyond the scope of Popovkin's duties, since he had not been speaking for his own country alone. The U.S. decision to rely exclusively on Russia's space transportation services for crew rotation to the ISS has made any Russian space crisis into an American space crisis as well. And the emotional roller-coaster ride the Russians had experienced was reprised among U.S. space officials, with the added burden that NASA was merely a passive passenger on this journey and had little input, or even insight, into the steering.

Gauging safety

Progress 44 was launched August 24, 2011. Early in the third-stage burn, the RD-0110

The general prosecutor's office concluded that four Glonass satellites had failed because builders had used microcircuits that were not radiation hardened.

engine shut down and the vehicle fell back into the atmosphere and disintegrated.

On August 29, a Roscosmos official described "irregular functioning of the gas generator" leading to "nonstandard pressure in the fuel tank." On September 8 the official commission announced that the gas generator's failure was due to "partial clogging" of the fuel pipe to the generator.

Extensive review of handling procedures and fueling systems uncovered no signs of anything that could have caused the introduction of a "foreign object."

In terms of safety, the Soyuz and its booster remain acceptable mainly because of a robust 'defense-in-depth' design. This means it tolerates failures whose occasional occurrence costs performance or mission success, but never—for over 40 years—crew loss. Had the August failure (or the December failure of the Meridian) occurred during the launch of a crewed vehicle, the crew would have survived a strenuous high-*g* descent into the mountainous region. A Soviet cosmonaut team lived through an almost exact duplicate of that event in April 1975.

Popovkin admitted as much at a September 16 press conference in Moscow. "We do not know the exact location of any alien item," he admitted. "It would be desirable to find the material part in order to be able to say for certain where the production process went wrong, where this alien item was located, and what it was," he continued, but the destruction of the third stage made that impossible.

There is even evidence that ad hoc workarounds intended to counter hypothetical problems can themselves introduce new hazards. How modifications to standard processing procedures can negatively impact safety became clear following a discovery made after the September 16, 2011, landing of the Soyuz TMA-21: Temporary screws had not been removed from cooling system fluid connectors between the command module and the orbital module that was jettisoned during descent.

"The presence of these screws may cause off-nominal separation," a NASA activity report noted. That possibility necessitated a 4-hr inspection of the interface on the still-in-flight Soyuz to ensure the screws had not also been left in place (they had not been). Removing them was necessary "to ensure safe conditions for a nominal landing," a tacit admission that the TMA-21 landing had *not* been safe, because of a human error by the ground crew.

The failure to remove the screws was due to a "vehicle processing" change made after damage was suspected following a railway accident that occurred during transport to the launch site. The spacecraft had to be replaced by the next-in-line production vehicle, whose checkout had not been completed at the factory. The replacement was rushed to the launch site, where the error (and who knows how many other errors) occurred during the checkout process.

The threat of 'off-nominal' separation is serious: Repeated flaws in pyrobolts had caused two earlier missions to suffer loss of stable attitude at the beginning of entry.

Less visible failures

Crashing rockets are spectacular causes of failed missions, but the Russian program has suffered even more expensive losses when boosters succeeded but payloads failed. Early in 2011, the general prosecu-

"A generation was lost for the space industry, when it was struggling to survive…." Georgiy Grechko tor's office in Moscow concluded that four Glonass satellites (each valued at $25 million) had failed in 2009 after reaching orbit because builders had used Taiwanese microcircuits that were not radiation hardened. With Russia's spacecraft fabrication facilities relying on foreign components for well over half their avionics because in-country vendors have lost the ability to manufacture the appropriate circuits, this is a vulnerability that promises to linger for years, if not indefinitely.

The poster child for this problem was the Phobos-Grunt debacle, which the official accident investigation board blamed on "non-space-qualified" foreign microchips—even though the far more likely cause was program management error in validating the flight software.

After each new failure, Russia had no shortage of experts eager to offer their own diagnoses of the collapse of the Soviet-era space industry. One news media favorite, and a legitimate expert, is former cosmonaut Georgiy Grechko, who also had an honorable career in the spacecraft fabrication industry.

On August 26, he told Interfax news agency, "This is precision technology that borders on fine art, yet young people are not being trained and old people are leaving." Interviewed after loss of the Phobos-Grunt probe on November 9, he repeated his refrain: "The scariest thing is that in 20 years everything was brought to ruin, so now no matter what they do, no matter what they pay to save it, nothing will be accomplished in 20 days....You need at least 10 years to rebuild everything."

"The staff employed are either over 60 or under 30. There is no intermediate age group," he later added. "A generation was lost for the space industry, when it was struggling to survive....People, most of them young, energetic and talented, would seek higher earnings in other places. The space industry could not offer them any decent salary."

Concerning the failure of Phobos-Grunt he said, "We last launched such a sophisticated system some 25 years ago. Think what the 25 years mean for the space industry. A shift of generations occurred."

Investigations and skepticism

Meanwhile, the 'magic clog' explanation for the Progress failure did elicit some skepticism. Russia's counterpart to the U.S. attorney general's office performed a criminal investigation of the accident. Contrary to claims that the failed engine was fabricated correctly, the probe found that records showed "multiple deviations from the design documentation" for the engine processing. It also complained that the initial investigation had only involved 'insiders' from the enterprise whose quality of work was under investigation, sparking suspicion about the "objectivity of the conclusions."

The loss of Phobos Grunt was originally blamed on the use of "non-space-qualified" microchips.

Another demurral from the official conclusion came from Igor Lisov, a respected space journalist with *Cosmonautics News* magazine. In an August 29 interview, he referred to inadequate investigation of a persistent 10% failure rate for the Briz upper stage. "Often they don't even have the source data needed for analysis," he stated, "and they accept easily fixable malfunctions as true causes." The accidents have continued, and Lisov urged: "We need to find out if it's due to design errors or defective parts," since without an accurate diagnosis, any 'fix' will have only a placebo effect on future launches. This was another prescient warning of disasters yet to come.

Similar suspicions were attributed by Interfax on August 26 to "a member of Baikonur Cosmodrome's management," who told them (without allowing use of his name) that no new "task force" would resolve the problem of quality, because of fundamental changes in the quality control process over the past 20 years.

"The current quality assurance system was created in Soviet times," the source explained. "Quality is controlled at all stages of launch vehicle, upper-stage, and space-

A Russian Soyuz rocket launches the unmanned Progress 44 cargo ship from Baikonur Cosmodrome on Aug. 24, 2011, to deliver fresh supplies to the ISS. The rocket and spacecraft crashed in eastern Russia just over five minutes after liftoff. Credit: RSC Energia.

craft production and assembly. It is the plant's technical control department and military representatives, that is to say representatives of the armed forces in civilian organizations, that give the go-ahead for the finished, assembled product to be shipped to the spaceport."

The difference today is that these former military inspectors are now paid by the civilian companies. So the greater the amount of hardware shipped, the better their relations with their management, and the bigger their bonuses will be. Thus they have become reluctant to make a fuss if a fault is found with a rocket or satellite. Instead, the source reported, "everything is settled internally."

"It is simply impossible to tackle this job in task-force format," the source believes. It would be ineffective, creating yet another management structure and spreading responsibility for quality control "even more thinly," he said. The recommendation also is unworkable, he continued, because it does not explain where to get the required staff of hundreds of trained experts—the kind of workers that "virtually every company is now short of."

Instead he recommended the acquisition of computerized quality control systems, to be "introduced from the bottom up, on site" in all stages of fabrication and testing. "This process is expensive and not quick, but there's hardly another way."

Attention from the top

With the failure of the Meridian launch last year, Prime Minister Vladimir Putin finally gave more than lip service to concerns over the chain of mishaps. He appointed a new deputy prime minister, Dmitriy Rogozin, and tasked him with revitalizing the entire defense industry, of which the space program is only one segment.

On December 26, state-owned Russian news channel Rossiya 24 showed Putin telling Rogozin: "As regards the rocket and space sector, as you can see yourself, a certain negative potential has accumulated there, too. Recent breakdowns, a whole range of breakdowns, speak for themselves.

"These problems should be thoroughly examined and investigated, and appropriate proposals should be submitted," Putin continued. "Some things are on the surface. After we abolished military acceptance in the rocket and space sector, in connection with the separation of military issues from it, unfortunately many things have gone worse. This does not mean that we need to return to previous methods of regulation, but it is completely obvious that the existing ones are not sufficient".

Defense Ministry-controlled Zvezda TV, Moscow, on December 26 showed Rogozin telling Putin: "I am ready to submit to you, in the very near future, proposals about reviving the defense-industrial complex. One of the most important aspects is, in fact, a new industrialization of the defense-industrial complex, which should serve as a locomotive for the growth of the entire Russian economy and industry. The second aspect, of course, is people, the human factor. Moral and material incentives should be created to attract young people, highly qualified personnel to the defense industry."

Recommended remedies

Illustrating one route to recovery was the successful effort to overcome a years-long series of frustrating and apparently random failures in the development of the Bulava sea-launched ICBM. Roscosmos managed the project, which by the end of 2011 had had several successful launches in a row.

The problems were solved by tightening control over its production, Gen. Nikolai Makarov, chief of the General Staff of the Russian Armed Forces, told the Moscow Echo radio station on February 20. "We are speaking of production technology," he was quoted as saying. After several launches failed, "we suspended the tests and looked into the cause. The cause was also hidden to a certain extent, attributable to human factors—to people not doing their job professionally," he said.

“Often they don’t even have the source data needed for analysis, and they accept easily fixable malfunctions as true causes.” Igor Lisov

“We assigned military acceptance officers to key positions where they could monitor every process. And after that all the launches [of Bulava] succeeded. That’s all! We realize that there is a very serious problem in our defense industry; that a person, a worker, should do his job conscientiously. Unfortunately, we have to check them and what they are doing very closely. And we are intensifying the process.”

These conclusions were confirmed in a long, candid interview with Yuriy Koptev, an emeritus space program manager who had been the first head of the then-newly formed Russian Space Agency in 1992. As published in the March 30 issue of *Kommersant*, Koptev pointed out the organization responsible for developing the missile was also responsible for reviewing its flight readiness before each test. “An institution of independent expertise must be restored immediately and provided with corresponding funding through the agency of lead institutes,” he wrote.

Responding to criticism about imposing a “new oversight bureaucracy,” Koptev argued it was the long-overdue restoration of a former system that had served well. “Nothing has to be invented!” he emphasized. The rocket-space sector, which began operating on an industrial basis in 1946, already has endured regulations and statutes in all directions in rocket and space technology. The process was precisely defined and documented.

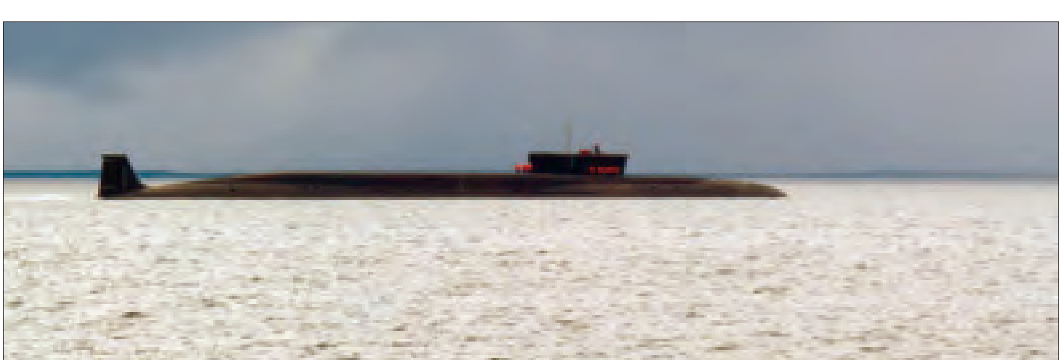
“As soon as we began violating these canons, we ended up with unpleasantness and accidents,” he argued. “The function of Roskosmos is to ensure unconditional fulfillment of the arrangement specified by a normative document. I support Popovkin’s decision to establish a representation of lead institutes in each organization of manufacturers—then who is doing what and how really can become visible.”

As for applying the ‘Bulava solution’ to the rest of the space industry and the high-tech military industry beyond, Rogozin was true to his word. By mid-February he had completed his diagnosis, and on February 28 he presented an insightful status report to the Russian government delineating the problems and offering a recovery plan.

Massive investment in acquiring new fabrication equipment will be needed to replace obsolete and worn-out tools across the entire military industry, said Rogozin. “We have to radically modernize the production-technological and experimental-test base,” he told the Duma. Specifically addressing Roskosmos and its supporting contractors, he said, “I cannot ignore the question of why failures have become more frequent in the missile-space sector, especially as there have been calls in this connection to demonstratively punish corrupt officials and careless individuals.” Rogozin endorsed Popovkin’s recovery strategy.

“Problems connected with rocket-space equipment…are caused both by the absence of a domestic electronic component base with appropriate characteristics and by a significant reduction in the institution of military representations at enterprises,” he explained. “On the whole, we are talking about the systemic nature of problems in industry and in the cadre training area.”

As part of the get-well plan, he continued, “we already are taking steps to increase the responsibility of heads of organizations for performing their assigned tasks and achieving measurable results. Certainly displays of negligence and ignoring of the already existing regulatory legal base must



After a series of frustrating failures, the Bulava submarine-launched ICBMs have now had a string of successful launches.

not go unpunished. We intend to continue to give special attention to the level of executive discipline. However, punitive measures in themselves will not ensure increased reliability of domestic equipment."

But the main thrust of Rogozin's plan involved the return of end-user inspection teams to all production enterprises, including space but mainly military systems. However, he did give a warning: "The system of military representations in itself is no panacea. It is a necessary but still insufficient condition for improving the quality of manufactured products. A system of unique quality management must exist and function in parallel with military representatives at all enterprises, without exception, participating in the manufacture of military products."

At least one rocket plant seems to have fallen into disrepair. Photo by Lana Sator.

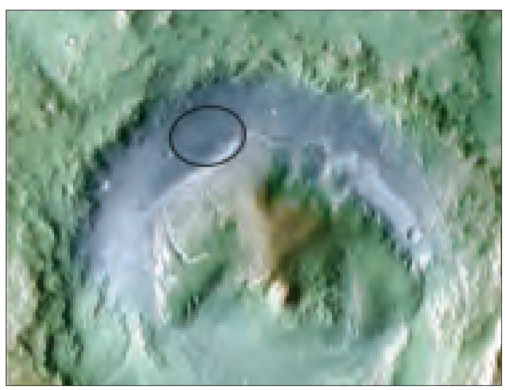
While these are laudable goals with a reasonably high likelihood of success in the long run—especially if sufficient young talent is induced to enter the aerospace labor market—the priority in terms of attention and resources given to the defense-related industries may leave the spaceflight industry recovery underfunded and undermanaged, even with Popovkin's best efforts. And the "long run" implies that many of the factors that contributed to recent problems remain in effect, even if somewhat diminished. The lamentably long list of recent Russian space setbacks—and their worldwide consequences—may not be complete. ▲

Touchdown
(Continued from page 35)

tions of Mars Reconnaissance Orbiter and earlier missions," Hubbard observes. "The innovative new technologies like the guided entry, Sky Crane, and sample handling tools are meant to help pave the way for a future Mars sample return."

MSL has been subject to rigorous design and testing, Hubbard says, "but Mars is hard!" Of the 44 missions to the red planet over the past 50 years, less than a third have been fully successful, he notes.

"If Mars should throw us a curve and MSL is not successful, I believe exploration *will* continue," Hubbard emphasizes. "Mars is the most Earth-like of the other planets in our solar system, the most likely to have developed life, and the most compelling target for future human exploration."



Color coding in this image of Gale Crater represents differences in elevation, with blue relatively low and tan relatively high. The vertical difference from a low point inside the landing ellipse for Curiosity to a high point on the mountain inside the crater is about 3 miles.

Historical record

Given today's tight budgets, how should MSL be viewed if it succeeds, or if it fails?

Hubbard says the administration has taken the position that it will not support any new so-called 'flagship' missions—generally viewed as costing more than $2 billion. "If MSL is a success—and particularly if evidence of organic materials is found—one would hope that NASA and the Office of Management and Budget in particular would take a fresh look at the potential of Mars exploration to answer the question: 'Are we alone?' If Mars causes the mission to have problems, I still think the red planet is so compelling that, as a nation, we can and must continue…as we did after the failures of MCO and MPL in 1999."

Holding a similar view is Roger Launius, senior curator in the Division of Space History at the National Air and Space Museum in Washington, D.C.

"With any mission, whether successful or a failure, there are always ramifications, but perhaps not in quite the way most people might think. Mission failures do not usually lead to decisions to stop undertaking exploration, as some believe," Launius says. So if MSL succeeds, everyone will cheer and press on with the program as currently defined, Launius continues. "Also, in that environment I doubt much will be said about the cost overruns on MSL. On the other hand, if it fails or is substantially degraded, the probe will be characterized as the 'troubled Mars Science Laboratory,' and most stories will probably relate the historical record of problems with the program as a preamble to whatever the current news might be," he says.

Day of reckoning

As MSL's day of reckoning draws closer, do its builders have lingering thoughts of carrying out more tests if the spacecraft can be brought back?

"I don't think I would want to drag it back and do more," says Theisinger. "We were very happy with the verification and validation program that we were able to run. I think we are very pleased with the quality of the vehicle that we launched. I don't think doing more on the Earth would really help us all that much," he adds.

On entry day, Theisinger says, "If we turn out to not have a good day at Mars, but we've done everything we can, that's karma. My experience with the public and everyone else is that they understand that. They won't forgive us for being stupid and for taking short cuts. But that's our job…not to be stupid, and not to take shortcuts."

In the end, Theisinger's engineering perspective is clear: "Get it down, hand the keys over to the scientists. Then say, okay, don't break it, and go do good stuff."

Destination: Gale Crater

NASA's July 2011 selection of Gale Crater as the landing site followed a five-year process in which some 150 Mars scientists narrowed the choice from about 60 candidate sites.

Gale Crater measures 96 mi. in diameter and holds a mound or mountain named Mount Sharp, which rises about 3 mi. above the crater floor. The slopes of the mountain are gentle enough for Curiosity to ascend, though the rover will not likely travel beyond some particularly intriguing layers near the base during the prime mission period, one Martian year (98 weeks).

Gale's low elevation relative to most of the Martian surface suggests that if Mars ever had much flowing water, some of it would have pooled inside the crater.

Like sequential chapters in a history book, the stacked layers that form Mount Sharp will present a record of the environmental conditions that prevailed when each layer was formed, scientists believe.

"Mount Sharp is the only place we can currently access on Mars where we can investigate this transition in one stratigraphic sequence," says Caltech's John Grotzinger, MSL chief scientist.

"The hope of this mission is to find evidence of a habitable environment…the promise is to get the story of an important environmental breakpoint in the deep history of the planet," he says. "This transition likely occurred billions of years ago…maybe even predating the oldest well-preserved rocks on Earth."

Out of the

25 Years Ago, July 1987

July 2 Richard Branson and Piers Lindstrand complete the first transatlantic crossing in a hot air balloon when they land in their Virgin Atlantic Flyer near Limavady, Northern Ireland. They left Sugar Loaf, Maine, the day before and rode a 153-mph tailwind most of the way. Richard Branson biographical file, National Air and Space Museum.

July 22 The USSR orbits the Soyuz TM-3 spacecraft, which docks with the Mir space station. TM-3's crew consists of Soviet cosmonauts Alexander Viktorenko and Alexander Alexandrov; Georgi Ivanov, the first Bulgarian in space; and Lt. Col. Mohammed Faris of Syria, the second Arab in space. The first was Prince Sultan bin Salman of Saudi Arabia, who was launched in 1985 aboard the space shuttle Discovery. NASA, *Aeronautics and Astronautics, 1986-1990*, pp. 122, 304.

50 Years Ago, July 1962

July 2 NASA announces four new contracts with Rocketdyne for further research, development, and procurement of the F-1, J-2, and H-1 rocket engines for Project Apollo. *Missiles and Rockets*, July 9, 1962, p. 12.

July 7 Russia sets a new world speed record of 1,665.9 mph in a Sukhoi Type E-166 over a 15-25-km course flown by Lt. Col. Georgy Mosolov at Siderovo, Tyumenskaya, in the USSR. F. Mason and M. Windrow, *Know Aviation*, p. 62; *Flight International*, July 19, 1962, p. 79.

July 10 A Thor-Delta rocket launches Telstar 1 from Cape Canaveral. The satellite relays through space the first TV pictures, telephone calls, fax images, and live transatlantic television feed. The first TV picture—a flag outside the Andover Earth Station, Maine—is relayed to Pleumeur-Bodou, France, on July 11. Following that are the first phone call and other transmissions, including both live and taped television. The satellite was built at Bell Telephone Labs by a team including John R. Pierce, who created the project. This is also the first privately sponsored space launch. *Aviation Week*, July 23, 1962, p. 27; *Interavia*, Aug. 8, 1962, p. 956.

July 11 Japan's first postwar airliner, the twin-Dart NAMC YS-11 aircraft, is rolled out at Nagoya southwest of Tokyo. *Flight International*, July 19, 1962, p. 88.

July 17 X-15 rocket research airplane No. 3 claims a new world altitude record of 314,750 ft, flown by Air Force Maj. Robert M. White. The first flight of an aircraft above 50 mi., it makes Maj. White the first 'winged astronaut' and the first non-Mercury space pilot to win astronaut wings. *Aviation Week*, July 23, 1962, p. 25; *Missiles and Rockets*, July 23, 1962, p. 10; D. Jenkins, *X-15*, p. 624.

July 19 In the first interception of an ICBM by another missile, a Nike-Zeus antimissile missile successfully intercepts an Atlas ICBM as it reenters the atmosphere in a test. A similar attempt took place earlier in the year, but without complete success. This time, the Atlas is fired from Vandenberg AFB, Calif.; the Zeus is launched from Kwajalein in the Pacific, 4,300 mi. to the west. *Flight International*, July 26, 1962, p. 148, and Aug. 2, 1962, pp. 167, 170.

July 20 British United Airways begins the world's first scheduled commercial air-cushion hovercraft flights, although bad weather temporarily halts them the following day. This service, which uses the Vickers VA-3, runs between England's Wirral Peninsula and the North Wales coast. *Flight International*, July 26, 1962, p. 114; *Flight International*, July 19, 1962, p. 9.

July 21 The United Arab Republic fires four of its single-stage liquid-fueled El Kahur (Conqueror) missiles from the Western Desert 50 mi. northwest of Cairo. This is the first public launching of Egyptian-assembled missiles before press members from nations beyond the Middle East. On July 23 in Cairo, two different size missiles are displayed: an El Kahur (the larger) and an Al Zafer (victor). Both

Past

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

have shapes similar to the German V-2 missile of WW II. *Aviation Week*, July 30, 1962, p. 20; *Missiles and Rockets*, July 30, 1962, p. 15.

July 24 Col. Charles E. Yeager, who in 1947 became the first man to fly supersonic in the Bell X-1, is named commandant of the USAF Aerospace Research Pilot School with the mission of training select pilots to monitor and conduct flight tests of research or experimental aerospace vehicles. *Aviation Week*, July 30, 1962, p. 23.

July 27 James H. 'Dutch' Kindelberger, U.S. aviation pioneer, dies in Pacific Palisades, Calif. Born in 1895, Kindelberger became president and general manager of North American Aviation in 1934. He was responsible for several major aerospace developments, including the Navaho missile program, which was the origin of Rocketdyne, and the development of large-scale liquid-fuel rocket engines in the U.S. *Missiles and Rockets*, Aug. 6, 1962, p. 10; *Flight International*, Aug. 2, 1962, p. 153.

75 Years Ago, July 1937

July 2 Amelia Earhart, the famous American pilot, and Fred Noonan, her copilot and navigator, are lost in the Pacific near Howland Island. Their disappearance creates scores of legends and many books and articles on what might have happened to them. E. Emme, *Aeronautics and Astronautics 1915-60*, p. 35.

July 4 Two Soviet women, Irina Vishnevskaya and Ekaterina Mednikova, achieve the world's altitude record for women when they fly their N-9 bis up to 6,518 m. A. van Hoorebeeck, *La Conquete de L'Air*, p. 300.

July 13-14 Three Soviet aviators flying an ANT-25 set a world distance record for airplanes when they land near March Field in San Jacinto, Calif., 6,262 mi. from their starting point in Moscow. They make the nonstop trip via the North Pole in 62 hr 2 min, surpassing the previous record of 5,653 mi. set by French aviators Paul Codos and Maurice Rossi in 1933. The flyers are pilot Mikhail Gromov, copilot Andrei Yumashev, and Sergei Danilin, navigator. *Aero Digest*, Aug. 1937, p. 66.

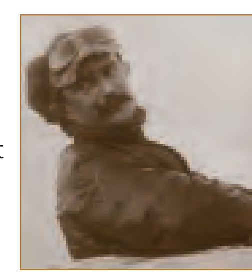
July 15 The Hamburger Flugzeugbau Ha 138 floatplane prototype makes its maiden flight. The craft will go through prolonged testing and enter production as the Blohm and Voss BV 138, serving throughout WW II. J. Smith and A. Kay, *German Aircraft of the Second World War*, pp. 63-66.

July 17 Belgian test pilot Lt. Claert breaks the Belgian altitude record in a Gloster Gladiator, reaching 10,200 m (about 33,500 ft). The previous record was 8,980 m, set in 1929. *The Aeroplane*, Aug. 11, 1937, p. 167.

And During July 1937

—German aircraft designer Alexander Lippisch begins the development of Projekt X (also called DFS 39), a rocket-propelled research aircraft, at German Research Institute for Sailplanes. Hellmuth Walter of Kiel builds the motor for this plane, which contributes to Lippisch's eventual design of the Me 163. M. Ziegler, *Rocket Fighter, the Story of the Me 163*, pp. 154-155.

100 Years Ago, July 1912



July 12 French pilot Jules Vedrines sets a speed record by flying 87.5 mi. in 1 hr. A. van Hoorebeeck, *La Conquete de L'Air*, p. 96.

July 31 The German dirigible LZ 13 Hansa completes its first flight. During the course of its career, the airship will make 297 flights, carry 6,217 passengers, and spend 632 hr in the air. A. van Hoorebeeck, *La Conquete de L'Air*, p. 96.

25 Years Ago, August 1987

Aug. 30 The Israeli government cancels the controversial Lavi, a domestically designed and built advanced fighter aircraft, as costs soar out of control. S. Wilson, *Combat Aircraft Since 1945*, p. 78.

50 Years Ago, August 1962

Aug. 1 A Jupiter intermediate range ballistic missile is successfully fired by a team of Italian air force troops at Cape Canaveral, Fla. *Missiles and Rockets*, Aug. 6, 1962, p. 20.

Aug. 1 The first Atlas F ICBM is test fired from an underground silo at Vandenberg AFB, Calif., and reaches its target area 5,000 mi. away in the Pacific Test Range. D. Daso, *U.S. Air Force: A Complete History*, p. 429.


Polaris

Aug. 7 In a test at Cape Canaveral, the Navy fires its first Polaris A-3. Although the missile is programmed to reach a distance of 1,700 mi., the second stage prematurely cuts off, making the flight a partial success. *Flight International*, Aug. 23, 1962, p. 292.

Aug. 10 U.K. Minister of Defence Peter Thornycroft announces the cancellation of Blue Water, a tactical guided missile, mainly because of its high cost. The weapon was to have replaced the Corporal missile. *Flight International*, Aug. 16, 1962, p. 218.

Aug. 11-12 The USSR launches its Vostok 3, piloted by Maj. Andrian Nikolayev. Vostok 4 is launched the following day with Pavel Popovich as pilot. The capsules' trajectories bring them within about 4 mi. of each other. Using radios, the two cosmonauts conduct the first ship-to-ship communications in space. This is also the first time two spacecraft have been in orbit at the same time. During his flight, Nikolayev unstraps himself and becomes the first human to float freely in zero-*g* in space. Both spacecraft land successfully in Kazakhstan on Aug. 15. *Flight International*, Aug. 16, 1962, p. 218, and Aug. 23, 1962, pp. 289-299.

Aug. 11-Sept. 3 More than 200 parachutists compete in the Sixth World Parachuting Championships at Orange Airport, Mass. Each country sends a team of seven parachutists, two reserves, and five crewmembers. Events include individual precision jumps from 500 m, individual jumps at 1,500 m, style events, and group jumps at 960 m and 1,470 m. *Flight International*, Aug. 2, 1962, p. 176.

Aug. 13 Britain's D.H. 125 Jet Dragon, a revolutionary small business jet, flies for the first time at Hatfield, England. It is built to replace the piston-engined de Havilland Dove business aircraft and light transport. *Flight International*, Aug. 16, 1962, p. 219, and Aug. 23, 1962, p. 282.

Aug. 13 A Westland SR.N2 hovercraft service between the Isle of Wight and Portsmouth, England, begins. Eleven days earlier, the Duke of Edinburgh went to sea on one of these vehicles. *Flight International*, Aug. 23, 1962, p. 24.

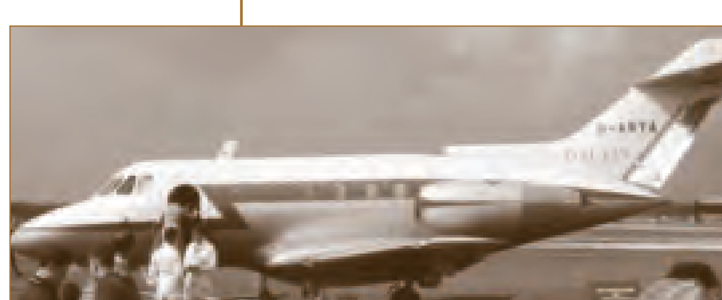
Aug. 31 A Navy airship makes its last flight at NAS Lakehurst, N.J., marking the end of an era. *United States Naval Aviation 1910-1980*, p. 246.

And During August 1962

—Beech Aircraft supplies the 7,000th of its Beech Bonanza general aviation aircraft. In service since 1947, this very popular plane remains in production longer than any other aircraft in history. More than 17,000 Bonanzas of all variants have been built. *Interavia*, Aug. 1962, p. 938; Beech Bonanza file, NASM.

75 Years Ago, July 1937

Aug. 6 Pan American Airways wins the 1936 Collier Trophy for establishing scheduled air transport service across the Pacific, and for demonstrating long-range marine air navigation basic to successful maintenance of transoceanic air transportation. Juan Trippe, Pan Am's president, receives the coveted award from President Franklin D. Roosevelt in a White House ceremony honoring "the greatest achievement in aviation in America" demonstrated in use or in practice the previous year. *Aviation*, Sept. 1937, p. 64; *Aero Digest*, Sept. 1937, p. 113.



Past

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

Aug. 11 The prototype of the Boulton Paul Defiant airplane, which becomes the RAF's first two-seat fighter fitted with a power-operated four-gun turret, makes its first flight. O. Thetford, *Aircraft of the Royal Air Force Since 1918*, pp. 102-103.

Aug. 13 A radio-controlled, Queen Bee target airplane is successfully shot down in the Bristol Channel, England, by an antiaircraft brigade of the Royal Artillery. Recently adopted by the British Army, the drone was previously used by the Navy, which rarely made hits on it. The aircraft flies about 100 mph. *The Aeroplane*, Aug. 18, 1937, p. 183.

Aug. 17 The name 'Stalin' is written in the sky by a formation of 48 aircraft during the annual Soviet air display in Moscow. Another formation writes 'Lenin,' and a third draws the five-pointed Soviet star. The display begins with the release of 12 balloons bearing a giant portrait of a Kremlin chief. A flight of airships with pictures of Stalin, Lenin, Marx, and Engels follows. Stalin watches the events. *The Aeroplane*, Aug. 25, 1937, p. 217.

Aug. 20-21 The Istres-Damascus-Paris Air Race, featuring 13 French, British, and Italian planes, is won by Lt. Cmdr. Samuel E. Cupini and Capt. Amadeo Paradisi in 17 hr 32 min 45 sec. They fly the trimotored Savoia Marchetti S.79 at an average of 219.2 mph. A. van Hoorebeeck, *La Conquete de l'Air*, p. 302.

Aug. 22-29 Seventy-six aircraft, representing Great Britain, Italy, France, Germany, Belgium, Czechoslovakia, Austria, Hungary, and Poland, compete in the international Littorio Rally at Rome's Littorio Airport. The contest, which covers a 1,210-m course, is a technical competition to test the takeoff, landing, and other qualities of aircraft. The winner is Italian pilot Giorgio Parodi, flying a Percival Vega Gull monoplane. *The Aeroplane*, Sept. 1, 1937, p. 265.

Aug. 23 The first completely automatic landing by a heavier-than-air aircraft without pilot assistance or radio control from the ground takes place at Wright Field in a Fokker C-14. Piloting the plane is Capt. Carl J. Crane, the system's inventor. E. Emme, ed., *Aeronautics and Astronautics 1915-60*, pp. 35, 184.

Aug. 26 Soviet pilots Vladimir Kokkinaki and A.M. Briandinsky, flying a CKB hydroplane over a closed course in the USSR, set three world speed records. The plane carries 2,204 lb over 3,106 mi. at 202 mph. *Air Facts Year Book, 1938*, p. 411.

Aug. 28-29 The Fifth Lympne International Air Rally takes place at Lympne, England, where Erwin Clausen of Germany wins the Wakefield Cup Race. Flying his Klemm 35 with its 60-hp Hirth motor, he averages 120 mph. Magdalena Hutton-Rudolph of Switzerland gives "an excellent exhibition" of aerial acrobatics in her Buecker Jungmann, whose inverted fuel system permits all maneuvers usually associated with more powerful planes. There are also triple parachute descents and other events. *The Aeroplane*, Sept. 1, 1937, p. 264-265.

100 Years Ago, August 1912

Aug. 21 French pilot Lt. Etienne Cheutin, flying a Farman, drops a military dispatch from his plane for his commandant over the Bourges Condé barracks. *Flight*, Aug. 31, 1912, p. 803.

Aug. 31 The Aero Club of France issues its 1,000th pilot's certificate to Italian aviator Carmanati de Brembilla. *Flight*, Sept. 7, 1912, p. 824.

University of Colorado Boulder

Aerospace Engineering Sciences

The Department of Aerospace Engineering Sciences at the University of Colorado Boulder invites applications for a tenure-track faculty position in the astrodynamics area. The department is an international leader in the area of astrodynamics research and is home to the Colorado Center for Astrodynamics Research (CCAR – http://ccar.colorado.edu). CCAR was established in 1985 and houses 15 faculty, ~60 graduate students, and has an annual budget of ~$6M. Applicants are sought with expertise in one or more of the following fields: satellite mission design and trajectory optimization, dynamical systems theory, advanced orbit and attitude estimation, space situational awareness, and satellite geodesy. Individuals with interdisciplinary interests across these and related areas are encouraged to apply. Familiarity with NASA, DoD, and/or international space programs, as well as with the emerging commercial spaceflight sector, is desired.

The position is targeted for candidates at the assistant professor level; however, experienced candidates with outstanding credentials may be considered at the associate professor level. Applicants should demonstrate the potential for establishing a robust research program, excelling at teaching aerospace engineering courses, and mentoring undergraduate and graduate students. Applicants are also encouraged to pursue multidisciplinary interests across the department, college and campus, and to establish interactions with the various space-related companies in the Boulder/Denver area and across the nation. Women and under represented minorities are especially encouraged to apply.

The duties of this position include teaching, research and service to the university and professional community. A Ph.D. in an appropriate engineering or science field is required. For more information about the department, please visit http://www.colorado.edu/aerospace.

Applicants should electronically submit their application to job posting **#817565** on www.jobsatcu.com, including their Curriculum Vitae, statements of research and teaching interests, and the names and contact information of four references. Address the cover letter to Prof. Steve Nerem, Search Committee Chair, Department of Aerospace Engineering Sciences, University of Colorado, Boulder, CO 80309-0429. Review of applications will begin August 15, 2012 and continue until the position is filled.

The University of Colorado Boulder is an Equal Opportunity Employer. The University of Colorado Boulder conducts background checks for all final applicants.

MISSOURI S&T
University of Science and Technology

MECHANICAL AND AEROSPACE ENGINEERING DEPARTMENT
Assistant Professor Position in Aerospace Engineering (Ref # 000030914)

The Department of Mechanical and Aerospace Engineering at the Missouri University of Science and Technology (formerly the University of Missouri – Rolla) invites applications for a full-time tenure-track Assistant Professor position in the general area of Aerospace Engineering. Priority will be given to candidates with specialization in the areas of aerospace structures and aerospace dynamics and controls.

Applications are invited from candidates who possess an earned Ph.D. in Aerospace Engineering or a closely related field. This opening is anticipated to be filled at the Assistant Professor level, although qualified applicants will be considered for appointment to a higher level. The successful candidates will demonstrate the potential to establish and grow a strong research program and will participate in all aspects of the Department's mission, including research, teaching and service. Several active research centers on campus (http://www.mst.edu/research/) support these, as well as other research areas.

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

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

The final candidate is required to provide official transcript(s) for any college degree(s) listed in the application materials submitted. Copies of transcript(s) must be provided prior to the start of employment. In addition, the final candidate may be required to verify other credentials listed in application materials. Failure to provide the official transcript(s) or other required verification may result in the withdrawal of the job offer.

Missouri University of Science and Technology is an AA/EEO employer. Females, minorities, and persons with disabilities are strongly encouraged to apply. Missouri University of Science and Technology participates in E-Verify. For more information on E-Verify, please contact DHS at: 1-800-464-3218.

NOTE: All application materials must have position reference number (R00030914) in order to be processed.

AIAA Bulletin

On 9 May, Jim Maser (center), AIAA's Corporate Member Committee Chair and President of Pratt & Whitney Rocketdyne, hosted an executive session in Washington, DC, to understand corporate perspectives on key issues and to strengthen AIAA's relevance and advocacy for the aerospace community.

JULY–AUGUST 2012

AIAA Directory

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* Also accessible via Internet. Use the formula first name last initial@aiaa.org. Example: megans@aiaa.org.
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Addresses for Technical Committees and Section Chairs can be found on the AIAA Web site at **http://www.aiaa.org**.

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

Meeting Schedule

DATE	MEETING (Issue of *AIAA Bulletin* in which program appears)	LOCATION	CALL FOR PAPERS (*Bulletin* in which Call for Papers appears)	ABSTRACT DEADLINE
2012				
11–14 Jul†	**ICNPAA 2012 – Mathematical Problems in Engineering, Aerospace and Sciences**	Vienna, Austria Contact: Prof. Seenith Sivasundaram, 386/761-9829, seenithi@aol.com, www.icnpaa.com		
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		
15–19 Jul	**42nd International Conference on Environmental Systems (ICES)** (Apr)	San Diego, CA	*Jul/Aug 11*	**15 Nov 11**
30 Jul–1 Aug	**48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit Future Propulsion: Innovative, Affordable, Sustainable** (Apr)	Atlanta, GA	*Jul/Aug 11*	**21 Nov 11**
30 Jul–1 Aug	**10th International Energy Conversion Engineering Conference** (Apr)	Atlanta, GA	*Jul/Aug 11*	**21 Nov 11**
13–16 Aug	**AIAA Guidance, Navigation, and Control Conference** (May) **AIAA Atmospheric Flight Mechanics Conference** **AIAA Modeling and Simulation Technologies Conference** **AIAA/AAS Astrodynamics Specialist Conference**	Minneapolis, MN	*Jul/Aug 11*	**19 Jan 12**
11–13 Sep	**AIAA SPACE 2012 Conference & Exposition** (Jun)	Pasadena, CA	*Sep 11*	**26 Jan 12**
11–13 Sep	**AIAA Complex Aerospace Systems Exchange Event** (Jun)	Pasadena, CA		
17–19 Sep	**12th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference** (Jul/Aug) **14th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference**	Indianapolis, IN	*Oct 11*	**7 Feb 12**
23–28 Sep†	**28th Congress of the International Council of the Aeronautical Sciences**	Brisbane, Australia Contact: http://www.icas2012.com		**15 Jul 11**
24–27 Sep†	**30th AIAA International Communications Satellite Systems Conference (ICSSC) and 18th Ka and Broadband Communications, Navigation and Earth Observation Conference** (Jul/Aug)	Ottawa, Ontario, Canada Contact: Frank Gargione, frankgargione3@msn.com; www.kaconf.org	*Nov 11*	**31 Mar 12**
24–28 Sep	**18th AIAA International Space Planes and Hypersonic Systems and Technologies Conference**	Tours, France	*Mar 12*	**12 Apr 12**
24–28 Sep	**7th AIAA Biennial National Forum on Weapon System Effectiveness** (Jul/Aug)	Ft. Walton Beach, FL	*Nov 11*	**15 Mar 12**
1–5 Oct	**63rd International Astronautical Congress**	Naples, Italy (Contact: www. iafastro.org)		
11–12 Oct†	**Aeroacoustic Installation Effects and Novel Aircraft Architectures**	Braunschweig, Germany (Contact: Cornelia Delfs, +49 531 295 2320, cornelia.delfs@dlr.de, www.win.tue.nl/ceas-asc)		
5–8 Nov†	**27th Space Simulation Conference**	Annapolis, MD Contact: Harold Fox, 847.981.0100, info@spacesimcon.org, www.spacesimcon.org		
6–8 Nov†	**7th International Conference Supply on the Wings**	Frankfurt, Germany (Contact: Richard Degenhardt, +49 531 295 2232, Richard.degenhardt@dlr.de, www.airtec.aero)		
2013				
7–10 Jan	**51st AIAA Aerospace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition**	Dallas/Ft. Worth, TX	*Jan 12*	**5 Jun 12**
21–25 Jan†	**Annual Reliability and Maintainability Symposium (RAMS)**	Orlando, FL Contact: Patrick M. Dallosta, 703.805.3119, Patrick.dallosta@dau.mil, www.rams.org		
10–14 Feb†	**23rd AAS/AIAA Space Flight Mechanics Meeting**	Kauai, HI	*May 12*	**1 Oct 12**
2–9 Mar†	**2013 IEEE Aerospace Conference**	Big Sky, MT Contact: David Woerner, 626.497.8451; dwoerner@ieee.org; www.aeroconf.org		
25–28 Mar	**22nd AIAA Aerodynamic Decelerator Systems Technology Conference and Seminar** **AIAA Balloon Systems Conference** **20th AIAA Lighter-Than-Air Systems Technology Conference**	Daytona Beach, FL	*May 12*	**5 Sep 12**

DATE	MEETING (Issue of *AIAA Bulletin* in which program appears)	LOCATION	CALL FOR PAPERS (*Bulletin* in which Call for Papers appears)	ABSTRACT DEADLINE
8–11 Apr	**54th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference** **21st AIAA/ASME/AHS Adaptive Structures Conference** **15th AIAA Non-Deterministic Approaches Conference** **14th AIAA Dynamic Specialist Conference** **14th AIAA Gossamer Systems Forum** **9th AIAA Multidisciplinary Design Optimization Conference**	Boston, MA	*Apr 12*	**5 Sep 12**
27–29 May	**19th AIAA/CEAS Aeroacoustics Conference (34th AIAA Aeroacoustics Conference)**	Berlin, Germany	*Jul/Aug 12*	**31 Oct 12**
27–29 May†	**20th St. Petersburg International Conference on Integrated Navigation Systems**	St. Petersburg, Russia Contact: Prof. V. Peshekhonov, +7 812 238 8210, icins@eprib.ru, www.elektropribor.spb.ru		
6 Jun	**Aerospace Today ... and Tomorrow: Disruptive Innovation, A Value Proposition**	Williamsburg, VA (Contact: Merrie Scott: merries@aiaa.org)		
24–27 Jun	**43rd AIAA Fluid Dynamics Conference and Exhibit** **44th AIAA Plasmadynamics and Lasers Conference** **44th AIAA Thermophysics Conference** **31st AIAA Applied Aerodynamics Conference** **21st AIAA Computational Fluid Dynamics Conference** **5th AIAA Atmospheric and Space Environments Conference** **AIAA Ground Testing Conference**	San Diego, CA	*Jun 12*	**20 Nov 12**
14–17 Jul	**49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit** **11th International Energy Conversion Engineering Conference (IECEC)**	San Jose, CA	*Jul/Aug 12*	**21 Nov 12**
14–18 Jul	**43rd International Conference on Environmental Systems (ICES)**	Vail, CO	*Jul/Aug 12*	**1 Nov 12**
12–14 Aug	**Aviation 2013**	Los Angeles, CA		
19–22 Aug	**AIAA Guidance, Navigation, and Control Conference** **AIAA Atmospheric Flight Mechanics Conference** **AIAA Modeling and Simulation Technologies Conference** **AIAA Infotech@Aerospace Conference**	Boston, MA	*Jul/Aug 12*	**31 Jan 13**
10–12 Sep	**AIAA SPACE 2013 Conference & Exposition**	San Diego, CA		

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
2012			
1 Jul–31 Dec	**Intro to Computational Fluid Dynamics**	Home Study Course	n/a
1 Jul–31 Dec	**Advanced Computational Fluid Dynamics**	Home Study Course	n/a
1 Jul–31 Dec	**Computational Fluid Turbulence**	Home Study Course	n/a
1 Jul–31 Dec	**Introduction to Space Flight**	Home Study Course	n/a
1 Jul–31 Dec	**Fundamentals of Aircraft Performance and Design**	Home Study Course	n/a
9–10 Jul	**Optimal Design in Multidisciplinary Systems**	Ohio Aerospace Institute	Cleveland, OH
14–15 Jul	**Spacecraft Design and Systems Engineering**	ICES Conference	San Diego, CA
2–3 Aug	**Hybrid Rocket Propulsion**	Joint Propulsion Conference	Atlanta, GA
2–3 Aug	**Advanced Solid Rockets**	Joint Propulsion Conference	Atlanta, GA
2–3 Aug	**Hydrogen Safety**	Joint Propulsion Conference	Atlanta, GA
2–3 Aug	**NPSS: A Practical Introduction**	Joint Propulsion Conference	Atlanta, GA
2–3 Aug	**Missile Design and System Engineering**	Joint Propulsion Conference	Atlanta, GA
6–7 Aug	**Systems Requirements Engineering**	Ohio Aerospace Institute	Cleveland, OH
11–12 Aug	**Flight Vehicle System Identification in Time Domain**	GNC Conferences	Minneapolis, MN
11–12 Aug	**Atmospheric Flight Dynamics and Control**	GNC Conferences	Minneapolis, MN
11–12 Aug	**Recent Advances in Adaptive Control: Theory and Applications**	GNC Conferences	Minneapolis, MN
11–12 Aug	**Fundamentals of Tactical and Strategic Missile Guidance**	GNC Conferences	Minneapolis, MN
11–12 Aug	**Optimal State Estimation**	GNC Conferences	Minneapolis, MN
11–12 Aug	**Six Degrees of Freedom Modeling of Missile and Aircraft Simulations**	GNC Conferences	Minneapolis, MN
13–14 Aug	**Computational Aeroacoustics: Methods and Applications**	National Institute of Aerospace	Hampton, VA
27–29 Aug	**Space Environment and its Effects on Space Systems**	Ohio Aerospace Institute	Cleveland, OH
9–10 Sep	**Systems Engineering Verification and Validation**	SPACE Conference	Pasadena, CA
9–10 Sep	**Introduction to Space Systems**	SPACE Conference	Pasadena, CA
11–12 Sep	**Robust Aeroservoelastic Stability Analysis**	National Institute of Aerospace	Hampton, VA
15–16 Sep	**Optimal Design in Multidisciplinary Systems**	ATIO/MAO Conference	Indianapolis, IN

**Courses subject to change*

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From the Corner Office

OUR NEW EVENT MODELS

Earlier this year both our new President Mike Griffin and I addressed the need for "change" in our Corner Office articles. Since we've moved past the "potential" stage for many of the things that are happening within your Institute I think it's time for another update.

The most visible change is the New Event Model that was proposed by Basil Hassan, VP (Technical Activities) and approved unanimously by the Board of Directors in May. From the perspective of the thousands of members that attend our conferences, and the many hundreds involved in planning and executing them, the big change is that we will integrate our many discipline-focused events into four domain-focused events starting in 2014. The names aren't firm yet, but think of them as Aerospace Science and Technology, continuing on the structure of Aerospace Sciences and the New Horizons Forum in January; Aviation 2014, building on our first Aviation conference that will debut in 2013; Space 2014 that will grow from the Space 20XX conferences that have existed for more than twenty years; and a Defense/Security-related event that will include classified, ITAR-restricted, and U.S.-only content. In addition, in 2014 we will celebrate the 50th anniversary of the Joint Propulsion Conference with a 2014 Propulsion and Energy event.

Much of the structure and work related to these new events will be very similar to what we do now. Each will have the technical content that we see today, but aligned with the end product as well as the technology. The idea is that the professionals who are working in a technical field, say structures or guidance or fluid dynamics, will have two obvious conferences that address what they do. If they are working at the "science and technology" level, the primary one would be the January Aerospace Sciences and Technology event. If they are aligned with either aviation or a space-related application of their work, one of those events would be the #2 conference. If the professional is more aligned with the application in aviation or space, either Aviation 2014 or Space 2014 would be their primary conference with the Aerospace Sciences and Technology event a valuable #2 to keep abreast of what is being done at the more fundamental level. All of the events are intended to have even more robust technical content than any one of today's conferences because multiple conferences have been integrated into them. Obviously, the challenge for the Technical Chairs, TAC Directors, Technical Committees, and others involved in the program preparation will be substantial, and we anticipate adding at least one more day to each event to accommodate the increased content.

The Defense/Security event responds to requests we've heard from you and from industry and government organizations for an event that has the same technical strength as our unclassified AIAA conferences but would include the opportunity for classified sessions, ITAR-restricted sessions, and U.S.-only sessions (classified or unclassified). The devil is in the details, but we think we have a model for how to include ITAR-restricted content in our new events. This has been a long-standing request from the propulsion community and elsewhere. We will use JPC/IECEC 2013 as a "test" and if things go as we anticipate we will include ITAR-restricted sessions in Aviation 2014, Space 2014, Propulsion and Energy 2014 and, of course, at the Defense/Security event. Elsewhere in this *Bulletin* you'll see the first announcements related to JPC/IECEC 2013—the process for ITAR-restricted papers will be different so if you want to participate, pay close attention to the instructions as they are distributed over the next few months. We've got to do this exactly right the first time.

At Space 2012 we will have an exciting, collocated new event, Complex Aerospace Systems Exchange (CASE). Attendees will have the opportunity to hear people who are working on tough technical and programmatic issues on a day-to-day basis discuss best practices and lessons learned—program managers, chief engineers, and systems engineers. This event was being planned before the New Event Model was proposed and collocation with Space 2012 was a matter of timing and convenience. However, the content of CASE will be introduced into Space 2013, Aviation 2013, and the 2014 New Event Model events. But don't wait until 2013 to join in this new dialogue—CASE 2012 is going to be something special!

The bigger message about the New Event Model, though, is that it isn't "just" about how we handle our technical content. The intent is that the new events will be technical, programmatic, and policy showcases for their areas. The broader events will help attract international participation and foster greater collaboration. Our Standards program is based on collaboration, and the events will be value-added locations to work and to roll-out new products. Last month Mike Griffin wrote about AIAA taking a lead in asking important aerospace policy questions (June *AIAA Bulletin*, **B5**). We see the new events as providing the forum for such debate. The new structure offers Public Policy a seat at the table right from the planning stage. Likewise, our Publications, Education, and Member Services will have a greater opportunity to use the new events, with their anticipated 2000+ attendees, as platforms for continuing and new programs. There are no barriers to what we can do with these new opportunities.

The changes coming from your Institute aren't limited to events. Last year President Brian Dailey asked Mike Yarymovych, a Past President and Honorary Fellow, to review the Fellow selection process. Dr. Yarymovych and his committee started with the sole description of Fellow in our Constitution: "Fellows shall be persons of distinction in aeronautics or astronautics, and shall have made notable and valuable contributions to the arts, sciences, or technology thereof." They concluded that "Fellow" was sometimes being characterized as a "membership grade" rather than the distinct honor that it was intended to be. Under our Bylaws only one-tenth of one percent of our membership may be selected for Fellow each year. AIAA Fellow and further selection of a Fellow to become an Honorary Fellow are among the highest distinctions an aerospace professional can receive. Selection must be based on the "notable and valuable contributions to the arts, sciences and technology thereof" of the individual. Dr. Yarymovych's Committee built on the work done by President Roger Simpson in 2005–2006 and proposed changes in the nomination and selection processes. The Board, which has the final responsibility for selection of Fellows, approved the recommendations without change. The criteria and process will be used by the new Fellow Selection Committee this year and new Nomination, Reference, and Review forms will be implemented next year.

The improvements to our information systems, including the website, conference-related applications, e-publications, databases, and the many tools used by volunteers and staff, are coming along very well. I hope you like the new "look" as much as I do. Of course, we continue to strive to become more user-friendly and we occasionally find glitches that didn't get caught in the testing process. So if you have specific issues or suggestions, please tell your staff point of contact or send a note to me at BobD@aiaa.org and I'll make sure it gets to the right department on staff.

The goal of all of us involved in what I've described, volunteers and staff, is to build on our technical strengths to create a more inclusive, dynamic, and relevant Institute that offers value and broad appeal to all segments of the aerospace profession. Please let us know what else we need to be doing.

Bob Dickman
bobd@aiaa.org

PREMIER AWARDS PRESENTED AT AIAA AEROSPACE SPOTLIGHT AWARDS GALA

AIAA presented its highest awards at the Aerospace Spotlight Awards Gala on 9 May, at the Ronald Reagan Building and International Trade Center, Washington, DC. The event provided the opportunity for senior leaders in government, academia, and industry to recognize the "best of the best" in aerospace. The Gala brought together over 500 guests to salute the honorees, which included a new class of AIAA Fellows and Honorary Fellows and distinguished winners of AIAA's premier awards in aerospace categories.

AIAA President Michael Griffin opened the Gala with a warm welcome to the evening's guests, followed by presentation of the 2012 AIAA Fellows and Honorary Fellows, all of whom were congratulated for their achievements. A special tribute to the 30-year legacy of NASA's Space Shuttle program and its many accomplishments was held and included comments by NASA Deputy Administrator Lori Garver. After dinner, Dr. Griffin presented AIAA's prestigious awards, which are the highest awards that the Institute and AIAA Foundation bestows.

Recognizing outstanding achievement is one of the primary responsibilities of AIAA. The honors and awards program is extensive, providing many opportunities for recognition of notable and significant contributions or technical excellence by members. Nominations are currently being accepted for AIAA's top honors; the nomination deadline is **1 October 2012** (see page **B10** for more details). For more information about the AIAA Honors and Awards program, please contact Carol Stewart at carols@aiaa.org or at 703.264.7623.

Right: 2012 Honorary Fellows. From left: Michael Griffin, AIAA President; Paul Nielsen, Honorary Fellow; Mike Yarymovych, Selection Board Chair; Arnold Aldrich, Honorary Fellow; Robert Stevens, Honorary Fellow; Brian Dailey Immediate Past AIAA President.

Below: 2012 AIAA Fellows

On behalf of the Boeing 787 Dreamliner Team, Mike Delaney, Vice President of Engineering, Boeing Commercial Airplanes (right), accepts the AIAA Foundation Award for Excellence from AIAA President Michael Griffin (center), and David Thompson, AIAA Foundation Board of Trustees Chair (left).

Jean-Michel Contant (left), Secretary-General, International Academy of Astronautics and recipient of the International Cooperation Award, with AIAA President Michael Griffin.

Donald Richardson (right) President and COO, DonRich Research Corporation and recipient of the 2012 Distinguished Service Award, with AIAA President Michael Griffin.

Guggenheim Medalist Burt Rutan (right), Founder and CTO (retired)/Designer Emeritus, Scaled Composites LLC, with AIAA President Michael Griffin (left).

Preston Henne (right), Senior Vice President of Programs, Engineering, and Test, Gulfstream Aerospace Corporation, with AIAA President Michael Griffin (left) after receiving the 2012 AIAA Reed Aeronautics Award.

AIAA President Michael Griffin (right) presents the AIAA Goddard Astronautics Award to David Thompson (left), Chairman & Chief Executive Officer, Orbital Sciences Corporation.

Kathryn Sullivan, (center), Assistant Secretary of Commerce for Environmental Observation and Prediction and recipient of the National Capitol Section Barry M. Goldwater Educator Award, with AIAA President Michael Griffin (left) and AIAA National Capitol Section Chair Bruce Milam (right).

MEMBERSHIP ANNIVERSARIES

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

25-Year Anniversaries

Jeffrey W Aksteter	National Capital
Joel Alpert	New England
Teresa C Arena	Long Island
Ryland S Barlow	Hampton Roads
Linda S Boyd	Connecticut
Dorothy L Buckanin	Southern New Jersey
John S Burks	Mid-Atlantic
Sung K Chung	Northern New Jersey
Frank W Cooper	Central Pennsylvania
Gerald J Dittberner	National Capital
Thomas N Farris	Northern New Jersey
Don R Faxon	National Capital
Jonathan L Fleming	Hampton Roads
Glen H Fountain	National Capital
Stuart W Frye	National Capital
Brian K Funk	Mid-Atlantic
Ehud Gartenberg	National Capital
Paul A Ghyzel	National Capital
Mark N Glauser	Northeastern New York
Kenneth J Gordon	National Capital
Kenneth P Iwanski	National Capital
Ivan Kadar	Long Island
Christopher O Kearney	National Capital
John D Knapp	National Capital
William A Kneisly	Delaware
Ronald P Lehrach	Connecticut
Rainald Lohner	National Capital
Gregory T Markham	Hampton Roads
Duane C McCormick	Connecticut
Michael H McGonigle	National Capital
James P Moran	New England
David R Mott	National Capital
Daniel R Mulville	National Capital
Michelle M Munk	Hampton Roads
Peter M Nagle	Long Island
Harry M Nahatis	New England
Rodolfo R Napisa	National Capital
Robert P Narducci	Greater Philadelphia
Douglas M Nark	Hampton Roads
Robert G North, II	Central Pennsylvania
Gopal Patnaik	National Capital
Gerald L Pellett	Hampton Roads
Louis J Poehlman	National Capital
Gerry D Pollock	New England
Anna Kay Rambo	Mid-Atlantic
John J Rush	National Capital
John W Rutherford	National Capital
Thomas E Ryan	National Capital
John H Seago	Greater Philadelphia
Kevin A Shinpaugh	Hampton Roads
Walter A Silva	Hampton Roads
Douglas L Sondak	New England
Ted J Stoecker	National Capital
John J Stolzenthaler	Connecticut
Anita L Tracy	Connecticut
Mark L Uhran	National Capital
James W Wade	New England
Patricia Waugh	National Capital
Jonathan M Weiss	New England
Joseph H Adams	Connecticut
William B Adkins	National Capital
Gilbert C Baird	Delaware
Daniel M Barry	New England
Alexander H Boschitsch	Northern New Jersey
William W Chung	National Capital
Jeffrey M Cohen	Connecticut
Bruce A Conway	Hampton Roads
William J Devenport	Hampton Roads
Robert A Dillman	Hampton Roads
Virendra K Dogra	Mid-Atlantic
Shelly M Ferlemann	Hampton Roads
Douglas G Fletcher	New England
Robert O Foelsche	Long Island
Arnold A Fontaine	Central Pennsylvania
Charles A Garris	National Capital
David A Gonzales	New England
Gavin J Hendricks	Connecticut
Charles J Henkin	National Capital
Jay K Hennig	Niagara Frontier
Gary W Kinnaman	National Capital
Christopher J Kubik	National Capital
Foluso Ladeinde	Long Island
Elizabeth M Lee-Rausch	Hampton Roads
J Gordon Leishman	National Capital
Mark J Lewis	National Capital
Jill M Marlowe	Hampton Roads
Pamela L Meredith	National Capital
Michael A Mesarch	National Capital
Lewis R Owens	Hampton Roads
Jaime Peraire	New England
Mark L Psiaki	Niagara Frontier
Todd R Quackenbush	Northern New Jersey
Nile D Radcliffe	National Capital
Surya Raghu	Mid-Atlantic
William F Readdy	National Capital
Mark A Roberts	National Capital
Jeffrey D Rosendhal	National Capital
Philip A Rubin	National Capital
John D Schierman	National Capital
Robert C Scott	Hampton Roads
Karl R Stapelfeldt	National Capital
Carol A Stewart	National Capital
Stanley C Underwood	National Capital
Marthinus C Van Schoor	New England
Steven H Walker	National Capital
Allison F Zuniga	National Capital
Mahesh M Athavale	Carolina
Donald C Barnes	Greater Huntsville
Steven B Brown	Greater Huntsville
Jeffrey N Burch	Atlanta
David C Butler	Greater Huntsville
Christina L Carmen	Greater Huntsville
Gary C Cheng	Greater Huntsville
Timothy R Conners	Savannah
Stuart M Coulter	Tennessee
Raymond E Daniels Jr.	Greater Huntsville
Christopher H DeMars	Cape Canaveral
Michael D Fennell	Greater Huntsville
Kenneth R Fernandez	Greater Huntsville
Timothy J Flores	Greater Huntsville
Carlton L Foster	Greater Huntsville
Jay I Frankel	Tennessee
Betty J Greene	Greater Huntsville
Wayne R Hawkins	Tennessee
Kevin S Ingram	Carolina
Warren G Ingram	Greater Huntsville
James A Keenan	Greater Huntsville
Larry C Lamb	Greater Huntsville
Ron J Litchford	Greater Huntsville
Arthur M Mellor	Tennessee
Alan K Minga	Greater Huntsville
James H Myatt	Greater Huntsville
Craig A Petty	Atlanta
Eliot S Ramey	Central Florida
Edward J Reske, III	Greater Huntsville
James L Saunders	Tennessee
Kenneth D Sebek	Greater Huntsville
Chiang Shih	Northwest Florida
Denette L Sleeth	Cape Canaveral
Douglas J Tincher	Carolina
Alexander W Tzetzo	Savannah
Lamar M Auman	Greater Huntsville
James R Beveridge	Greater Huntsville
Johnny H Evers	Northwest Florida
Norman Fitz-Coy	Central Florida
Robert B Funk	Atlanta
Michael W Gesner	Palm Beach
Thomas E Hannigan, III	Greater Huntsville
Sharon A Heise	Northwest Florida
Susan T Hudson	Carolina
Timothy M Keeter	Greater Huntsville
Paul L Luz	Greater Huntsville
Lakshmanan L Narayanaswami	Central Florida
Joseph H Ruf, IV	Greater Huntsville
John R Sprague, Sr	Palm Beach
David S Thompson	Greater Huntsville
Mark S Whorton	Greater Huntsville
FuhGwo Yuan	Carolina
John Abraham	Indiana
Philip S Beran	Dayton/Cincinnati
Vincent R Capece	Dayton/Cincinnati
Kelly S Carney	Northern Ohio
Rajnish Chandrasekhar	Illinois
Jen Ping Chen	Columbus
Julianne Dudek	Northern Ohio
Erick J S Gantt	Illinois
Richard L Henry	Dayton/Cincinnati
Kevin R Jackson	Dayton/Cincinnati
Michael A Landry	Dayton/Cincinnati
Mr. Kevin S Magee	Northern Ohio
Edward A Martin	Dayton/Cincinnati
Claudia Meyer	Northern Ohio
Charles E Niederhaus	Northern Ohio
Richard A Slywczak	Northern Ohio
Timothy B Tobin	Illinois
Charles Tyler	Dayton/Cincinnati
William A Veenhuis	Michigan
Michael J Barrett	Northern Ohio
Howard E Bethel	Dayton/Cincinnati
Victor A Canacci	Northern Ohio
David J Chato	Northern Ohio
Victoria L Coverstone	Illinois
Steven J D'Urso	Illinois
Datta V Gaitonde	Dayton/Cincinnati
Nicholas J Georgiadis	Northern Ohio
James H Gilland	Northern Ohio
Mark Gruber	Dayton/Cincinnati
Mark A Hagenmaier	Dayton/Cincinnati
Philip Handleman	Michigan
Uday G Hegde	Northern Ohio
Dennis L Huff	Northern Ohio
Alex G Kurtz	Dayton/Cincinnati
Michael J LeDocq	Wisconsin
David B Newill	Indiana
Gordon G Parker	Michigan
Eric J Pencil	Northern Ohio
William M Roquemore	Dayton/Cincinnati
Suzanne W Smith	Dayton/Cincinnati
George Williams	Northern Ohio
John D Wolter	Northern Ohio
William B Wright	Northern Ohio
Walter J Barnett	Houston
Charles H Campbell	Houston
Lee A Coggins	Houston
Leif G Fredin	Southwest Texas
Edwin Kessler	Oklahoma
Robert J Malins	Albuquerque
Toby B Martin	Houston
Kenneth B Milligan	Albuquerque
Norman N Parker	Houston
Bryan L Peterson	North Texas
Donald H Peterson Sr.	Houston
Lawrence Sher	Albuquerque
James H Stramler	Houston
Timothy D Stuit	Houston
J Olusegun Thomas	Houston
Victor H Treat, Jr.	Houston
Thomas J Vukits	North Texas
Keith D Zimmerman	Houston
Larry S Bell	Houston
Srinivas V Bettadpur	Southwest Texas
Noel T Clemens	Southwest Texas
James K Clutter	Southwest Texas
Fernando F Grinstein	Albuquerque
Timothy L Howard	Albuquerque
Tak Kahto	Houston
E Glenn Lightsey	Southwest Texas
Burke E Nelson	Albuquerque
Jeffrey S Osterlund	Houston
Eric L Petersen	Houston
Kenneth W Van Treuren	North Texas
Russell G Adelgren	Rocky Mountain
Michael G Asbury	St. Louis
Todd J Beltracchi	Rocky Mountain
Jon S Berndt	Rocky Mountain
Terry P Ercolani	Wichita
Norman J Hahn	Rocky Mountain
Jeffrey D Irwin	Rocky Mountain
Douglas H Kirkpatrick	Rocky Mountain
Robert T Marshall	Wichita
Dimitri J Mavriplis	Rocky Mountain
Joseph K McDermott	Rocky Mountain
Scott J Mitchell	Rocky Mountain
Todd J Mosher	Rocky Mountain
James D Rendleman	Rocky Mountain
Jon K Rohrbach	St. Louis
Bryan L Stauffer	Wichita
Alan C Tribble	Iowa
Oskar Von Heydenreich	Wichita
Michael C Wendl	St. Louis
Brent E Anderson	Twin Cities
John P Andrews	Rocky Mountain
Peter Y Cheng	St. Louis
Leon A DeHaven	St. Louis
Demoz Gebre-Egziabher	Twin Cities
Scott E Gilles	Rocky Mountain
David A Hickerson	Rocky Mountain
Kailash C Karki	Twin Cities
Randy Nelson	Wichita
Gary J Obermiller	Twin Cities
William P Schonberg	St. Louis
Joseph N Stemler	St. Louis
Kyle K Wetzel	Wichita
Kevin A Wise	St. Louis
Harlow G Ahlstrom	Pacific Northwest
William H Ailor, III	Los Angeles
Robert G Albers	Pacific Northwest
Andres Juvenal Aparicio	San Francisco
Patrick D Bangle	Arrowhead
James E Beck	San Fernando Pacific
Lester H Beck	Orange County
Stephen C Bishop	San Francisco
Bruce A Biskup	Pacific Northwest
Gary H Blackwood	San Gabriel Valley
Michael J Bockelie	Utah
Rodney K Bogue	Antelope Valley
Neil W Bosmajian	Los Angeles
Philip W Bowen	China Lake
Craig T Bowman	San Francisco
John W Boyd	San Francisco
Steven J Bullock	Arrowhead
Mark A Burgess	Pacific Northwest
Paul D Burkhart	San Fernando Pacific
Peter P Camacho	Orange County
Craig J Chivatero	San Francisco
Peter S Chmelir	San Fernando Pacific
Robert Clifton	San Fernando Pacific
Brent R Cobleigh	Antelope Valley
Stephen Corda	Antelope Valley
Douglas G Culy	Phoenix
David M Davidson	Tucson
Victoria A Davis	San Diego
Neil E Decker	China Lake
Charles H Dillon, Jr	Antelope Valley
Lonnie R Dillon	Arrowhead
Bruce L Drolen	San Gabriel Valley
Earl P Duque	Phoenix
Daniel K Emadi	Pacific Northwest
Shahram Farhangi	San Fernando Pacific
William C Forrest	San Diego
Perry L Fuehrer	Orange County
Eric K Hall, II	Orange County
Jonathan K Hart	Orange County
Christopher M Henry	Los Angeles
John M Hitner	Tucson
Marvin R Horton	San Francisco
Edward S Huston	San Francisco
Laurence F Inokuchi	Orange County
Sean L Jersey	Sacramento
Patrick A Jordan	Phoenix
Lawrence A Keller	Pacific Northwest
Robert E Kendall	Vandenberg
Clayton C LaBaw	San Fernando Pacific
Tung T Lam	Los Angeles
Peter V Law	San Fernando Pacific
Eric S Lester, Jr	Pacific Northwest
Steven M Lunde	Pacific Northwest
John P Mattei	Los Angeles
Charles D May	Los Angeles
Stephen F McCleskey	Orange County
Murugappan Meyyappa	Phoenix
James K Miller	San Fernando Pacific
M Brooke Miner	Tucson
William M Munsch	San Fernando Pacific
Christopher C Nelson	Pacific Northwest
Eric E Nichols	Phoenix
Ramon B Nonato	Los Angeles
Thomas W Obert	Pacific Northwest
Michael E Olsen	San Francisco
Karen E Petersen	San Fernando Pacific
James B Planeaux	Los Angeles
David Poladian	San Gabriel Valley
Robert E Pool	Pacific Northwest
Kent M Price	San Francisco
Christopher P Rahaim	China Lake
John N Rajadas	Phoenix
Max A Roler	Los Angeles
Hamdi A Saleh	Los Angeles
Y. T Sasaki	San Francisco

Steven F Saterlie	Arrowhead
Eric V Schrock	Antelope Valley
Charles T Stelzried	San Fernando Pacific
David E Taflin	Pacific Northwest
Yin M Tang	San Diego
Mary Joan Trafton	Los Angeles
Kirk R Traynham	Los Angeles
Gary M Vance	Tucson
Raymond F Walsh, IV	San Fernando Pacific
Richard C Waterman	Los Angeles
Mark Adler	San Gabriel Valley
Mark A Brosmer	Los Angeles
Glen J Brown	Arrowhead
Gelsomina Cappuccio	San Francisco
Aditi Chattopadhyay	Phoenix
Victor H Cheng	San Francisco
Aaron B Cozart	Los Angeles
Matthew Creager	San Fernando Pacific
Shailen D Desai	San Gabriel Valley
Corey M Dunsky	San Francisco
Rangasamy Elangovan	Pacific Northwest
Charles F Fitzgerald	San Francisco
Kajal K Gupta	Antelope Valley
Michael S Hersh	Pacific Northwest
John B Hinkey	Pacific Northwest
Steven J Hollowell	Orange County
Kenneth S Hunziker	Pacific Northwest
Jeffrey W Jacobs	Tucson
Mike F Kerho	Los Angeles

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CORPORATE MEMBER NEWS

AIAA is pleased to welcome two new corporate members to our roster. **Astrox Corporation**, College Park, MD, is a growing engineering firm providing a broad range of research and development services for aerospace, aviation, and software systems; and **Virginia Tech Applied Research Corp**, Blacksburg, VA, extends the brand and impact of Virginia Tech by providing innovative and timely solutions to complex science and technology challenges of national importance.

For more information about the AIAA corporate membership program, please contact Merrie Scott at merries@aiaa.org or 703.264.7530.

CALL FOR BOARD OF DIRECTORS NOMINATIONS

The 2012–2013 AIAA Nominating Committee will meet on 2 August 2012 to review nominees and select candidates to participate in the Board of Directors election to fill the following vacancies:

- President Elect
- VP-Elect Technical Activities
- VP-Elect Member Services
- Director-At-Large
- Director–International
- Technical Director—Information Systems
- Technical Director—Propulsion and Energy
- Director—Region IV
- Director—Region V
- Director—Region VII

AIAA members may submit themselves or other members qualified for the chosen position as nominees by submitting a nomination through the AIAA website (go to **www.aiaa.org**, log in, and select Board of Director Nomination from the left-hand navigation bar) by **25 July 2012**. Nominations will open 20 June.

Klaus Dannenberg
AIAA Executive Deputy Director and Corporate Secretary

CALL FOR NOMINATIONS

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

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

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

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

Premier Awards & Lectureships

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

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

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

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

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

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

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

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

Technical Excellence Awards

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Service Award

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

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

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

DR. SRIVASTAVA APPOINTED AS NEW EDITOR-IN-CHIEF OF THE *JOURNAL OF AEROSPACE COMPUTING, INFORMATION, AND COMMUNICATION*

On 10 May 2012, outgoing AIAA President Brian Dailey formally appointed **Dr. Ashok Srivastava** to succeed Professor Michael Hinchey as editor-in-chief of the *Journal of Aerospace Computing, Information, and Communication* (*JACIC*).

Dr. Srivastava holds B.S., M.S., and Ph.D. degrees in electrical engineering from the University of Colorado at Boulder. He is currently at NASA Ames Research Center, where he serves as the principal scientist for Data Mining and System Health Management and group leader for the Intelligent Data Understanding Group. He is also the project manager for the System-Wide Safety and Assurance Technologies project in the NASA Aviation Safety Program. Recent experience also includes working as the principal investigator of the Integrated Vehicle Health Management (IVHM) project at NASA, which was concerned with detecting and mitigating adverse events during aircraft flight. The IVHM project ranks among the most productive research projects within NASA's Aviation Safety Program in terms of publications generated, and awards and international recognition received, including the 2011 NASA Associate Administrator's Award.

A leader in information sciences, Srivastava is a prolific conference contributor, steering committee member, and session chair, as well as serving as an editor and author for numerous books and journals. He is the founder of the Conference on Intelligent Data Understanding (CIDU), which is a key conference on the application of machine learning, data mining, and other information sciences to aerospace systems and Earth and space sciences. He is also the founder of DASHLink and the c3 platform, a social network at NASA dedicated to aerospace computing and information science.

Dr. Srivastava is a senior member of AIAA and IEEE. He has won numerous awards, including the IEEE Computer Society Technical Achievement Award for "pioneering contributions to intelligent information systems," the NASA Exceptional Achievement Medal for contributions to state-of-the-art data mining and analysis, the NASA Distinguished Performance Award, several NASA Group Achievement Awards, the IBM Golden Circle Award, and the Department of Education Merit Fellowship. Recently he was honored with the 2012 Distinguished Engineering Alumni Award from the University of Colorado at Boulder.

JACIC was launched in January 2004 as AIAA's online-only rapid-publication journal. Prof. Lyle Long noted in his inaugural editorial as editor-in-chief that traditionally aerospace engineering has been supported by four "pillars": aerodynamics, propulsion, structures, and dynamics/control. *JACIC* was conceived to recognize a new pillar, reflecting the role of computing power and communication systems in modern aerospace engineering, for design and analysis of systems and also the operation of manned and unmanned vehicles. Dr. Srivastava becomes the third editor-in-chief of *JACIC*, following Lyle Long (2004–2006) and Michael Hinchey (2006–2011); Prof. Vigor Yang, of Georgia Institute of Technology, served a six-month term as interim editor-in-chief during the search process for the new editor.

Srivastava was selected from a competitive pool of applicants. AIAA Vice President of Publications Dr. Michael Bragg appointed an ad hoc search committee chaired by Prof. R. John Hansman, T. Wilson Professor of Aeronautics & Astronautics, and Director of the MIT International Center for Air Transportation at the Massachusetts Institute of Technology, and Dr. John Daily, Director of the Center for Combustion and Environmental Research and Professor of Mechanical Engineering, University of Colorado at Boulder. Dr. Srivastava's outstanding application reflected not only his expertise in the field but also the high regard of his peers, several of whom remarked on his wise and intelligent leadership within the community.

Looking toward the future, Dr. Srivastava sees his appointment as editor-in-chief of *JACIC* as "an important way for me to support and foster the broader aerospace and computing communities and to set a new standard of publication excellence in this important domain." He believes that *JACIC* can have a clear focus on aerospace topics that have international interest and are relevant to problems in computing and information science that are currently being addressed, as well as those on the horizon.

AUGUST IS FOR AEROSPACE

The AIAA "August is for Aerospace" program is a great way to showcase the aerospace profession. Every August, members of Congress return to their home districts as part of a summer work period. Meeting with your representative in your home district is a great opportunity to increase advocacy effectiveness. It enables a continuation of relationships started at AIAA's Congressional Visits Day (CVD) or a new opportunity to begin an ongoing dialogue between you and your member of Congress.

Unlike CVD, visits in the home district office are a lot less formal. You could invite your representative to tour the facility where you work, or to come to an AIAA section dinner or special event. Tell your representative why aerospace is important to you and your congressional district; thank them for the work they've been doing during the current session; and talk about the things that are important to you and how they fit with the overall theme of the value the aerospace sector provides the United States.

With November's presidential elections approaching, this is an ideal way to make our policymakers aware of the crucial importance of aerospace to national and economic security, and the pressing need to prepare the next-generation workforce for an increasingly competitive global marketplace. August is for Aerospace is your opportunity to explain how these issues affect us locally, and highlight what AIAA members are working on for the future.

Start by coordinating with your local AIAA chapter to see who else is interested or already planning activities. AIAA sponsorships are available on a first-come, first-served basis, and must demonstrate a specific need such as defraying the costs of catering, event promotion, or travel. Sponsorships are in amounts between $250 and $750. For more details, visit **www.aiaa.org/A4A** or contact Duane Hyland at duaneh@aiaa.org or 703.264.7510.

OBITUARIES

AIAA Senior Member North Died in April

Warren J. North died on 10 April. He was 89 years old.

Mr. North was a pilot in World War II, and worked as an engineering test pilot at Lewis Flight Laboratory in Cleveland, OH, specializing in turbojet noise research and missile design. After earning a bachelor of science degree from Purdue University and two masters degrees in aeronautical engineering from Case and Princeton, he participated in the formation of NASA, served on the selection team for the seven original astronauts, completed rigorous astronaut training with them, worked on Projects Mercury, Gemini, and Apollo, and rose to one of the most important positions at NASA: Chief, Flight Crew Operations Division, Manned Spacecraft Center, Houston, Texas. Astronaut selection, training, evaluation, and designs for spacecraft operations were all part of his job description.

Mr. North ended his illustrious career at NASA by retiring in 1985. After retiring, he built his own plane and continued to fly until a year before his death. Mr. North was awarded the de Florez Award for Flight Simulation in 1966.

AIAA Fellow Noton Died in May

Bryan R. Noton, 83, died 3 May.

Born in England, Noton was an internationally recognized authority in the application of advanced materials, especially composites, to innovative structures such as aircraft, spacecraft and ships. He was a research engineer at the Aeronautical Research Institute of Sweden (1951–1958) and technical assistant to its Director-General (1958–1963). In 1963, he became a visiting professor of aerospace engineering at the University of Virginia. From 1965 to 1967, he was technical director (advanced development-new products) with the Whittaker Corporation in California. In 1967, he returned to university life as Visiting Professor of Aerospace Engineering at Stanford University until moving to Washington University, St. Louis, MO, as Professor, Department of Aerospace and Mechanical Engineering in 1970.

Noton began a 20-year career at Battelle in 1973 to lead its activities in composite materials and later headed a unit involving the interaction of design and manufacturing. He was the lead developer of Battelle's Manufacturing Cost/Design Guide that was applied to complex engineering and development programs including Boeing aircraft, the U.S. Space Shuttle, and B-1 bomber.

A 60+-year AIAA member, AIAA presented Noton with a U.S. flag and AIAA's banner that flew in the Space Shuttle *Challenger* in February 1984, in recognition of his leadership in the Institute. He received the AIAA Structure, Structural Dynamics, & Materials Award in 1986, as well as numerous other awards/recognitions including being elected a Fellow of the Institution of Mechanical Engineers, UK, and the Royal Aeronautical Society, UK.

AIAA Associate Fellow Reese Died in May

Terrence G. Reese died on 4 May. He was 70 years old.

Mr. Reese attended the University of Pittsburgh, where he majored in Mechanical Engineering with the Aeronautics option. He joined the Institute of Aerospace Sciences while in college.

He was hired by NASA and began his career at the Manned Spacecraft Center in Houston as an impact dynamist. He led projects to perform laboratory testing of the Apollo docking hardware and full-scale land impact tests of an instrumented Apollo Command Module that resulted in onshore wind restrictions being imposed on Apollo launches. As Crew Systems Mission Manager, he was responsible for maintenance, testing, flight preparation and post-mission performance analysis of flight crew equipment for Apollo 10, 14, and 17. He was also responsible for the emergency kit aboard Apollo 13 and was one of the engineers on lockdown when the mission was in jeopardy. He used to say, "They came to me and asked, "okay, Reese, what is in that emergency kit you sent up there?!"

In 1979, he moved to Washington, DC, for a job with General Research Corporation. He also worked at Lockheed Martin for 12 years, rising to the position of Director, NASA and NOAA Programs. He retired from Lockheed and returned to NASA in 2003, where he worked as Lead Systems Analyst for Space Flight and then in the OCFO as Senior Program Analyst for Human Exploration and Operations.

AIAA Fellow Treanor Died in May

Charles E. Treanor, 87, a physicist and engineer who was the first president of Calspan-UB Research Corp., died 27 May.

A World War II veteran, Dr. Treanor served with the Army Air Forces. After attending Yale University and the University of Minnesota, where he graduated in 1948, he went to the University of Buffalo, where he received his master's and doctorate degrees in physics. He worked his entire professional life at Cornell Aeronautical Laboratory and its successor entities, Calspan and Arvin. An internationally recognized expert in fluid dynamics, he contributed more than 100 papers on the subject. The field now includes the "Treanor Number," "Treanor Distribution," and "Treanor Equation" as routine computational processes.

Dr. Treanor was a vice president of Calspan and in 1983 became the first president and director of CUBRC, a pioneering collaboration between UB and private industry, serving in that capacity until his retirement in 1988.

Dr. "Chuck" Treanor served for many years on the Fluid Dynamics Technical Committee for AIAA and the American Physical Society, and was a tremendous influence on the students and members of the AIAA Niagara Frontier Section. He was elected a Fellow of the AIAA in 1980, a member of the National Academy of Engineering in 1990, and was awarded the AIAA Fluid Dynamics Award in 1978.

12th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference
14th AIAA/ISSMO Multidisciplinary Analysis and Optimization (MAO) Conference
Diversity, Design, and Details—Facing the Challenge of Synthesis and Integration

17–19 September 2012
Hyatt Regency Indianapolis
Indianapolis, IN

Introduction

In today's technologically advanced society, we rely on the seamless integration of technology, complex systems, and products to enhance and enrich our daily lives. Development of these innovative and practical systems and products is the result of multidisciplinary synthesis—the combination of different theories, ideas, and entities brought together to produce novel technology. Synthesis in design is a sophisticated and demanding challenge. People from diverse backgrounds, with vastly differing skill sets, must communicate with and learn from each other. Integration of tools and methods often developed in one field becomes useful to another. Finally, all of these skills, ideas, and theories must be brought together to produce useful and functional products.

AIAA brings together two of its premier conferences to explore the issues of synthesis, and foster its occurrence, through the integration of two separate, yet synergistic, technical communities. Practicing engineers, researchers, and policymakers will interact to explore ideas, share research, and discuss the preeminent issues in design, optimization, and synthesis.

12th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference Synopsis

The Next Generation Air Transportation System will depend on the concepts and results of synthesis. From the design of diverse individual vehicles, to the development and implementation of the air traffic control system, to the airspace system itself, the amalgamation of diverse knowledge, people, and ideas into a cohesive, optimized, and useful entity is critical. The design of aircraft and the systems in which they operate requires advanced multidisciplinary design tools, methodologies, and optimization. New paradigms in technology, innovative vehicle configurations and design solutions, and new operational systems are emerging for this future synergistic aviation world. The AIAA Aviation Technology, Integration, and Operations (ATIO) Conference has an established reputation for bringing together aviation professionals, practicing engineers, researchers, and policymakers to explore ideas, share research, and create interactive opportunities in response to these issues.

14th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference Synopsis

The purpose of the Multidisciplinary Analysis and Optimization (MA&O) Conference is to bring together users, developers, and researchers to present the latest theoretical and computational developments, applications, ideas, and problems in the field of multidisciplinary analysis, design, and optimization. Advances in methodology, process, and tool development will be presented. Of particular interest are the continuing challenges associated with the design and optimization of large-scale coupled design problems, and the ways in which recent technological advances provide an enabling platform for achieving a truly integrated system design. Panel sessions and keynote speakers from industry, academia, and government will represent key views and issues in multidisciplinary design optimization (MDO) synthesis and integration. These events are always considered highlights of the program.

New Horizons in Aviation Forum

The New Horizons Aviation Forum offers a networking opportunity as well as a place to discuss the grande challenges facing innovation throughout the aviation enterprise today. These challenges might be summarized under one banner: Aviation Life Cycle.

Modernization and sustainment issues face our air vehicles and our airspace system. The operational pace imposes unprecedented requirements for repair, replacement, and enhancement of an aviation system in need of complete renovation. What can be done to accelerate the renovation through innovation! Join us in discussions of the complexity of the business models that drive acquisition decision making and thus effect engineering and technology development. Bring insights to the performance and production challenges influenced by the balance of government and industrial infrastructure and capability. Share visions of a future influenced by technologies outside of aviation and as simple (or complex) as social media and globalization. The New Horizons Aviation Forum welcomes you to the present and dares you to take an adventure to the future!

Conference General Chair
Brad Belcher, Rolls-Royce, Indianapolis, IN

12th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference
The Next Generation of Aviation – Analysis and Design of a Complex System
www.aiaa.org/atio2012

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Technical Activities Committee
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14th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference
MDO: Solving Today's Synthesis and Integration Problems
www.aiaa.org/mao2012

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New Horizons in Aviation Forum

New Horizons in Aviation Forum Chair
Vicki Crisp
NASA Langley Research Center

NHAF Liaison
Dave Maroney

Sponsor: Rolls-Royce

Benefits of Attendance

Why Attend?
- Expand your knowledge as practicing engineers, researchers, and policymakers interact to explore ideas, share research, and discuss the preeminent issues in design, optimization, and synthesis.
- Network, discuss challenges, and share ideas during technical sessions, luncheons, networking breaks, and social activities.
- Participate in the second annual New Horizons in Aviation Forum with high-level speakers and panelists.
- Stay at the top of your game with AIAA's continuing education programs.

What to Expect?

Networking
- Daily Networking Coffee Breaks
- Monday Off–Site Event
- Tuesday Awards Luncheon
- New Horizons in Aviation Forum

Continuing Education
- Two-Day Short Course: Optimal Design in Multidisciplinary Systems (See page **B17** for more information)

Who Should Attend?
- Aviation professionals
- Government/military professionals
- Engineers, researchers, and operators
- Engineering managers and executives
- Media representatives

Special Events

Indianapolis Artsgarden

Monday, 17 September, 1800–2030 hrs

Enjoy a reception with live music in the Indianapolis Artsgarden, formed of painted steel, limestone and tinted glass. The Artsgarden is a seven-story-tall, glass-enclosed structure offering a spectacular view of the city.

Awards Luncheon

Tuesday, 18 September, 1200 – 1400 hrs

Admission to the awards luncheon is included in the registration fee where indicated. Additional tickets may be purchased via the registration form or at the AIAA on-site registration desk.

Awards scheduled to be presented include the Aircraft Design Award, the Hap Arnold Award for Excellence in Aeronautical Program Management, the Multidisciplinary Design Optimization Award, the best paper certificate of merit, and the overall winner of the MDO Student Paper Competition, which is sponsored by Rolls-Royce and by Optimization and Advanced Analytics, Information Analytics, Caterpillar, Inc.

Tour of the Rolls-Royce (Allison Branch) Heritage Trust Museum

Tuesday and Wednesday, 18–19 September

Tuesday—first tour: 1430–1545 hrs; second tour: 1645–1800 hrs)

Wednesday—first tour: 1345–1500 hrs; second tour: 1600–1715 hrs)

Student Paper Competition

The MAO Student Paper Competition will be held during the conference, with the best student paper awards presented at the Awards Luncheon. All undergraduate and graduate students who made significant contributions and are the lead authors are invited to submit their full papers by **13 July 2012** for consideration. The finalists will present their work as posters during the conference and they will be assessed by a panel of experts. The best three papers will be selected for the awards. The 2012 MAO Student Paper Competition is sponsored by Rolls-Royce and Optimization and by Advanced Analytics, Information Analytics, Caterpillar, Inc.

Technical Sessions

Joint Special Sessions

Aircraft Performance Methods
Air Transportation and Operations Optimization
Propulsion System Design and Optimization Subsonic Aircraft Design and Optimization
Supersonic Aircraft Design and Optimization
UAV Design and Optimization
Wing Design and Optimization

Technical Sessions—ATIO

ADS-B From Concept to Operational Use
Air Transportation Systems/Air Traffic Management Operations
Aircraft Design and Design Methodologies
Industry Identified Issues in the NAS
Research Under Development
Systems and Systems Integration
Transformational Flight
Unmanned Air Systems: Technology, Design, Integration & Operations

Technical Sessions—MAO

Applications of MA&O
Enabling Technologies for MA&O
Multidisciplinary Design Optimization Methodologies
Optimization Methods and Algorithms
Uncertainty and Reliability Methods in MA&O

AIAA Programs

	Saturday	Sunday	Monday	Tuesday	Wednesday
0700 hrs			Speakers' Briefing	Speakers' Briefing	Speakers' Briefing
0730 hrs					
0800 hrs			Plenary Session	Plenary Session	Plenary Session
0830 hrs					
0900 hrs			Networking Break	Networking Break	Networking Break
0930 hrs					
1000 hrs					
1030 hrs			Technical Sessions	Technical Sessions	Technical Sessions
1100 hrs	Continuing Education Course	Continuing Education Course			
1130 hrs					
1200 hrs					
1230 hrs			Lunch Break	Awards Luncheon	Lunch Break
1300 hrs					
1330 hrs					
1400 hrs			Technical Sessions		Technical Sessions
1430 hrs				Technical Sessions	
1500 hrs					
1530 hrs			Networking Break	Networking Break	Networking Break
1600 hrs					
1630 hrs			Technical Sessions	Technical Sessions	Technical Sessions
1700 hrs					
1730 hrs					
1800 hrs					
1830 hrs					
1900 hrs			Offsite Indianapolis Arts Garden		
1930 hrs					
2000 hrs					
2030 hrs					
2100 hrs					
2130 hrs					
2200 hrs					

Continuing Education Courses

Let AIAA Continuing Education courses pave the way to your continuing and future success! As the premier association representing aeronautics and astronautics professionals, AIAA has been a conduit for continuing education for more than sixty years. AIAA offers the best instructors and courses, and is committed to keeping aerospace professionals at their technical best.

On 15–16 September 2012 at the Hyatt Regency Indianapolis, AIAA will offer a Continuing Education course in conjunction with the AIAA ATIO and MAO Conference. Please check the conference website for up-to-date information regarding the course. Register for the course and attend the Conference for FREE! (Registration fee includes full conference participation: admittance to technical and plenary sessions; receptions, luncheons, and online proceedings.)

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

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

You will be presented with a review of the state-of-the-art methods for disciplinary optimization that exploit the modern computer technology for applications with large numbers of variables, design limitations, and many objectives. You will learn how to evaluate sensitivity of the design to variables, initial requirements, and constraints, and how to select the best approach from many currently available.

From that disciplinary-level foundation, the course will take you to system-level applications where the primary problem is in harmonizing the local disciplinary requirements and design goals to attain the objectives required of the entire system, and where performance depends on the interactions and synergy of all its parts. In addition to imparting skills immediately applicable, the course will give you a perspective on emerging methods and development trends.

	Registration Type	Conference Rate Before 20 August 2012	AIAA Member Before 20 August 2012	Conference Rate 21 August – 15 September 2012	AIAA Member 21 August – 15 September 2012	Conference Sessions	Online Proceedings	Monday Offsite Reception	Tuesday Awards Luncheon
Option 1	**Full Conference with Online Proceedings**	**$875**	**$720**	**$975**	**$820**	●	●	●	●
Option 2	**Full-Time Undergraduate Student**	**$50**	**$20**	**$60**	**$30**	●			
Option 3	**Full-Time Undergraduate Student with Networking**	**$164**	**$134**	**$174**	**$144**	●		●	●
Option 4	**Full-Time Graduate or Ph.D. Student**	**$90**	**$60**	**$100**	**$70**	●			
Option 5	**Full-Time Graduate or Ph.D. Student with Networking**	**$204**	**$174**	**$214**	**$184**	●		●	●
Option 6	**Full-Time AIAA Retired Member**	**N/A**	**$40**	**N/A**	**$50**	●		●	●
Option 7	**Group Discount***	**N/A**	**$648**	**N/A**	**$648**	●	●	●	●
Option 8	**Continuing Education Course****	**$1,365**	**$1,260**	**$1,465**	**$1,360**	●	●	●	●
	Extra Tickets						**$170**	**$72**	**$42**

Pricing subject to change.

*10% discount off AIAA/IAF member rate for 10 or more persons from the same organization who register and pay at the same time with a single form of payment. Includes sessions and all catered events. A complete typed list of registrants, along with completed individual registration forms and a single payment, must be received by the preregistration deadline of 15 September 2012.

**Standard deadline for Continuing Education course is 14 September.

Cancellations must be received in writing no later than 3 September 2012. There is a $100 cancellation fee. Registrants who cancel beyond this date fail to attend will forfeit the entire fee. For questions, please contact Chris Brown, AIAA conference registrar, at 703.264.7504 or chrisb@aiaa.org.

Registration Information

All participants are urged to register online on the AIAA website at either **www.aiaa.org/atio2012** or **www.aiaa.org/mao2012**, or you may download the registration form and return it via mail or fax. 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. Early-bird registration forms must be received by **20 August 2012**. Preregistrants may pick up their materials at the advance registration desk. All those not registered by 15 September 2012 may do so at the on-site registration desk. If you require more information, please call 703.264.7504.

On-Site Registration Hours:

Saturday, 15 September	0700–1000 hrs (CE course Only)
Sunday, 16 September	1500–1900 hrs
Monday, 17 September	0700–1700 hrs
Tuesday, 18 September	0700–1700 hrs
Wednesday, 19 September	0700–1700 hrs

Meeting Site Information

As you land in Indianapolis, the first thing you'll notice is the airport. As the first new international airport in America designed and built after 9/11, Indianapolis International Airport was rated #1 (on everything from security to baggage claim) by travelers in a J.D. Power & Associates poll.

Indianapolis boasts many fine restaurants, ranging from Shapiro's (which *USA Today* called one of America's greatest delis), to Goose The Market (ranked one of the Top 10 U.S. sandwich shops by *Bon Appetit*), to St. Elmo Steak House (declared home of the hottest meal in the world by the Travel Channel).

With many attractions including the Indianapolis Zoo (located in the nation's only urban cultural state park) ranked among the nation's top 10 zoos by TripAdvisor, and the Indianapolis Museum of Art—one of the country's 10 largest and oldest general art museums, which won the 2009 National Medal for Museum and Library Services (the nation's highest honor for museums and libraries) there is something for everyone to enjoy!

Hotel Reservations

AIAA has made arrangements for a block of rooms at the:

Hyatt Regency Indianapolis
One South Capitol Avenue
Indianapolis, Indiana 46204
Phone: +1.317.632.1234
Fax: +1.317.616.6299

We have negotiated special event rates of $149 for single or double occupancy. Book your rooms early! Rooms will be held until **24 August 2012** or until the block is full. You must mention AIAA when you make your reservations to be included in this block. To make reservations by phone, please call 1.888.421.1442 or online by visiting the conference website for a direct link to make reservations.

There are a small number of federal government per-diem rooms available. Please select "government block" under guest type on the reservations website. Federal ID is required upon check-in.

Help Keep Our Expenses Down (And Yours Too!)

AIAA group rates for hotel accommodations are negotiated as part of an overall contract that also includes meeting rooms and other conference needs. Our total event costs are based in part on meeting or exceeding our guaranteed minimum of group-rate hotel rooms booked by conference participants. If we fall short, our other event costs go up. Please help us keep the costs of presenting this conference as low as possible—reserve your room at the designated hotel listed in the event preview and on our website, and be sure to mention that you're with the AIAA conference. Meeting our guaranteed minimum helps us hold the line on costs, and that helps us keep registration fees as low as possible. All of us at AIAA thank you for your help!

Hertz Car Rental

AIAA members can save up to 15% on your car rental with Hertz. Wherever your travel takes you, your discount CDP # 66135 is the key to special savings. Be sure to include it in all of your reservations. Visit www.hertz.com for the lowest rates, special offers and information about Hertz locations, vehicles and services. Or call Hertz at 1.800.654.2210.

Airports/Transportation

Indianapolis International Airport (IND) is 13 miles from the hotel.

Car Service

- *Shared Ride Service*—Approximate cost is $16 each way. Reservations suggested. On demand service available at Ground Transportation Center across from baggage claim.
- *Yellow/Checker Cab Co.*—Approximate cost is $35 each way for airport transportation.
- *Limo Service*—Approximate cost is $45 (one way, dependent upon company and number of passengers).

All ground transportation services at Indianapolis International Airport are located on Level 1 of the Parking Garage. The GTC is a one-stop shop for rental cars, taxi and limousine service, commercial bus and shuttle service, and public transportation via IndyGo. For information, call 317.487.7243 or visit indianapolisairport.com and click on Parking & Transportation.

Public Transportation

- IndyGo Green Line: Cost is $7 per person each way
- Buses run 0500–2100 hrs, approximately every 20 minutes. Bus stops in front of Hyatt Regency Indianapolis on Washington Street.
- Board the Green Line at the Ground Transportation Center, Zone 6. For ticket information, call 317.635.3344 or visit indigo.net.

"No Paper, No Podium" and "No Podium, No Paper" Policy

If a written paper is not submitted by the final manuscript deadline, authors will not be permitted to present the paper at the conference. Final manuscripts are due at AIAA by 28 August 2012. It is the responsibility of those authors whose papers are accepted to ensure that a representative attends the conference to present the paper. If a paper is not presented at the conference, it will be withdrawn from the conference proceedings. These policies are intended to eliminate no-shows and to improve the quality of the conference for attendees.

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.

For more information, visit either **www.aiaa.org/atio2012** or **www.aiaa.org/mao2012**.

A Conference jointly held with

Under the auspices of

FGM EVENTS LLC

AIAA The World's Forum for Aerospace Leadership

2012 Joint Conference

Satellites in the Service of Humanity

September 24-27, 2012 - The Westin Ottawa - Ottawa, Canada

The **30th AIAA International Communications Satellite Systems Conference (ICSSC)** and the **18th Ka and Broadband Communications, Navigation and Earth Observation Conference**, the two most influential technical conferences on satellite systems, will be held jointly in **Ottawa, CANADA, September 24** to **27, 2012**. As Canada's capital, the beautiful city of Ottawa is a hub of federal politics and culture. It is also a global high technology center, sometimes referred to as Silicon Valley North, supported by four universities and two colleges. At this period of the year, the nature in the Gatineau Hills offers breathtaking views of the fall foliage.

The theme of the Joint Conference "**Satellites in the Service of Humanity**" emphasizes the vital role satellites play in providing information, entertainment, weather forecasting, travel directions and communications for all of us.

For governments, satellites provide key functions for civil and military needs, security and public safety, search and rescue operations, tracking of moving vehicles on land and at sea, environmental sensing and monitoring, and disaster assistance. Satellites are the only means of achieving a better understanding of the universe and in particular of our galaxy. This search calls for unprecedented communication capacity, now provided by Ka-band satellites Improving on the above capabilities and providing new ways to serve mankind are challenges the satellite community must face.

This Joint Conference will explore these challenges, propose and discuss solutions, and provide a forum for the exploration of the economic, marketing, technical and regulatory issues affecting these new and planned services.

Come and hear what our leaders from academia, industry, Governments have to say about projects and technologies including the special events of the conference:

- The **Colloquium** on "Communications requirements of a changing Arctic",
- The **BroadSky Workshop** on "Space Robotics and Applications",
- The **ICSSC Poster Paper Session** for students, our future, and last but not least,
- A stimulating **Plenary Opening Session** with leaders from the Canadian, Italian and European space agency.

An event not to be missed!

For additional information about the conference and to register please visit the conference web site ***www.kaconf.org***

2012 Sponsors

7th AIAA Biennial National Forum on Weapon System Effectiveness

Achieving Capabilities-Based Weapons Effectiveness in the 21st Century

(SECRET/U.S. ONLY)

24–28 September 2012
Eglin Air Force Base
Ft. Walton Beach, FL

Synopsis

The AIAA Biennial National Forum on Weapon System Effectiveness is dedicated to promoting and sharing knowledge about the complex nature of modern weapon systems. It provides a SECRET/U.S. ONLY forum for discussing entire weapon systems, design considerations, and the engineering decisions that must be made to acquire and produce effective and successful weapon systems.

The 7th AIAA Biennial National Forum on Weapon System Effectiveness is supported by the AIAA Weapon System Effectiveness Technical Committee. The forum will address the themes of major weapons, acquisition reforms, test and evaluation, performance analysis, and future systems. Topics for discussion include the technology, design, development, engineering, and operational considerations important to the successful employment of modern ground, sea, air, and space weapon systems and platforms. A capabilities-based approach requires a tooth-to-tail perspective of the weapon life cycle with a well-defined requirements process that better assures weapon effects will meet the combatant commander's intent. The forum is directed toward engineers, scientists, technical managers, program managers, and policymakers. There will be special opportunities for policymakers to discuss the role of weapon system effectiveness assessments and weapon acquisition and force structure. The implementation of the Weapon Systems Acquisition Reform Act (WSARA) and the role of Analysis of Alternatives in the early development planning of future weapon systems are examples of policies that explore the cost-effectiveness trade space to deliver warfighter capabilities during a time of constrained budgets. The program is being developed around a distinguished group of keynote speakers, government and industry panels, and classified and unclassified technical paper presentations.

Special Events

Welcome Reception

A welcome reception will be held Tuesday, 25 September, 1830–2000 hrs, at Four Points by Sheraton at Kiwi's on the Beach. The reception ticket is included in the registration fee where indicated. Additional tickets may be purchased upon registration or at the on-site registration desk.

Luncheons

Luncheons for conference attendees will be held Tuesday–Thursday, 25–26 September, at the Conference Center on Eglin Air Force Base. The cost of the luncheons are included in the conference registration fee where indicated. Additional tickets may be purchased upon registration or at the on-site registration desk.

Meeting Site

The conference will take place on Eglin Air Force Base. Security at Eglin AFB is stringent and parking is limited. Registration will take place at the host hotel (Four Points by Sheraton).

Parking and Busing

Parking at Eglin AFB is on a first-come, first-served basis and is limited. AIAA will offer bus transportation from the Four Points by Sheraton Hotel and the Station from 0700–1800 hours. Parking is available at the Station for those not staying

Hosted by Eglin Air Force Base

Organized by AIAA

General Chair
O. Nick Yakaboski
Chief, Modeling Simulation and Analysis Air Armament Center, Capabilities Integration Directorate (AAC/XR)

AIAA Weapon System Effectiveness Technical Committee Chair
David Lyman
Senior Staff Scientist
Science Applications International Corporation

at the host hotel. A bus schedule will be available in your registration packets.

Registration

All participants are urged to register on the AIAA website at **www.aiaa.org/wse2012**, or you may download the registration form and return it via mail or fax. 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. Early-bird registration forms must be received by **27 August 2012**. *All those not registered by* **14 September 2012** *who wish to register by pdf may do so at the on-site registration desk at the on-site price.* All those that wish to register at the Standard Price between 19–23 September must register online. Preregistrants may pick up their materials at the advance registration desk. All those not registered by **24 September 2012** may do so at the on-site registration desk. Attendance at this conference is restricted to U.S. citizens who possess a final SECRET security clearance verified by your Security Office. ***Security clearance must be received by*** **31 October** ***to be processed.*** Please see Security Information below for more details.

Registration fees are as follows:

	Early Bird By 27 Aug	Standard 28 Aug–23 Sep*	On- Site 24–27 Sep

*All pdfs must be received by **14 September** to receive Standard pricing. Standard pricing will be available 15–23 September if you register *online*.

Full Conference

Member	$695	$795	$895
Nonmember	$850	$950	$1050

Includes sessions Tuesday, Wednesday, and Thursday luncheons, and Tuesday Welcome Reception.

Government Rate (Advance Only)

Member	$295	$295	n/a
Nonmember	$295	$295	n/a

One complete typed list and individual forms for ten or more from the same organization. Includes sessions and Tuesday Welcome Reception. (Lunch tickets are sold separately)

Extra Ticket

Tuesday Luncheon	$15
Wednesday Luncheon	$15
Thursday Luncheon	$15
Kiwi Welcome Reception	$75

On-Site Registration Hours

On-site registration hours are as follows:

Monday, 24 September	1700–1900 hrs	Four Points by Sheraton
Tuesday, 25 September	0700–1600 hrs	Four Points by Sheraton
Wednesday, 26 September	0700–1600 hrs	Four Points by Sheraton
Thursday, 27 September	0700–1300 hrs	Four Points by Sheraton

Security Information

Classified Visit Authorization Request: Attendance at this conference is restricted to U.S. citizens who possess a final SECRET security clearance verified by your Security Office. All attendees must submit the Security Clearance Certification Form found at **www.aiaa.org/wse2012**.

1) For classified meetings ensure that visit request is sent via JPAS to SMO Code AAC XR (AAC space XR), list POC and their phone number. Date of visit request can be for up to 1 year.

2) Attendees will need base access, i.e., Common Access Card (CAC). If they do not possess a CAC, then an Affidavit will need to be provided. Please go to **www.aiaa.org/wse2012** to download.

3) A Memorandum will need to be processed and this will be done by the visiting POC.

To confirm receipt of your clearance information, please contact Nick Yakaboski at 850.883.3499.

The Security Clearance is separate from the conference registration form. Submitting does not register you for the conference. Please register through **www.aiaa.org/wse2012**.

A security badge is required for admittance to all conference session rooms. Each attendee will be required to produce a passport, military photo I.D. or driver's license prior to receiving a conference badge.

Security Restrictions: *Notes may not be taken during the conference sessions. All electronic devices—including cell phones, pagers, PDAs, and laptops are not allowed in the session. Radios, cameras, and video/audio recording equipment—are not allowed at the conference facility.*

Hotel Reservations

AIAA has arranged for a block of rooms at the Four Points by Sheraton Destin-Fort Walton Beach located at 1325 Miracle Strip Parkway, Fort Walton Beach, FL 32548. To make reservations, please use the direct link located on the AIAA website under "Planning your Trip" or call the hotel at 800.874.8104 and identify yourself as attending the AIAA conference. Room rates are $109 per night single or double occupancy and include a full hot breakfast. The hotel has a 72-hour cancellation policy. Please make your reservations by **3 September 2012**. Rooms will be held only until that date or until the block is full.

Car Rental

AIAA members can save up to 15% off your car rentals with Hertz. Your discount CDP#66135 is the key!

Wherever your travel takes you, close to home or around the world, your CDP#66135 is the key to special savings. Be sure to include it in all of your reservations. Visit Hertz at www.hertz.com for the lowest rates, special offers and information about Hertz locations, vehicles and services. Or call Hertz at 1.800.654.2210.

Audiovisual

Each session room will be preset with the following: LCD projector and screen, laser pointer, and computer with Microsoft PowerPoint. All digital presentations will need to be on a CD. *Thumb drives cannot be connected to the computers provided*.

Restrictions

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

For full program, including paper titles, authors, and days and times of presentations, please visit **www.aiaa.org/wse2012**.

Keynote Addresses, Panels, and Technical Program

Tuesday 25 September 2012

0800–0830 hrs
Opening

0830–1030 hrs
Panel Session: Early Weapon Acquisition: "Starting Right"

1030–1200 hrs
Past Chairs' Presentations—What an Honor!
Speakers: "Bridging 'Valley of Death' for DE Weapons," James Horkovich; "DE Solution for a Counter Ram Capability," David Lyman; "Simulation Based Arena Test Analysis," Jeffrey Elder

Wednesday 26 September 2012

0800–0900 hrs
Opening

0900–1000 hrs
Panel Session: DE Weapon Acquisition Challenges

Thursday 27 September 2012

0800–0900 hrs
Opening

0900–1000 hrs
Panel Session: Defeating Underground Facilities

Technical Program at a Glance
Ballistic Missile Defense
Counter RAM
Blast Mechanisms
Advanced Design
DE Effects
Computational Mechanics
Counter RAM/IED
Lethality Analysis
Mathematical Modeling
Advanced Protection Techniques
Fragmentation Weapons
Innovative Modeling
Advanced Simulation
Aircraft Systems
Hard Target Defeat
Sensor Systems
Weaponeering/MSN Planning
Ballistic Missile Defense (2)

19th AIAA/CEAS Aeroacoustics Conference (34rd AIAA Aeroacoustics Conference)

27–29 May 2013
Berlin, Germany

Abstract Deadline: 31 October 2012

The AIAA/CEAS Aeroacoustics Conference has established itself as the premier international forum for the field of aeroacoustics. It offers scientists and engineers from industry, government, and universities an exceptional opportunity to exchange knowledge and results of current studies and to discuss directions for future research. Papers that address all aspects of the generation, propagation, and control of vehicle noise, as well as the effect of noise on structures and individuals, are being solicited. The program's technical content will include theoretical, numerical, and experimental contributions that describe original research results and/or innovative design concepts. In addition, in-depth reviews and timely surveys will be considered. Topics for the conference are listed below. Studies in other related areas, particularly the application of aerospace noise suppression technologies in other industries and papers pertaining to non-aerospace research with potential application to the aerospace industry, are encouraged.

Student Paper Award

Undergraduate and graduate students are encouraged to submit papers for consideration in the Aeroacoustics Student Paper Competition. Student papers should report on thesis work conducted by students in collaboration with faculty advisors. The student submitting a paper for consideration must be the primary author, and must have been a student at the time of the preceding Aeroacoustics Conference. Papers submitted by students must be presented by the primary author at the conference. The student author of the best paper will receive a monetary award and certificate during the conference. The award will be selected on the basis of the technical quality of the paper, including its presentation. Papers not received by the student paper submission deadline or not presented by the student at the conference will not be considered for the award.

Interested students should select "Student Paper Submission" as the presentation type when submitting their extended abstract and send an email to the Organizing Committee (lars.enghardt@dlr.de and philip.nickenig@dglr.de) stating that you want your paper to be considered for the student award. Authors participating in the Student Award competition must also send a copy of their manuscript to the Education Subcommittee Chair (s.w.rienstra@tue.nl) no later than **29 April 2013**. Please use "Student Paper Manuscript" as the subject line of your email.

Technical Session Topics

Acoustic/Fluid Dynamic Phenomena

Analysis, measurement, and control of subsonic and supersonic flows, vortex-driven flows, reacting and non-reacting flows, combustion instabilities, flow acoustic interactions and resonance, and flow receptivity to acoustic disturbances.

Active Noise Control

Active control of noise and related unsteady flows and vibration; noise cancellation through active acoustic treatment, and active source control as related to noise and vibration in the cabin, and within engine ducts and jets; development of associated sensors and actuators; and feedback and feed-forward control strategies.

Advanced Testing Techniques

Development and application of novel testing techniques, advanced diagnostic methods, and test facilities. Topics of particular interest are detailed measurements of mean and turbulent flow phenomena that contribute to noise generation and/or affect the radiated sound; source localization; flow, reverberation, and "noise" effects on measured data and their suppression; properties of sound-absorbing materials, including bulk absorbers and liners at high temperatures; interior-noise test facilities, including source simulation and noise-source path identification; and comparisons of model and full-scale testing

Airframe/High-Lift Noise

Noise source mechanisms of flow/surface interaction as related to airframe acoustics. Measurement, analysis, and prediction methods for wing, flap, slat, and landing gear noise. Noise reduction strategies including devices and methods of circulation and boundary-layer control.

Community Noise and Metrics

Response of individuals and the community to aircraft noise, including noise from rotary wings, prop-fans, sonic boom, and subsonic and supersonic jets; noise assessment methodologies and criteria for acceptability; tools for land-use planning with respect to airport noise; development of airport noise reduction strategies and airport noise monitoring methods.

Computational Aeroacoustics

Development of innovative numerical techniques for aeroacoustics applications. Emphasis is placed on the ability of algorithms to simulate and/or track accurately acoustic information from flows, and on the development of proper boundary conditions for aeroacoustic applications. Applications are sought in areas of sound generation by turbulence, unsteady flows, or moving boundaries; and propagation, transmission, and scattering of sound through non-uniform flows.

Duct Acoustics

New and innovative methods to analyze, predict, and control the turbomachinery noise propagating through nacelle ducts. A topic of particular interest is lightweight passive and active/adaptive liners to control the noise in ducts.

General Acoustics

Theoretical, numerical, and experimental research involving all areas of physical acoustics and those involving noise associated with commercial systems.

Integration Effects and Flight Acoustics

Aeroacoustics effects of propulsion and airframe integration. Understanding and prediction of noise source modifications originating from the interaction of flow and/or acoustic propagation mechanisms. Noise reduction approaches based on aspects of propulsion and airframe system integration or aircraft configuration. Integrated test model and flight vehicle acoustic experimental and/or prediction research.

Interior Noise/Structural Acoustics

Reduction of interior noise and vibration associated with aircraft, Space Shuttle configurations, expendable launch vehicles, and automobiles; noise transmission through structures; structure and payload response; and vibro/acoustic test and prediction methods.

Jet Aeroacoustics

Aerodynamics and aeroacoustics of jets focusing on identifying and modeling noise production mechanisms; near-field noise; shock noise; turbulence prediction and characterization for subsonic, supersonic, and noncircular and multi-stream jets; and suppression methods for both subsonic and supersonic jet noise. Of particular interest are new aeroacoustic modeling methods and flow and noise diagnostics techniques; and the effects of jet heating on the experimental data and on the modeling.

Loads/Sonic Fatigue

Prediction, testing, design, and control of sonic fatigue; sources of fluctuating loads on structures; jet/structure interactions; flow resonance phenomena; structural and material stress-strain responses; and high temperature effects.

Propeller, Rotorcraft and V/STOL Noise

Conventional and advanced single and counter rotating propellers, tone and broadband noise, propagation and ground reflection effects, fuselage boundary layer refraction and scattering, noise source control, effects of inflow distortions, and installation effects. Rotorcraft source studies, including rotor harmonic noise, high-speed impulsive and blade/vortex interaction noise, blade-turbulence interaction noise, jet/surface interaction noise including both ground and aircraft surfaces. Components and system noise prediction and validation, ground and flight test measurements, and noise control/reduction strategies.

Sonic Boom

Modeling and prediction of noise from Supersonic Business Jets. Methods for sonic boom prediction, minimization through design and/or operation, response studies, and metrics; atmospheric effects on noise propagation including refraction, diffraction, absorption, and turbulence scattering.

Turbomachinery and Core Noise

Generation, propagation, and control of noise from fans, compressors, combustors, and turbines; propagation and interaction with the mean flowfield; transmission and reflection from blade and vane rows; generation of afterburner noise; control using active or passive techniques; and measurement techniques for source identification.

Abstract Submittal Requirements

An extended abstract of at least 1000 words, with key figures and references to pertinent publication in the existing literature, is required. Authors must dearly identify in the abstract new or significant aspects of their work. Abstract reviewers will base recommendations for acceptance or rejection on:

1) Whether the abstract meets the requirements described above
2) The relevance of the work
3) The originality of the work
4) Contributions to the field, i.e., does it advance the current state of knowledge?
5) Are significant results presented to ensure timely completion of the paper?

Abstracts will be due no later than **31 October 2012**. Authors will be notified of paper acceptance by **23 January 2013**. An Author's Kit, containing detailed instructions and guidelines for submitting papers to AIAA, will be made available to authors of accepted papers. Authors of accepted papers must provide a complete manuscript online to AIAA by **13 May 2013** for inclusion in the online proceedings and for the right to present at the conference. It is the responsibility of those authors whose papers or presentations are accepted to ensure that a representative attends the conference to present the paper. Sponsor and/or employer approval of each paper is the responsibility of the author. Government review, if required, is the responsibility of the author(s). Authors should determine the extent of approval necessary early in the paper presentation process to preclude paper withdrawals or late submissions. Abstract submissions for the conference will be accepted electronically through AIAA's Website at **www.aiaa.org/aeroacoustics2013**.

"No Paper, No Podium" Policy

If a written paper is not submitted by the final manuscript deadline, authors will not be permitted to present the paper at the conference.

Contact Information

Questions about abstracts themselves should be referred to:

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43rd International Conference on Environmental Systems (ICES)

14–18 July 2013
Vail Marriott Mountain Resort and Spa
Vail, Colorado

Abstract Deadline: 1 November 2012

Synopsis

The 43rd International Conference on Environmental Systems (ICES) will cover all topics related to humans living and working in hostile environments with applications inside or outside of terrestrial or outer space habitats or vehicles, including aerospace human factors; environmental control and life-support system technology; environmental monitoring and controls; planetary protection; EVA system technology; life sciences; planetary habitats and systems; and thermal control systems technology for both manned and unmanned vehicles. The conference is open to participants from any nation, from academic, government, or industry organizations. There will be four days of technical presentations, with approximately 50 sessions. The conference is organized by AIAA, and supported by the American Institute of Chemical Engineers (AIChE), the American Society of Mechanical Engineers (ASME), and the ICES International Committee (INT).

Abstract Submittal Guidelines and Procedures

Authors who wish to contribute a paper to the conference must submit a 300-word abstract. Papers should present technical developments and progress in any of the fields of environmental systems listed in this Call for Papers and should make a new and original contribution to the state of the art, or be a constructive review of the technical field. Authors need not be affiliated with any of the cosponsoring societies. Papers proposed will be evaluated solely on the basis of their suitability for inclusion in the program. Please note that only written papers will be accepted, except for sessions indicated as panels.

Organized by AIAA

Supported by
AIAA Life Sciences and Systems Technical Committee
AIAA Space Environmental Systems Program Committee
American Institute of Chemical Engineers (AIChE) Environmental Systems Committee
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Genesis Engineering Solutions LLC

Amy Ross
NASA Johnson Space Center

David Williams
NASA Johnson Space Center

Abstract submissions will be accepted electronically through the AIAA website at **www.aiaa.org/ices2013**. Once you have entered the conference website, click "Submit A Paper", and follow the instructions listed. The deadline for receipt of abstracts via electronic submittal is **1 November 2012, 2359 hrs Eastern Time Zone, USA**. The electronic submission process is as follows.

1) Access the AIAA website at **www.aiaa.org/ices2013**.
2) On the right-hand side, click the "Submit Paper" button.
3) You will be prompted to log in. If you do not have an AIAA account, you will be asked to create one.
4) After you log in, you will be in the ScholarOne Abstracts submission site.
5) Click the Submission tab at the top of the page to begin your submission.
6) To begin the submission, click the "Create a New Submission" link on the left 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.

Special Notes

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

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

AIAA SES: Wes Ousley, Genesis Engineering Solutions LLC, wes.ousley@nasa.gov
ASME: Amy Ross, NASA Johnson Space Center, amy.j.ross@nasa.gov
AIAA LS&S: Grant Anderson, Paragon Space Development Corporation, ganderson@paragonsdc.com
AIChE: Tim Nalette, Hamilton Sundstrand, t.nalette@hs.utc.com
INT: Markus Huchler, EADS Astrium GmbH, markus.huchler@astrium.eads.net

Authors will be notified of paper acceptance or rejection on or about **6 December 2012**. An Author's Kit, containing detailed instructions and guidelines for submitting papers to AIAA, will be made available to authors of accepted abstracts. Authors of accepted abstracts must provide a draft manuscript by **4 March 2013**. Authors of accepted draft manuscripts must then provide a complete final manuscript to AIAA by **10 June 2013** for inclusion in the conference proceedings and for the right to present at the conference. It is the responsibility of those authors whose papers or presentations are accepted to ensure that a representative attends the conference to present the paper. Sponsor and/or employer approval of each paper is the responsibility of the author(s). Government review, if required, is the responsibility of the author(s). Authors should determine the extent of approval necessary early in the paper presentation process to preclude paper withdrawals or late submissions.

"No Paper, No Podium" and "No Podium, No Paper" Policies

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

Publication Policy

AIAA will not consider for presentation or publication any paper that has been or will be presented or published elsewhere. Authors will be required to sign a statement to this effect.

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

Warning—Technology Transfer Considerations

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

International Traffic in Arms Regulations (ITAR)

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

Travel and Accommodations

Meeting Site

From golf in the summer to skiing in the winter, there's always something to do in Vail, CO. Visitors and residents alike enjoy the 1,100 acres of open space accounting for 30 percent of Vail's town-owned land (350,000 surrounding acres of national forest, 15 miles of recreation paths), countless special events, the highest botanical gardens in the world, and an outdoor amphitheater named for Vail's most famous resident, President Gerald R. Ford. There's always something happening in Vail during the summer. Outdoor sports races and competitions, world-class concerts of all genres, food and dining events, and more. With world-renowned skiing, diverse shops and restaurants, luxurious accommodations, friendly neighborhoods, and breathtaking mountain views, Vail is arguably the finest resort destination in the world. See for yourself why Vail is a great place to visit! For more information, go to www.visitvailvalley.com.

Hotel Information

AIAA has made arrangements for a block of rooms at the Marriott Vail Mountain Resort and Spa, 715 West Lionshead Circle, Vail, CO 81657. Room rates are $179 plus applicable taxes, for single and double occupancy. A limited number of room nights are available at the prevailing U.S. government per diem rate at the time of the conference for those who qualify. To make a reservation, call 1.877.622.3140 and refer to the AIAA 43rd International Conference on Environmental Systems (ICES). Rooms at the AIAA rate will be held until **21 June 2013** while availability lasts. After **21 June 2013**, any unused rooms will be released to the general public. You are encouraged to book your hotel room early.

Help Keep Our Expenses Down (And Yours Too!)

AIAA group rates for hotel accommodations are negotiated as part of an overall contract that also includes meeting rooms and other conference needs. Our total event costs are based in part on meeting or exceeding our guaranteed minimum of group-rate hotel rooms booked by conference participants. If we fall short, our other event costs go up. Please help us keep the costs of presenting this conference as low as possible—reserve your room at the designated hotel listed in this Call for Papers and on our website, and be sure to mention that you're with the AIAA conference. Meeting our guaranteed minimum helps us hold the line on costs, and that helps us keep registration fees as low as possible. All of us at AIAA thank you for your help!

Airport Information

Vail Marriott Mountain Resort is 127 miles from Denver International Airport (DEN), and just 35 miles from Vale Eagle County Regional Airport (EGE).

Car Rental

AIAA members can save up to 15% off your car rentals with Hertz. Wherever your travel takes you, close to home or around the world, your discount CDP#66135 is the key to special savings. Be sure to include it in all of your reservations. Visit Hertz at www.hertz.com for the lowest rates, special offers, and information about Hertz locations, vehicles, and services, or call Hertz at 1.800.654.2210.

Technical Topics

ICES101: AIAA SES—Spacecraft and Instrument Thermal Design, Testing, and Technology

This session presents thermal design, testing, and on-orbit performance of near-Earth and interplanetary unmanned/robotic spacecraft, instruments, and payloads, and the application of key new technologies.

(Organizers: Wes Ousley, Genesis Engineering Solutions LLC, wes.ousley@nasa.gov; Joe Gasbarre, NASA Langley Research Center; Jose Rodriguez, NASA Jet Propulsion Laboratory; Dave Wasson, Orbital Sciences Corporation)

ICES102: AIAA SES—Thermal Control for Planetary Surface Missions and Systems

This session focuses on passive and active thermal control for planetary surface missions and systems such as Mars rovers, comet rendezvous systems, surface mapping and science instruments and systems, and in-situ resource mapping and processing.

(Organizers: Gaj Birur, NASA Jet Propulsion Laboratory, gbirur@jpl.nasa.gov; Paul McElroy, Touchstone Research Laboratory)

ICES103: AIAA SES/INT—Thermal and Environmental Control of Exploration Vehicles and Surface Transport Systems

This session covers environmental control, thermal control (passive and active), and thermal protection topics for vehicles used to transport crew and cargo to/from the moon, Mars, and asteroids, with emphasis on landers and surface crew transport vehicle systems. Papers on related systems within the United States and international programs are welcome. Potential topics include encountered space environment, thermal and environmental control and life support requirements, design, analysis, verification, and testing.

(Organizers: Gualtiero Brambati, Thales Alenia Space, gualtiero.brambati@thalesaleniaspace.com; Tom Leimkuehler, Paragon Space Development Corporation, thomas.o.leimkuehler@nasa.gov; Burkhard Behrens, Astrium Space Transportation; Joe Chambliss, NASA Johnson Space Center; Jose Roman, NASA Marshall Space Flight Center; Ryan Stephan, NASA Johnson Space Center)

ICES104: AIAA SES/INT—On-Orbit Operations and Logistics of Thermal and Environmental Control Subsystems

This session focuses on operations and logistics aspects of thermal and environmental control subsystems for on-orbit spacecraft.

(Organizers: Zoltan Szigetvari, Astrium Space Transportation, zoltan.szigetvari@astrium.eads.net; Andrea Ferrero, Thales Alenia Space)

ICES105: AIAA SES/INT—Thermal and Environmental Control and System Integration for Surface Habitats

This session focuses on passive and active thermal control and life support for surface habitats. Included is the system engineering that integrates those functions with rovers, EVA systems, and surface utilities. Other potential topics include the transition from exploration to habitation, base heat rejection, dust mitigation, extreme long duration environment characterization, and advanced technologies to address habitat functionality.

(Organizers: Darius Nikanpour, Canadian Space Agency, darius.nikanpour@asc-csa.gc.ca; Joe Chambliss, NASA Johnson Space Center, joe.p.chambliss@nasa.gov)

ICES106: AIAA SES/INT—Space Station and Manned Orbiting Infrastructures Thermal Control

This session addresses thermal control on board the current Space Station and future long-term, manned (or man-tended) orbiting habitats, platforms, laboratories, and small-scale prototypes. Topics range from system and component issues with the space station thermal control systems to thermal aspects of payloads and experiments that utilize the station as a science platform or as a test bed for future exploration applications, including advanced thermal control solutions and/or techniques.

(Organizers: Andrea Ferrero, Thales Alenia Space, andrea.ferrero@thalesaleniaspace.com; Gary Adamson, Hamilton Sundstrand; Zoltan Szigetvari, Astrium Space Transportation; Dale Winton, Honeywell International)

ICES107: AIAA SES/INT—Thermal and Environmental Control Engineering Analysis and Software

This session addresses thermal and environmental control engineering analysis, including associated analysis methods, algorithms, modeling, software tools, integration with other engineering disciplines, and data exchange.

(Organizers: Olivier Pin, European Space Agency, olivier.pin@esa.int; Brian Briggs, Orbital Sciences Corporation; Nick Teti, Hawk Institute for Space Sciences; Henry Brouquet, ITP Engines UK)

ICES108: AIAA SES/INT—Advances in Thermal Control Technology

This session addresses novel or advanced technologies and development activities pertaining to heat acquisition, transport, rejection, and storage, as well as cryogenic cooling and thermal protection systems not specific to any existing or future scientific instruments, spacecraft, or planetary systems. Some examples include advanced insulation, "smart" optical coatings, nanoparticle-based heat transfer enhancements, and multifunction thermal materials

(Organizers: Jeff Farmer, NASA Marshall Space Flight Center, jeffery.t.farmer@nasa.gov; Matthias Holzwarth, Astrium Space Transportation, matthias.holzwarth@astrium.eads.net; Richard Briet, CNES; Brian O'Connor, NASA Marshall Space Flight Center; Olivier Pin, European Space Agency; Ryan Stephan, NASA Johnson Space Center)

ICES109: AIAA SES—Space Structures for Exploration

This session addresses the efficient use of in-situ resources as well as the application of reduced mass stowable/deployable structures to space and planetary exploration. Environmental robustness, effective storage, and the use/transformation of native resources will be considered as integral parts of these technologies, which range from materials and components to full scale structures.

(Organizers: Paul McElroy, Touchstone Research Laboratory, pmm@trl.com; Rick Helms, NASA Jet Propulsion Laboratory)

ICES110: AIAA SES—Thermal and Environmental Control of Commercial Spacecraft

This session focuses on the thermal and environmental control aspects of commercial venture, crewed, or robotic spacecraft and systems.

(Organizers: Nick Teti, Hawk Institute for Space Sciences, nicholas.m.teti@nasa.gov; Brian Briggs, Orbital Sciences Corporation)

ICES111: AIAA SES—Thermal Standards and Design/Development Practices

This session focuses on current and future efforts and needs for development of spacecraft thermal control standards and reference documents dealing with such areas as design, analysis, testing, equipment, specifications, and processes. These standards might be dedicated to a specific company or applicable to entire programs like Constellation or agencies like NASA.

(Organizers: Eric Grob, NASA Goddard Space Flight Center, eric.w.grob@nasa.gov; Joe Gasbarre, NASA Langley Research Center; Art Avila, NASA Jet Propulsion Laboratory)

ICES112: AIAA SES/LS&S—Orbital Debris Mitigation

This session addresses all aspects of orbital debris reduction, effects on orbiting vehicles, spacecraft and components, protection schemes, and management of the debris risk.

(Organizers: Eric Grob, NASA Goddard Space Flight Center, eric.w.grob@nasa.gov; Mary Christine Desjean, CNES)

ICES113: AIAA SES—Spacecraft Propulsion Systems Thermal Control

This session features papers on thermal control design, analysis, testing, and flight performance of propulsion systems for rockets, spacecraft, orbiting platforms, space vehicles, and landers, including advanced propulsion techniques.

(Organizers: Jose Roman, NASA Marshall Space Flight Center, jose.m.roman@nasa.gov; Joe Chambliss, NASA Johnson Space Center)

ICES114: AIAA SES—Thermal Control of Space Nuclear Power Systems

This session includes papers on thermal control of nuclear power systems for spacecraft, orbiting platforms, space vehicles, landers, and rovers, including systems for power generation, propulsion, and heating.

(Organizers: Joe Chambliss, NASA Johnson Space Center, joe.p.chambliss@nasa.gov; Jose Roman, NASA Marshall Space Flight Center)

ICES115: AIAA SES & INT—James Webb Space Telescope Thermal Control

This session focuses on the thermal design, analysis, and testing of spacecraft, instrument, optical, and thermal protection systems for the international James Webb Space Telescope mission.

(Organizers: Wes Ousley, Genesis Engineering Solutions LLC, wes.ousley@nasa.gov; Jose Rodriguez, NASA Jet Propulsion Laboratory; Gerd Jahn, EADS Astrium GmbH)

ICES200: INT—Physico-Chemical Processes: Air and Water

This session covers technology studies, design, development, manufacturing, integration, testing and operations experience in the areas of water regeneration and treatment, air renewal and cleaning, human waste recycling, energy storage and transformation, and in-situ resource utilization, that apply physico-chemical processes.

(Organizers: Cesare Lobascio, Thales Alenia Space Italia S.p.a., cesare.lobascio@thalesaleniaspace.com; W. Raatschen, EADS Atrium GmbH; Leonid Bobe, Niichimmash)

ICES201: INT—Two-Phase Thermal Control Technology

This session presents the latest developments and innovations of two-phase heat transport systems, modelling techniques, and on-orbit performances for space applications. It covers all variants of heat pipe technologies, capillary pumped loops, and loop heat pipes.

(Organizers: Darius Nikanpour, Canadian Space Agency, Darius.Nikanpour@asc-csa.gc.ca; Frank Bodendieck, OHB System AG; Tarik Kaya, Carleton University; Alejandro Torres, IberEspacio S.A.)

ICES202: INT—Satellite, Payload, and Instrument Thermal Control

This session covers the development and design of thermal control systems for satellites, payloads, and instruments.

(Organizers: Patrick Hugonnot, Thales Alenia Space France, patrick.hugonnot@thalesaleniaspace.com; Marco Molina, Carlo Gavazzi Space; Hiroyuki Ogawa, Japan Institute of Space and Astronautical Science; Johannes van Es, NLR)

ICES203: INT—Thermal Testing

The thermal testing session focuses on all aspects of thermal tests, test methods, test correlation, and test facilities. Tests for all kinds of spacecraft, instruments, equipment, and materials are of interest. Special attention is given to sharing lessons learned from thermal test and test analysis and correlation activities, and also to innovative test methods, set-ups, and approaches to testing and verification of the hardware and of the analysis.

(Organizers: Gerd Jahn, EADS Astrium GmbH, gerd.jahn@astrium.eads.net; Steve Price, EADS Astrium GmbH; Hiroyasu Mizuno, JAXA)

ICES204: INT/AIAA LS&S—Bioregenerative Life Support

This session focuses on the design and development of ground-based facilities and experiments, and flight hardware designs and experiments associated with integrated systems that incorporate biological, physical, and chemical processors.

(Organizers: Mark Kliss, NASA Ames Research Center, mark.h.kliss@nasa.gov; Masato Sakurai, JAXA; Cesare Lobascio, Thales Alenia Space Italia S.p.a.)

ICES205: INT/AIChE—Advanced Life Support Sensor and Control Technology

This session includes papers describing approaches to monitoring water and air in enclosed habitats, thermal control of habitats, chemical sensors and sensing devices for detection of chemical constituents in water and air, and systems and system concepts for environmental monitoring and control.

(Abhijit V. Shevade, NASA Jet Propulsion Laboratory, abhijit.v.shavade@jpl.nasa.gov; Darrell L. Jan, NASA Jet Propulsion Laboratory; Timo Stuffler, Kayser-Threde GmbH)

ICES300: AIChE—ECLSS and Thermal Modeling and Test

This session reports on applications of and advances in modeling physiochemical and biochemical life support processes, as well as in numerical modeling of atmospheric pressure, cabin ventilation, and composition distributions in closed space habitats, such as the International Space Station, the deep exploration spacecraft, the lunar habitat, and commercial crewed and cargo space transport vehicles.

(Organizers: Chang Hyun Son, The Boeing Company, chang.h.son@boeing.com; Nikolay Ivanov, Saint Petersburg State Polytechnic University, Russia; Brian Dunaway, The Boeing Company)

ICES301: AIChE—Advanced Life Support Systems Control

The Advanced Life Support Systems Control session reports on advanced life support system control topics, such as controller technology; control theory and application; autonomous control; integrated system control; control software; and modeling, simulation, and emulation for control development.

(Organizers: David Kortenkamp, TRACLabs Inc., korten@traclabs.com; Chang Hyun Son, The Boeing Company)

ICES302: AIChE—Physio-Chemical Life Support Process Development

This session addresses research issues and development of physio-chemical technology for the Air Revitalization System (ARS), Water Recovery System (WRS), Waste Management System (WMS), and integration of these systems for space vehicles and planetary habitats. Reports on performance of technologies for processing air, water, and solid wastes, on cross-cutting technologies demonstrating the integration of the systems together with reduction of mission costs, and on performance of hardware in microgravity conditions are also presented.

(Organizers: K. Wignarajah, NASA Ames Research Center, Wiggy.Wignarajah@nasa.gov; John Fisher, NASA Ames Research Center; Mike Flynn, NASA Ames Research Center; John Hogan, NASA Ames Research Center; Mark Kliss, NASA Ames Research Center)

ICES304: AIChE—Development for Space Missions and Terrestrial Applications

This session focuses on NASA-derived technologies that have terrestrial applications toward air purification, water treatment, and solid waste management. Papers should clearly demonstrate the original NASA application and conclude with the modifications taken to transform the original technology for terrestrial applications. In addition, papers should cover the terrestrial market, bench-scale, and pilot/full-scale data if available. Papers that discuss the development of terrestrial applications that have potential for NASA applications are also solicited.

(Organizers: David Mazyck, University of Florida, dmazyck@ufl.edu; Kristen Riley, University of Florida)

ICES305: AIChE—In-Situ Resource Utilization

This session addresses research and development issues in utilization of in-situ lunar, planetary, and asteroidal resources to produce consumables and propellants for future human or robotic space missions. Presentations will include, but are not limited to, hardware development and testing, system integration, trade studies, process simulations, and ISRU reliability and safety.

(Organizers: Tim Nalette, Hamilton Sunstrand, t.nalette@hs.utc.com; Jean Hunter, Cornell University)

ICES306: AIChE/ASME—Environmental and Thermal Control for Commercial Crewed and Cargo Transport Spacecraft

This session seeks papers that describe the environmental control and thermal control systems and subsystems being developed for commercial suborbital and orbital crewed spacecraft and commercial cargo transport vehicles, the differences in driving requirements for these commercial vehicles as compared to traditional governmental spacecraft, and reliable but cost-efficient design solutions.

(Organizers: Barry Finger, Paragon Space Development Corporation, bfinger@paragonsdc.com; Chang Hyun Son, The Boeing Company; David Williams, NASA Johnson Space Center)

ICES307: AIChE/AIAA LS&S—Orion Multi-Purpose Crew Vehicle Environmental Control and Life Support System

This session addresses Crew Exploration Vehicle current configuration and status.

(Organizers: John Lewis, NASA Johnson Space Center, john.f.lewis@nasa.gov; Grant Anderson, Paragon Space Development Corporation; Tim Nalette, Hamilton Sundstrand)

ICES308: AIChE—Education and Outreach

The Education and Outreach session features papers that link human activities in space with human activities on Earth. The session provides educators the opportunity to share experiences and present the most recent methodologies for linking students and the general public to human exploration of space.

(Organizers: Jean Hunter, Cornell University, jbh5@cornell.edu; Dean Muirhead, Barrios Technology)

ICES400: ASME—Extravehicular Activity: Space Suits
This session covers topics related to space suit pressure garments. It includes advanced development work, as well as ongoing efforts toward the Constellation Program flight space suit design.
(Organizer: Lindsay T. Aitchison, NASA Johnson Space Center, lindsay.t.aitchison@nasa.gov)

ICES401: ASME/AIAA LS&S—Extravehicular Activity: Systems
This session includes topics describing aspects of EVA systems, technologies, and studies that envision the space suit as a system. Concepts and testing of advanced space suit systems are also included.
(Organizers: Robert Trevino, NASA Johnson Space Center, robert.c.trevino@nasa.gov; Shawn Macleod, David Clark Company)

ICES402: ASME—Extravehicular Activity: PLSS Systems
This session covers topics describing design studies and new technology development or significant experience and lessons learned with existing systems in the area of portable life support systems and associated support hardware. Also, this session will deal with emerging technology and concepts relating to Orion or other Constellation systems.
(Organizers: Edward W. Hodgson, Hamilton Sundstrand, ed.hodgson@hs.utc.com; Bruce Webbon, NASA Ames Research Center; Gregory Quinn, Hamilton Sundstrand)

ICES403: ASME—Extravehicular Activity: Operations
This session addresses EVA operational activities associated with the Space Shuttle, the International Space Station (ISS), and future human spacecraft. Lessons learned on the logistics, maintenance, and conduct of EVA operations that may apply to the future of EVA are also of interest.
(Organizer: Bill West, Hamilton Sundstrand, william.w.west@nasa.gov)

ICES404: ASME—International Space Station ECLS: Systems
This session addresses ECLS System issues and lessons learned from the International Space Station.
(Organizers: Gregory Gentry, The Boeing Company, gregory.j.gentry2@boeing.com; David Williams, NASA Johnson Space Center; Zoltan Szigetvari, Astrium Space Transportation)

ICES405: ASME—International Space Station ECLS: Air and Water Systems
This session addresses ECLS water and air issues and lessons learned from the International Space Station.
(Organizers: Gregory Gentry, The Boeing Company, gregory.j.gentry2@boeing.com; David Williams, NASA Johnson Space Center; Zoltan Szigetvari, Astrium Space Transportation)

ICES406: ASME—Human/Robotics System Integration
This session addresses the design and development of robotics for space exploration and how these robotic systems will work together with humans.
(Organizers: Loel Goldblatt, Hamilton Sundstrand, loel.goldblatt@hs.utc.com; Shane McFarland, Wyle)

ICES407: ASME/AIChE—Spacecraft Water/Air Quality: Maintenance and Monitoring
This session addresses recent developments in spacecraft air and water quality monitoring technology.
(Organizers: John Schultz, Wyle Laboratories, john.r.schultz@nasa.gov; Darrell Jan, NASA Jet Propulsion Laboratory; John Straub, Wyle Laboratories)

ICES408: ASME—Regenerable Life Support Processes and Systems
This session addresses recent developments of regenerable life support processes and systems for spacecraft.
(Organizers: Loel Goldblatt, Hamilton Sundstrand, loel.goldblatt@hs.utc.com; Tim Nalette, Hamilton Sundstrand; Morgan Abney, NASA Marshall Space Flight Center)

ICES409: ASME—Airliner Cabin Air: Monitoring, Control, and Environmental Health Issues
This session addresses recent developments in airliner cabin air monitoring, control, and environmental health issues.
(Organizers: Ruel Overfelt, Auburn University, overfra@auburn.edu; David R. Space, The Boeing Company)

ICES500: AIAA LS&S—Life Science/Life Support Research Technologies
This session emphasizes research technologies to support astrobiology, habitation and life support system design. Life sciences-related hardware developments, experiment designs, and flight experiment results for manned spaceflight, unmanned systems such as free flying platforms and planetary spacecraft, and terrestrial analogs will be presented.
(Organizer: Bob Morrow, Orbital Technologies Corporation (ORBITEC), morrow@orbitec.com)

ICES501: AIAA LS&S—Life Support Systems Engineering and Analysis
This session addresses life support for future crewed space missions, including defining systems architecture and selecting technology options. Life support systems engineering and analysis should help guide overall design and selection, development, and integration of technologies to produce complete systems.
(Organizers: Harry Jones, NASA Ames Research Center, hjones@mail.arc.nasa.gov; John Hogan, NASA Ames Research Center)

ICES502: AIAA LS&S—Space Architecture
This session focuses on the application of architectural principles to the design of facilities beyond Earth, to provide for comfortable lodging, productive work, and enjoyment of life, in full recognition of the technical challenges presented by the environment.
(Organizers: Ondrej Doule, International Space University, doule@isu.isunet.edu; Tedd Hall, University of Michigan)

ICES503: AIAA LS&S—Radiation Issues for Space Flight
This session addresses major issues in space radiation and analysis, tools, and research that are being developed and applied to support the space exploration initiative to insure astronaut radiation protection and safety.
(Organizers: Bill Atwell, The Boeing Company, william.atwell@boeing.com; Lawrence Townsend, University of Tennessee)

ICES504: AIAA LS&S—Management of Air Quality in Sealed Environments
This session enables experts who manage submarine, spacecraft, and airliner air quality to share new research findings on the control of air pollutants in these sealed or semi-sealed environments to include air quality standards, hazards associated with specific compounds, and monitoring of those compounds to protect the health of crew and passengers.
(Organizers: John James, NASA Johnson Space Center, John.t.james@nasa.gov; Thomas Limero, Wyle Laboratories)

ICES505: AIAA LS&S/ASME—Microbial Factors Applied to Design

This session focuses on the dynamic effects of microorganisms on materials and systems to minimize hardware performance issues.

(Organizers: Monserrate Roman, NASA Marshall Space Flight Center, monsi.roman@nasa.gov; Rebekah Jean Bruce, Wyle Laboratories; Letty Vega, Jacobs Technology)

ICES506: AIAA LS&S—Human Exploration Beyond Low Earth Orbit: Missions and Technologies

There are many potential destinations for human exploration beyond Low Earth Orbit (LEO), each with specific mission requirements, capabilities, and other attributes that may be common or unique. This session addresses mission designs, technology needs, vehicle systems and analyses for sending humans to destinations beyond LEO including geosynchronous orbit, libration points, the moon, near Earth objects (comets and asteroids), Mars, and its moons. Relevant subjects include mission requirements, concepts, and architectures, technology development needs, challenges, and gaps, and candidate system designs. Special attention will be given to Environmental Control and Life Support Systems (ECLSS), habitability, unique environmental considerations, and architectures.

(Organizers: Dan Barta, NASA Johnson Space Center, daniel.j.barta@nasa.gov; James Chartres, Carnegie Mellon)

ICES507: AIAA LS&S—Human Factors for Space Missions Ground and Flight Operations

This session presents human factors topics applicable to space missions with special emphasis on ground assembly, deployment, logistics, maintenance, and operations for both Earth-bound preflight as well as extraterrestrial planetary missions. Topics may include (but are not limited to) procedures, tools, human-automation interaction, remote operation, team performance, design assessment techniques, translating test results into design, temporary structures for preflight ground assembly, and training. The session will include papers reporting research as well as descriptions of design, methods, tools, and lessons learned or past successes.

(Organizer: Grant Anderson, Paragon Space Development Corporation, ganderson@paragonsdc.com)

ICES508: AIAA LS&S—Mars and Beyond

This session is dedicated to general matters concerning Mars: the environment and surroundings encountered on the planet, vehicles and vehicle behavior, problems and solutions found to sustain operations and life in this particular environment, and all Mars-related technologies. Also appropriate are ECLSS perspectives on Jupiter, asteroids, and other planets..

(Organizers: Marie-Christine Desjean, CNES, marie-christine.desjean@cnes.fr; Andrew Jackson, Texas Tech University)

ICES509: AIAA LS&S—Fire Safety in Spacecraft and Enclosed Habitats

This session covers all aspects of fire safety in closed environments including prevention, detection, and suppression. Relevant subjects include material controls for fire prevention; fire suppression; fire detection; fire signatures and toxicity; post-fire cleanup; risk assessment; material selection; fire related combustion research; lessons learned and design status of current systems; and life support and control system designs to enable fire detection and suppression. Applicable environments include EVA suits; past, present, and future space transportation vehicles; different gravitational levels; extraterrestrial habitats; aircraft; ships; and submarines.

(Organizers: David Urban, NASA Glenn Research Center, david.l.urban@nasa.gov; James Russell, Lockheed Martin Corporation; Gary A. Ruff, NASA Glenn Research Center)

ICES510: AIAA LS&S—Lunar and Martian Dust Properties and Mitigation Technologies

This session focuses on the properties and mitigation technologies for lunar and Martian dust. The effects of dust will pose significant challenges to space operations for crewed and robotic missions. Papers are solicited on mitigation strategies for life support systems and dust encountered in planetary surface environments. Mitigation strategies may involve cleaning and repelling approaches for the protection and nominal performance of susceptible hardware, and the capture and filtration of airborne lunar dust that may enter the pressurized volumes of spacecrafts and habitats. Measurements of lunar and/or Martian dust properties that provide engineering data for the development of mitigation technologies are also of interest. This session will bring together government, industrial, and academic participants in the space research and technology development community to present their ideas and concepts on this focused topic.

(Organizers: Juan H. Agui, NASA Glenn Research Center, juan.H.Agui@nasa.gov; Mark Hyatt, NASA Glenn Research Center)

ICES511: AIAA LS&S—Mission Assurance and Reliability Techniques for Environmental Systems

This session covers testing and analysis for system reliability and maintainability. Relevant subjects include verification and validation, risk assessment, accelerated life testing and aging, environmental screening, acceptance testing, and qualification testing. Special attention is given to failure modes and mechanisms associated with electronic devices, mechanical assemblies, chemical processing, and life sciences.

(Organizers: Todd H. Treichel, Orbital Technologies Corporation (ORBITEC), treichelt@orbitec.com; Greg Davis, NASA Jet Propulsion Laboratory, gregory.l.davis@jpl.nasa.gov)

ICES512: AIAA LS&S—Human Rating for Space Systems

This session engages industry, government, and academia in the definition and analysis of safety and mission assurance parameters as they relate to the design and operations of spacecraft intended for human occupancy. One key objective is to assess the relevancy and commonality of requirements and policies for NASA and FAA commercial human spaceflight missions.

(Organizers: Dave Klaus, University of Colorado, klaus@colorado.edu; Rene Rey, FAA)

ICES513: Computational Modeling for Human Health and Performance Analysis

This session covers practical application of computational modeling (deterministic and probabilistic) for analysis of human health and performance risks, and countermeasure development. Discussion areas include modeling and simulation of physiologic, biomechanical and behavioral responses to reduced gravity, radiation, spacecraft environment, planetary environment, extravehicular activity, crew dynamics, ergonomics, work-load, and countermeasure prescriptions (exercise and non-exercise).

(Organizers: Lealem Mulugeta, Universities Space Research Association, mulugeta@dsls.usra.edu; Grant Schaffner, University of Cincinnati, grant.schaffner@uc.edu)

ICES600: Other

If you are not sure of the best placement for your abstract, please submit to ICES600.

Student Poster Competition

The ICES student poster competition is a program targeted to stimulate the participation of students and provide an excellent forum for students to present their work in an informal and interactive setting. Posters are ideal for presenting speculative or late-breaking results, or for giving an introduction to interesting, innovative work. Posters are intended to provide students and ICES participants with the ability to connect with one another and discuss the work presented. Each poster will be judged on both the format of the poster and the student's ability to convey the poster content to the judges. University/college students are invited to submit abstracts on their proposed poster by **1 June 2013** per the abstract submittal procedures described below. The student's abstract and poster should be pertinent to ICES; that is, they should follow the same theme of the general conference, focusing on humans living and working in hostile environments with applications inside or outside of terrestrial or outer space habitats or vehicles. Abstracts of approximately 300 words must include poster title, author name(s), mailing and e-mail addresses, phone and fax numbers, and university or college. The first author and the presenting author of the poster must be students. Abstracts must not be more than one page in length and must be double-spaced. Adherence to this format is required. Abstracts that do not adhere to this format will be rejected. Poster abstracts should be emailed as an attachment to Chang Hyun Son by **1 June 2013**. Authors will be notified of poster presentation acceptance by **10 June 2013**. Each participating student will receive a ticket to Wednesday night's banquet. For questions on the student poster competition, please contact Chang Hyun Son at chang.h.son@boeing.com.

49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit and 11th International Energy Conversion Engineering Conference (IECEC)

14–17 July 2013
San Jose Convention Center
San Jose, California

Abstracts Deadline: 21 November 2012

Abstract and Manuscript Submission Guidelines

Procedures for Abstract and Manuscript Submittal

Abstract submissions for the JPC or IECEC conferences will be accepted electronically through AIAA's website at **www.aiaa.org/jpc2013** or **www.iecec.org**, respectively. Abstracts will be due no later than **21 November 2012**. Authors will be notified of paper acceptance via email by **18 March 2013**. An Author's Kit, containing detailed instructions and guidelines for submitting papers to AIAA, will be made available to authors of accepted papers. Authors of accepted papers must provide a complete manuscript online to AIAA by **25 June 2013** for inclusion in the online proceedings and for the right to present at the conference. It is the responsibility of those authors whose papers or presentations are accepted to ensure that a representative attends the conference to present the paper. Sponsor and/or employer approval of each paper is the responsibility of the author. Government review, if required, is the responsibility of the author(s). Authors should determine the extent of approval necessary early in the paper presentation process to preclude paper withdrawals or late submissions.

The electronic submission process is as follows:

1) Access the AIAA website at **www.aiaa.org/jpc2013** or **www.iecec.org**.

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 website.

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, click the Submit 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. Select the appropriate conference to submit to on the following page.

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. ***Pleas Note***: If you have previously visited the site and begun a draft submission, click the "View Submissions" link on the left-hand side to resume your submission.

Special Notes

1) If authors wish to revise an abstract that has already been submitted, they must go to "View Submissions" and select "Return to Draft" to make any corrections. This step 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.

Authors having trouble submitting abstracts electronically should email AIAA technical support at **ts.acsupport@thomson.com**. Questions about abstract submission or full draft manuscript themselves should be referred to the appropriate Technical Chair.

The Joint Propulsion Conference and the International Energy Conversion Engineering Conference are unclassified conferences. All abstracts and papers by U.S. persons (U.S. citizens or permanent residents who are not explicitly acting as agents of a non-U.S. entity) must be approved through the ITAR, and in many cases other (e.g., corporate) approval processes. Authors are encouraged to contact their company's ITAR and Intellectual Property point of contact to start the approval process early, thus ensuring timely approval and submittal of the paper.

New for 2013

AIAA is planning to offer a limited number of sessions at the 2013 conference where ITAR-restricted material can be presented in a U.S.-only forum. Procedures are being finalized and complete details will be available on the AIAA website when the abstract submission site opens on **15 August 2012**.

General Submission Guidelines

Abstracts are to be submitted subject to the following general rules:

- The abstract should not be submitted to more than one technical area. If an author is unsure which area is most appropriate, it is the author's responsibility to communicate with the technical program organizers in question well before the abstract submission deadline to determine to which area the abstract should be submitted. There is too little time in the

review process for an abstract rejected by one technical program chair to be forwarded for review by another.
- Early submissions are encouraged to permit review and discussion of the abstracts among the technical program organizers, by the technical session chairs, and, if appropriate, with potential authors before final selections for the program are made. Abstracts submitted after **21 November 2012** may be subject to rejection without review.
- Authors will be notified of paper acceptance on or about **18 March 2013**. An author's kit, containing detailed instructions and guidelines for submitting papers to AIAA, will be made available to authors of accepted papers.
- As abstracts may be reviewed by non-U.S. persons, if required they should undergo ITAR review.
- Additional guidelines and exceptions to the aforementioned guidelines (except for deadlines) can be made at the discretion of the technical chair.

Abstract Submittal Requirements

JPC
- An abstract of at least 1,000 words is recommended, with key figures and references to pertinent publication in the existing literature; contact session organizers for specifics. Authors must clearly identify new or significant aspects of their work in the abstract.
- The abstract should include key figures that illustrate the primary intent of the author's message. Dummy figures are acceptable if final data are not available, provided that final data will be submitted with the manuscript. The review and acceptance process will be weighted in favor of authors who submit more relevant documentation of their proposed papers.

IECEC
- An abstract of 300–500 words (1–3 pages in length with 12-point font) is recommended; contact session organizers for specifics. Authors must clearly identify new or significant aspects of their work in the abstract.
- The review and acceptance process will be weighted in favor of authors who submit more relevant documentation of their proposed papers.

Authors, Please Note: Be sure that all of your submission data—authors, keywords, title, and abstract file—is accurate before finalizing your submission as no modifications can be made to this data after the submission site closes.

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

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

Publication Policy
- AIAA will not consider for presentation or publication any paper that has been or will be presented or published elsewhere. Authors will be required to sign a statement to this effect.
- AIAA policy precludes an abstract or paper from being submitted multiple times to the same conference. Also, once a paper has been published by AIAA or another organization, AIAA will not republish the paper.

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 of papers accepted to the JPC must submit their final manuscripts via the conference website no later than **25 June 2013**.

Authors of papers accepted to the IECEC must turn in a full manuscript for review via the conference website no later than **8 May 2013** and a Final Manuscript via the conference website no later than **25 June 2013**.

Warning—Technology Transfer Considerations

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

International Traffic in Arms Regulations (ITAR)

AIAA speakers and attendees are reminded that some topics discussed in the conference could be controlled by the International Traffic in Arms Regulations (ITAR). U.S. nationals (U.S. citizens and permanent residents) are responsible for ensuring that technical data they present in open sessions to non-U.S. nationals in attendance or in conference proceedings are not export restricted by the ITAR. U.S. nationals are likewise responsible for ensuring that they do not discuss ITAR export-restricted information with non-U.S. nationals in attendance. *While the regular open sessions still have to be mindful of the ITAR regulations, we will be having a specific number of ITAR secure sessions that will be presented in a U.S.-only forum* (see above for information).

Exhibit Opportunities

The 49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit will feature an impressive exhibit showcasing leading industry products and services. We encourage industry members to bring their best and most innovative products, systems, and services to the JPC 2013 Exhibit for broad exposure to air-breathing, liquid, solid, nuclear, electric, and other forms of propulsion for aerospace. Also invited to exhibit are those companies involved in engine systems, environmental control systems, ground support equipment, software, testing, analysis, research and development, management, propellant tanks, thermal products, noise and vibration, and simulation components of propulsion technology. For more information about the exhibition, please contact Chris Grady at chrisg@aiaa.org or 703.264.7622.

Sponsorship Opportunities

For information regarding Sponsorship Opportunities, please contact John Gattasse at johng@aiaa.org or 703.264.7514.

49TH AIAA/ASME/SAE/ASEE JOINT PROPULSION CONFERENCE AND EXHIBIT

Advancing Propulsion Capabilities in a New Fiscal Reality

AIAA, ASME, SAE, ASEE, and their industry partners proudly invite you to San Jose, CA, for the 49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit (JPC), 14–17 July 2013. We face many challenges to develop new propulsion technologies and systems in the future due to constrained funding dictated by a new fiscal reality. Evolving current systems and developing revolutionary propulsion technologies that provide better capabilities in current and new systems is imperative for laying the foundation for growth and opportunity across the globe. The propulsion technologies and systems employed in the future will provide us with capabilities to fly at hypersonic speeds, provide more range and carry more cargo, use fuel more efficiently with commercial and military aircraft, and provide more affordable access to space. Building on established aerospace capabilities is essential to preserving progress and continuing forward with new propulsion capabilities. Advanced, innovative propulsion research for aircraft and space systems based on focused investment is the key to permitting those capabilities to become reality.

Come to San Jose and be part of the solution to defining the paths for overcoming fiscal obstacles so we can continue to grow the aerospace propulsion industry. The objective for JPC 2013 is to identify and highlight how new generations of aerospace propulsion systems and technologies can be designed, tested, and flown in this restrictive fiscal environment.

Flight applications include next-generation commercial aircraft, regional, and business jets, military applications, supersonic/hypersonic high speed propulsion applications, commercial and government-sponsored launch systems, orbital insertion, satellite, and interstellar propulsion.

Special panel sessions will focus on commercial crew development for space, directions in space exploration, green propulsion directions, military systems coming on line, advanced system applications and their propulsion systems and components, and the technologies that enable them. A unique engineering executive forum will provide aerospace leaders the opportunity to discuss overarching issues affecting the capability of organizations to create new programs, adapt to business changes, and develop the next generation of technical leadership.

For more information, or to offer suggestions, please contact any of the organizers listed in this Call for Papers.

Air-Breathing Propulsion, Combined Cycle Systems, and Components

Air-Breathing Propulsion Systems Integration Sessions

Air-Breathing Propulsion Systems Integration Organizer
Bruce Geoffrey McKay
Lockheed Martin Aeronautics
770.494.2599
Email: bruce.mckay@lmco.com

Papers are solicited in all aspects of air-breathing propulsion systems integration including: a) installed performance and controls; b) propulsion aerodynamics; c) inlet and nozzle technologies; c) power and thermal management; and d) propulsion system/air vehicle interface and certification.

The sessions are jointly sponsored by the AIAA Air-Breathing Propulsion Systems Integration Technical Committee, the SAE Aircraft Propulsion Committee and Turbomachinery Committee, and the ASME Propulsion Technical Committee. Please submit abstracts in one of the four organizational areas below (refer to the details below or contact the above organizer for more information):

- Aerodynamic Performance
- Systems Integration
- Propellers, Pistons, and Turboprops
- Requirements Verification, Certification, and Testing

The aerodynamic performance organizational area includes the development and integration of aircraft inlets, nozzles, and exhaust systems. Emphasis is given to computational results, experimental results and comparisons of computational and experimental results (including sub-scale and flight components), component optimization, and inlet and exhaust system design techniques at speeds ranging from subsonic through hypersonic. Areas of interest include:

- Subsonic intake and diffuser flow physics, including boundary layer ingesting inlets
- Supersonic compression systems: flowpath and mechanical design
- Induction system contribution to drag and other aerodynamic forces and pitching moments
- Boundary layer effects, control, and management
- Flow control, including scaling effects
- Inlet/engine operability
- System-level performance
- Aerodynamic effects of propulsion system integration
- Nacelle/wing interaction
- Jet effects and thrust vectoring
- Area control
- Thrust reversers
- Real-world operation environmental issues (corrosion, icing, sand, rain, bird strike, etc.)
- Acoustics and acoustic treatments
- Inlet and nozzle effects on sonic boom
- STOVL concepts and integration
- Survivability

The systems integration organizational area includes:

- System-level assessments of integrated propulsion concepts, including distributed propulsion
- Propulsion system structural integration
- Integrated flight/propulsion control, hardware/software integration
- Power/thermal management—integrated propulsion/power/thermal architecture, all electric architectures, power/fluid systems integration, environmental control system integration, thermal management systems
- Engine physical integration—performance-based specification development, interface control and associated contractor/supplier management
- Propulsion operations—reliability and maintainability, field support, removal and installation, and overhaul and maintenance.
- Emerging propulsion-system technologies including hydrogen fuel cell and battery electric propulsion

The propellers, pistons, and turboprops organizational area addresses all aspects of air-breathing propulsion system integration with emphasis on those issues particular to propeller driven systems.

The requirements verification, certification, and testing organizational area addresses all aspects of air-breathing propulsion integration certification and testing including FAA compliance and regulations.

Gas-Turbine Engine Sessions

Gas Turbine Engine Organizer
Ian Halliwell
Principal Engineer
Aerodynamics with Power Systems Manufacturing, an Alstom Company
561.354.9205
Email: ianhalliwell@earthlink.net

Papers are solicited in all areas related to the science and technology of gas turbine engines, internal combustion engines, and associated engine components, for air vehicle applications in the subsonic and transonic flight regimes. The sessions are jointly sponsored by the AIAA Gas Turbine Engine Technical Committee, the SAE Aircraft Propulsion Committee and Turbomachinery Committee, and the ASME Propulsion Technical Committee. Please contact the above organizer for more information.

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ASEE Technical Program Chair
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Topics of interest for the GTE sessions include, but are not limited to, the following:

- Research and technology development efforts related to inlets, nozzles, and engine components—props, fans, compressors, combustors, turbines, augmentors, controls, heat exchangers, transmissions, shafting, bearings, and seals—and their interaction.
- Methods/tools for preliminary and detailed design, manufacturing, inspection, and assembly
- Advanced materials
- Engine or component test techniques, advanced instrumentation/sensors, diagnostics/health-monitoring/CBM techniques
- Advanced combustor technology and alternative fuels
- Multidisciplinary design, analysis and optimization of engine systems and components
- Analytical and computational models for component- and engine-level analysis, optimization, and steady and transient simulation
- Heat transfer, thermal management, cooling, and secondary flow management
- Advanced thermodynamic cycles and game-changing component technologies
- Application and integration of pressure-gain combustors (deflagrative and detonative) in turbine engines, their valving, and interaction with adjacent turbomachinery components.
- Advanced engine architectures/installations, variable cycle engines, distributed propulsion
- Aeroacoustics, engine and jet noise generation and mitigation
- Engine icing, engine protection (sand/dust)
- Engine stability and inlet/engine compatibility
- Electric power generation and rapid power extraction
- Hybrid engines, turbo-electric propulsion, and distributed propulsion
- Comparisons of engine flight and ground test data and simulation results
- Auxiliary systems and structures, and their interaction with the primary engine system
- Engine component life and cost methods/analyses

High Speed Air-Breathing Propulsion Sessions

High Speed Air-Breathing Propulsion Organizer
Faure Joel Malo-Molina
USAF, AFRL/RBAC
937.904.4049
Email: faure.malo-molina@wpafb.af.mil

Hypersonic and Combined Cycle Propulsion Application Sessions

Hypersonic and Combined Cycle Propulsion Organizer
Tim O'Brien
Aerojet
916.355.2825
Email: timothy.o'brien@aerojet.com

Papers are solicited for all forms of air-breathing hypersonic and combined cycle propulsion systems, as well as high speed air-breathing propulsion systems used in the full spectrum of aircraft, space launch vehicles, and missiles. The sessions are jointly sponsored by the AIAA Hypersonic Technology and Aerospace Plane Program Committee, the AIAA High Speed Air Breathing Propulsion Technical Committee, the SAE Hypersonics Committee, and the ASME Propulsion Technical Committee. Please contact the above organizers for more information.

Topics of interest for these sessions include, but are not limited to, the following:

- Ramjet, scramjet, and combined cycle (TBCC, RBCC, etc.) engines using hydrogen, hydrocarbon, or alternate fuels
- Engine components such as combustors, injectors, isolators/diffusers, and MHD generators for power generation
- The use of plasmas to modify shock structure and combustion
- Ground and flight test of hypersonic propulsion systems
- Control systems
- Applications for reusable launch vehicles, including single- and multiple-stage to orbit launch vehicle concepts
- Flight demonstrator research vehicle concepts
- Combined cycle engine system design and development
- Combined cycle engine analysis, optimization, and performance prediction
- Internal/external flow CFD analyses
- Innovative propellant management concepts
- System demonstration/validation plans
- Component development status
- Engine life-cycle costs
- Mission requirements
- Vehicle/engine integration and performance, engine thrust and specific impulse, mass fraction
- Ramjet, scramjet, and combined cycle engine air inlets, including inlet airflow, inlet boundary layer considerations, bleed/bypass, and shock positioning requirements
- Ramjets, scramjets, including combustors and combustion, fuel injection, flame holders, ramjet/scramjet transition, and fuel heating/thermal management
- Propellants, including propellant handling, air liquefaction, slush hydrogen, and bi/tri propellants
- Constant volume combustion engines (pulse detonation engines, wave rotors, continuous detonation engines, etc.), mechanical and thermal design, practical design and integration of detonation initiation and propagation systems, fuel system, and inlet system
- High-fidelity propulsion system simulations discussing physics-based subsystem and system simulation methods and technologies, including validation, simulation frameworks, variable fidelity analysis, visualization environments, and high performance computing

Rockets and Space Propulsion

Electric Propulsion Sessions

Electric Propulsion Organizer
Paulo Lozano
Department of Aeronautics and Astronautics
Massachusetts Institute of Technology
617.258.0742
Email: plozano@mit.edu

Papers are solicited in all areas of electric propulsion, such as:

- Hall thrusters
- Ion thrusters
- Field emission thrusters, colloid thrusters, and other micropropulsion concepts
- MPD, PPT, and PIT thrusters
- Resistojets and arcjets
- Advanced thruster concepts
- Other electrothermal, electromagnetic, or electrostatic thruster concepts
- Innovative or advanced electric propulsion systems

For the concepts or systems listed above, the topics of interest include:

- Fundamental physics
- Analytical modeling
- Numerical simulations
- Laboratory and space testing
- Diagnostics
- Lifetime characterization
- Mission analysis
- Systems analysis
- Development programs
- Flight programs
- Other applications

The sessions will be sponsored by the AIAA Electric Propulsion Technical Committee and the ASME Propulsion Technical Committee. Contact the above organizer for more information.

Hybrid Rocket Propulsion Sessions

Hybrid Rocket Propulsion Organizer
Madhan Bala
Space Propulsion Group, Inc.
760 San Aleso Avenue
Sunnyvale, CA 94085.
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Email: han@spg-corp.com

Papers are solicited that address all areas of hybrid propulsion technology including propulsion system applications, engine development and testing, oxidizer and fuel evaluation, and computational studies. These sessions are sponsored by the AIAA Hybrid Rockets Technical Committee. Please contact the above organizer for more information. Specific topics of interest for these sessions include, but are not limited to, the following:

- Development and evaluation of novel oxidizer and fuel formulations and combinations
- Injector designs and effect on engine performance and stability
- Physical processes related to oxidizer vaporization, heat transfer, solid-phase to gas phase species evolution, and mixing of oxidizer and fuel species
- Chemical kinetics between fuel and oxidizer species
- Analysis of internal ballistics including predictive capability
- Computational fluid dynamics studies of internal flow fields and combustion
- Design studies including cost and feasibility analysis
- Combustion stability, motor performance, and related issues
- Design and development of novel hybrid rocket motor concepts
- Descriptions of current programs—their objectives and progress to date

Liquid Rocket Propulsion Sessions

Liquid Rocket Propulsion Organizer
Silvio Chianese
Space Exploration Technologies
310.363.6400 ext. 21160
Email: Silvio.Chianese@spacex.com

The sessions will be jointly sponsored by the AIAA Liquid Propulsion Technical Committee, the SAE Space Transportation and Propulsion Technical Committee, and the ASME Propulsion Technical Committee. Contact the above organizer for more information. Unclassified papers are solicited in all areas of liquid propulsion technology, including propulsion system applications, engine development and testing, fluid control instrumentation, pressurant, and propellant storage. Papers that combine numerical/analytical with experimental results are encouraged. Studies that involve unique or new propulsion systems that are affordable and sustainable, or improvements to existing systems to make them more affordable and sustainable are of particular interest.

Topics of interest for these sessions for analytical, experimental and numerical studies include, but are not limited to, the following:

Liquid Rocket Engine and Propulsion Systems

- Expendable and reusable launch vehicle propulsion for booster, upper stage, and single stage to orbit applications
- Space vehicle propulsion for orbital, de-orbit, and interplanetary applications
- Liquid engine and propulsion systems for exploration systems and programs
- Propulsion systems utilizing non-toxic propellants and associated technologies

Liquid Rocket Engine and Propulsion System Components

- Ignition systems such as combustion wave, laser, advanced torch, and hypergolic
- Engine combustion chamber design and analysis including coolant channels, innovative concepts, heat transfer, manufacturing processes, and materials
- Combustion instability experiments
- Combustion device injector design and analysis including acoustic analysis, innovative concepts, manufacturing processes, materials, testing at supercritical pressures, scaling laws from cold-flow to hot-fire experiments, scaling laws from single to multiple elements
- Nozzle design, analysis, manufacturing processes, materials, and testing, innovative concepts
- Turbomachinery for liquid rocket engines: fluid dynamic analysis, design innovation, manufacturing, materials, and testing
- Lightweight gas storage vessels and propellant tanks; propellant acquisition technology involving positive expulsion or surface tension devices; all phases of design, development, fabrication, materials, testing, ground handling, and flight performance

Feed System Studies: Valves, Tank, and Duct Flows

- Feed systems/fluid management technology; fluid controls, sensors, pressurization, space vehicle servicing, control and health monitoring, on-orbit gauging, and materials compatibility
- CFD/experimental investigations of high pressure gas and cryogenic liquid valves for liquid rocket feed system. Flow instabilities that result in valve chatter, valve sticking, and high dynamic actuation loads are of particular interest.
- Modeling of cryogenic storage tanks including tank pressurization, tank sloshing, and mixing of high temperature gas with cryogenic liquids
- Studies addressing interaction and coupling between system components in liquid rocket feed systems (e.g., inlet feed ducts, cavitating venturis, orifices, valves, etc.)

Modeling and Simulation of Liquid Rocket Engines and Propulsion Systems

- Liquid rocket fluid dynamics, chemical kinetics, interactions of fluid dynamics with combustion, engine/system modeling
- Flow and combustion performance and stability including propellant injection phenomena, combustion stability, injector-chamber coupling, faceplate compatibility, and alternative fuels

Solid Rocket Propulsion Sessions

Solid Rocket Propulsion Organizers
C.W. Rousseau
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+27 (0)21 850 2933
Email: Werner.Rousseau@rheinmetall-denelmunition.com

Rob Black
Gencorp Aerojet
Email: Rob.Black@aerojet.com

Papers are solicited for the solid rocket propulsion sessions. Specific topics include, but are not limited to, the following:

- Air-launched tactical missile propulsion
- Surface/ground-launched tactical propulsion
- Commercial-launched vehicle propulsion
- Space-launched vehicle propulsion
- Space storable solids
- Strategic propulsion
- Divert and attitude control propulsion
- Missile interceptor propulsion
- Safety, health, and environmental issues
- Rocket motor demilitarization and propellant and ingredient reclamation, reuse, and disposal
- Propellant hazards classification; procedures and practices for safe handling, transportation and storage
- Insensitive munitions technology, including advanced cases, active & passive mitigation concepts, and advanced propellants
- Propellant development
- Analysis and evaluation, including internal ballistics prediction, combustion, precision and accuracy, internal flow field assessment, heat transfer, structural/material response, particle impingement on insulation and nozzle, crack/de-bond propagation, performance, and energy management
- Solid rocket combustion instability
- Safety, reliability, and maintainability
- Materials and component technology relating to nozzles, igniters, safe/arm devices, TVC, and gas generators
- Lessons learned in rocket design, manufacture, qualification, static test, and flight programs
- Composite case technology
- Advanced nozzle technology; advanced composite materials, materials processing, quality control and assurance
- Innovative ignition systems
- Multi-pulse solid rocket motors
- Propellant and motor temperature sensitivity
- Development/production cost reduction, including modeling and analysis
- Nondestructive diagnostic evaluation of motors or components
- Innovative approaches to qualification of solid rocket motor design
- Solid rocket motor aging evaluation
- Solid rocket motor failure and accident investigations
- Solid rocket motor history
- University initiatives/programs in solid rocket propulsion
- Health monitoring systems for solid rocket motors
- Future technologies
- Solid rocket propulsion for crewed vehicle systems
- Controllable solid propulsion/thrust management

Space and Earth-to-Orbit Vehicle Systems Sessions

Space Transportation and Future Generation Space Transportation Sessions Organizer
Miroslav Sir
The Aerospace Corporation
310.336.6053
Email: Miroslav.Sir@aero.org

Space Transportation and Future Generation Space Transportation sessions are sponsored by the AIAA Space Transportation Technical Committee and the ASME Propulsion Technical Committee. In these sessions, special emphasis will be given to propulsion system and launch vehicle developments associated with contemporary commercial, military, and civil programs. For more information, please contact the session organizer listed above. Topics of interest for these sessions include, but are not limited to, the following:

Space Transportation
Papers are sought for sessions on space transportation including enabling technologies and economics. Of particular interest are papers that address propulsion system impact on performance, reuse, operability, and overall mission effectiveness of space transportation systems. Space transportation systems may include expendable launch vehicles, reusable launch vehicles, missiles, and upper stage and orbital transfer vehicles. Papers are sought for space transportation topics, including, but not limited to, commercial, civil, and military systems; cost modeling; performance safety, reliability, and maintainability; and environmental aspects.

Future Generation Space Transportation
This session set is directed to presentations of advanced fully reusable space transport vehicle and propulsion system concepts. Future civil, military, and commercial space transport missions are to be addressed, such as envisioned Spaceliner-/Spacelifter-class systems featuring aircraft-like mission dependability, flight safety, and overall affordability. Papers are solicited that present the latest thinking in system design and operations, relating key enabling and enhancing technologies. Innovative development and demonstration program approaches are of interest, including the use of X-vehicle flight testing and early prototyping.

Advanced Propulsion and Technologies

Advanced Propulsion Concepts for Future Flight Sessions

Advanced Propulsion Concepts for Future Flight Organizer
John W. Robinson
The Boeing Company (Retired)
714.625.2107
Email: jwelshr@gmail.com

These sessions are sponsored by the ASME Propulsion Technical Committee. Please contact the above organizer for more information.

Unique Propulsion Systems
Papers are solicited that address unique propulsion systems and innovative or non-conventional engine concepts. Some specific topics include design and development of systems for prime movers for the following:

- Earth-to-orbit launch systems
- Space systems
- Advanced compact systems
- Nano-propulsion systems
- Reciprocating systems
- Lightweight aircraft engines

Innovative Approaches and Advanced Conventional Systems
Papers are solicited on the subject of innovative approaches that focus on near-term techniques or concepts that may enhance or advance the state of the art of existing systems.

Topics of interest for these sessions include, but are not limited to, the following:

- Theoretical concept development
- Computational results
- Proposed experimental facilities
- Experimental results
- Mission analysis
- Instrumentation and diagnostic techniques
- Low LCC systems

In-Situ Propellants for Lunar and Mars Missions

Papers are solicited that investigate all aspects for utilizing indigenous space materials for propulsion for lunar and Mars missions. Topics of interest for these sessions include, but are not limited to, the following:

- Production of propellants
- Theoretical and experimental designs
- Theoretical evaluations of engine performance
- Analyses on the benefits of in-situ technologies for current and future missions

Energetic Components and Systems Sessions

Energetic Components and Systems Organizer
Jim Baglini
Exodynamics Technology Inc.
602.363.2549 • 480.759.8042
Email: jlbaglini@exodynamics.com

Papers are solicited in the areas of energetic components and systems and their applications. Energetic materials provide controlled and directed energy to perform a variety of functions for a wide range of applications. Energetic systems are defined as any component or system containing or operated by propellants, explosives, or pyrotechnics. International submissions are encouraged. The sessions are sponsored by the AIAA Energetic Components and Systems Technical Committee. Please contact the above organizer for more information. Topics of interest for these sessions include, but are not limited to, the following:

- Applications and requirements for civilian and military aircraft, space vehicles and missiles, automotive safety, mining, and controlled demolition
- Electro-explosive devices, initiators, detonators, gas generators, igniters and their initiation systems (which may include hot bridge wire, exploding bridge wire, exploding foil, laser/fiber optics, or semiconductor bridge elements) and explosive energy transfer products, including detonating cord, thin layer explosive, linear shaped charge, and through bulkhead initiators
- Explosively actuated devices, including severing/penetration charges, expanding tube/bellows separation systems, explosive bolts, frangible nuts, separation nuts, pin pullers, bolt cutters, cable cutters, pyrovalves, and safe/arm devices
- Lessons learned and education
- Modeling and simulation of energetic materials/components/systems
- Energetic material chemistry, including synthesis, characterization, compatibility, and aging, and analysis techniques as applied to ordnance applications
- Nontraditional topics other than those listed

Nuclear and Future Flight Propulsion Sessions

Nuclear and Future Flight Propulsion Organizer
Greg Meholic
The Aerospace Corporation
310.336.2919
Email: Greg.Meholic@aero.org

Papers are solicited that address all aspects of relatively far-term, future concepts in propulsion. Submissions should offer never-before-published findings, insights, or new problem statements to guide future work. Any performance comparisons must include uncertainty bands. Minor revisions and updates to previously reported material is strongly discouraged. The sessions are supported by the AIAA Nuclear and Future Flight Propulsion Technical Committee. Please contact the above organizer for more information.

Nuclear Thermal Propulsion

Papers are requested on all aspects of Nuclear Thermal Rocket (NTR) propulsion design, testing, and utilization for future robotic and human exploration missions of the solar system. Topics of interest for these sessions include, but are not limited to, the following:

- Bimodal NTR concepts capable of producing both spacecraft thrust and electrical power
- Vehicle concepts, applications and mission designs employing NTR systems
- Gas-cooled reactor concepts for propulsion or closed surface power generation
- Alternative nuclear fuels and processes
- Reactor controls and shielding requirements
- NTR ground test facility options and environmental studies
- Prospects for commercial space activities that could be enabled by NTR systems
- Advancements for heritage solid-core NTR systems

Fusion and Alternative Nuclear Concepts

Papers are solicited on the subject of innovative or emerging concepts for fusion-based space propulsion or alternative/hybrid approaches. Topics of interest for these sessions include, but are not limited to, the following:

- Fusion plasma confinement and management schemes
- Vehicle-based fusion power sources
- Theoretical concept development, computational results and mission analysis
- Proposed experimental approaches
- Instrumentation and diagnostic techniques
- Fission/fusion hybrid systems
- Concepts that utilize fusion reactions directly or indirectly
- Novel fusion concepts

Future Flight Propulsion Systems

Papers are solicited that present concepts for both near- and far-term future space propulsion that require significant advancements in many areas of advanced physics and propulsion science. Papers focusing on theories and approaches should clearly define their propulsion application. Subjects include, but are not limited to, the following:

- Antimatter engines
- Directed energy propulsion (laser, microwave, etc.)
- Mass drivers
- Interstellar propulsion
- Breakthrough propulsion physics, including:
  – Fundamental physics of space–time, matter, motion, forces, and energy exchange
  – Possible coupling between electromagnetism, inertia, and gravitation
  – Creation or modification of general relativistic space–time topologies
- Properties of the quantum vacuum

Propellants and Combustion Sessions

Propellants and Combustion Organizer
Thomas L. Jackson
Center for Simulation of Advanced Rockets
217.333.9311 • 217.333.1910 FAX
Email: tlj@illinois.edu

Papers are solicited that describe recent experimental, theoretical, and numerical work in all areas related to the combustion of liquid, solid, and gaseous fuels in air-breathing, rocket, and underwater propulsion systems. An award will be given for the best paper. These sessions are jointly sponsored by the AIAA Propellants and Combustion Technical Committee and the ASME Propulsion Technical Committee. Contact the above organizer for more information. Papers covering a broad range of topics are sought. These topics include, but are not limited to the following.

Propellant and Fuel Development (Green Fuels)
Future propellants with special emphasis on "green propellants": those with minimal environmental impact. Topics include, but are not limited to, formulations and physical chemical properties of fuels including characterization by surrogates, hazards, safety evaluation, materials compatibility, applications to propulsion devices, high-energy and high-density fuels and materials, propellants for operation under extreme thermodynamic conditions, thermal stability of fuels and propellants, reformed fuels, implications of rising oil prices on jet propellants, and in-situ propellant production concepts for military contingencies and planetary missions.

Combustion Diagnostics
Development, assessment, and calibration of advanced diagnostic techniques related to fundamental experiments or their applications to practical combustion devices.

Spray Combustion
Spray flame characteristics; supercritical droplet combustion; design of fuel spray systems; break-up behavior; non-dilute spray characteristics encountered in propulsion combustors.

Fundamental Combustion Processes
Ignition; laminar and turbulent flame propagation and extinction; detonation; chemical kinetics; infrared radiation from gas flames of gas turbine combustors; lean pre-vaporized premixed combustion systems; other transport processes in gas, liquid, solid, or mixed systems.

Combustion Modeling
Reynolds-averaged turbulent combustion models, sub-grid scale turbulent combustion models for large-eddy simulations, other methods for capturing turbulent transport and fluid-chemistry interactions. Strategies for model implementation in computational tools influence of initial and boundary conditions, numerical diffusion, etc.

Combustion Dynamics/Detonations
Mechanisms of combustion instability in gas turbine and rocket combustors and augmentors. Instability suppression techniques. Detonation physics; applications to pulsed and continuous (or rotating) detonation engines.

Hybrid Combustion Systems
Chemical reaction in power/propulsion systems consisting of two or more integrated, chemically reacting components. Examples include fuel cells and reformers integrated with conventional combustors to provide propulsive and electric power, and endothermic reactors integrated with scramjet combustors to provide leading-edge cooling and fuel cracking.

Advanced Combustor Concepts
Application of combustion technologies to novel combustor geometries. These include the consideration of all forms of combustion, control of combustion processes, and unconventional designs for unique applications.

Micro-Scale Combustion
Combustion in miniaturized propulsion systems with special emphasis on combustion in channels/passages with characteristic dimensions of the order or smaller than the flame thickness, system performance scaling, and the role of fluid structure coupling.

Education

Propulsion Education Sessions

Propulsion Education Organizer
Robert A. Frederick Jr.
UAH Propulsion Research Center
256.824.7203
Email: robert.frederick@uah.edu

Papers are solicited from both universities and industry on topics relating to all aspects of propulsion education and research. Sessions are planned for University Initiatives in Propulsion. Areas of interest include air-breathing, rocket, and advanced propulsion systems, subsystems, and component analysis and design course work as implemented for both graduate and undergraduate programs. Students may present the results of critical literature reviews or advanced design projects. Industry papers of interest include desired attributes of next-generation engineers and examples of successful industry/education outreach programs.

The sessions are sponsored by the ASEE Propulsion Education Committee. Please contact the above organizer for more information. Topics of interest include the following:

- K–16 educational outreach case studies
- Industry-desired attributes of new engineers
- University/industry initiatives in propulsion education/research
- University capabilities in propulsion education/research-institutional summary
- Student design projects/experiments
- Software tools for propulsion education
- International propulsion projects
- Propulsion laboratories

11TH INTERNATIONAL ENERGY CONVERSION ENGINEERING CONFERENCE (IECEC)

The 11th International Energy Conversion Engineering Conference (IECEC) will be collocated with the 49th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 14–17 July, at the San Jose Convention Center in San Jose, CA. The IECEC provides a forum to present and discuss engineering aspects of energy conversion technology, advanced energy and power systems, devices for terrestrial energy systems and aerospace applications, and the policies, programs, and environmental impacts associated with the development and utilization of this technology.

The IECEC is hosted by AIAA, which is joined this year by four Participating Organizations. These organizations are:

- The Heat Transfer Society of Japan (HTSJ)
- The IEEE Aerospace & Electronic Systems Society (AESS)
- The Egyptian Society of Mechanical Engineers (ESME)
- The Japan Society of Mechanical Engineers (JSME)

IECEC Organizing Committee

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TERRESTRIAL ENERGY-EFFICIENT AND RENEWABLE ENERGY SYSTEMS

Technical papers are being sought that address the latest research, developments, and viable new technologies applicable to terrestrial energy-efficient and renewable energy systems. This topical area focuses on, but is not limited to, the following areas:

Energy Efficiency
Buildings (commercial and residential)
—Appliances
—Building equipment
—Building energy codes
—Solid state lighting
Homes
—Energy efficient houses
—Energy efficient multi-family buildings
Transportation (ground vehicles)
Industry
—Boiler and steam systems
—Combustion
—Compressed air
—Data centers
—Distributed energy
—Fuel and feedstock flexibility
—Motors, fans and pumps
—Process heating and energy intensive processes
—Sensors and controllers
Government
—Federal government facilities
—State government facilities
—Local government facilities

Renewable Energy
Biomass
Geothermal
Hydropower
Solar (photovoltaic cells; solar thermal; solar water heating; solar desalination)
Wind
Hydrogen
Ammonia

Mobile and Military Power Systems
Marine energy systems
Electric ship components and systems
Advanced naval power systems
Transportable military power
Small portable power design

Applications of Nanotechnology for Terrestrial Energy-Efficient and Renewable Energy Systems
Policy, Environmental and Historical Perspectives of Terrestrial Energy-Efficient and Renewable Energy Systems

Papers dealing with energy conversion technology at the component or device level should be submitted to the Energy Conversion Device Technology topical area. Papers dealing with energy storage technology at the component or device level should be submitted to the Energy Storage Technology topical area. Papers dealing with thermal management technology should be submitted to the Thermal Management Technology topical area.

TERRESTRIAL FOSSIL ENERGY SYSTEMS

Technical papers are being sought that address the latest research, developments, and viable new technologies applicable to terrestrial fossil energy systems. This topical area focuses on, but is not limited to, the following areas:

Fuels
Coal
Natural gas
Oil
Gas from methane hydrate, shale, and deepwater regions

Clean Coal and Natural Gas Power Systems
Combustion
—Advanced designs
—Micro-combustors
—Waste fuels
—Opportunity fuels
—Pollution
—Chemical kinetics
—Diagnostics
—Modeling, simulation, and analysis
Carbon capture and storage
Gasification
Combustion turbines
Carbon sequestration

Fire
Applications of Nanotechnology for Terrestrial Fossil Energy Systems
Policy, Environmental and Historical Perspectives of Terrestrial Fossil Energy Systems

Papers dealing with energy conversion technology at the component or device level should be submitted to the Energy Conversion Device Technology topical area. Papers dealing with energy storage technology at the component or device level should be submitted to the Energy Storage Technology topical area. Papers dealing with thermal management technology should be submitted to the Thermal Management Technology topical area.

TERRESTRIAL NUCLEAR ENERGY SYSTEMS

Technical papers are being sought that address the latest research, developments, and viable new technologies applicable to terrestrial fusion and fission energy systems. This topical area focuses on, but is not limited to, the following areas:

Fusion
Energy producing plasmas
Inertial fusion reactors
Magnetic fusion reactors

Fission
Advanced modeling and simulation
Advanced reactor concepts
Fuel cycle research and development
Gas cooled reactors
Generation IV nuclear energy systems
Global nuclear fuel assurance
Instrumentation and controls
International nuclear energy policy and cooperation
Light water reactor sustainability
Nuclear hydrogen
Systems engineering and integration
Thermal hydraulics
Transmutation
Used nuclear fuel disposition research and development

Fusion-Fission Hybrids
Applications of Nanotechnology for Terrestrial Nuclear Energy Systems
Policy, Environmental, and Historical Perspectives of Terrestrial Nuclear Energy Systems

Papers dealing with energy conversion technology at the component or device level should be submitted to the Energy Conversion Device Technology topical area. Papers dealing with energy storage technology at the component or device level should be submitted to the Energy Storage Technology topical area. Papers dealing with thermal management technology should be submitted to the Thermal Management Technology topical area.

TERRESTRIAL ELECTRICITY DELIVERY AND GRID RELIABILITY

Technical papers are being sought that address the latest research, developments, and viable new technologies applicable to terrestrial electricity delivery and grid reliability. This topical area focuses on, but is not limited to, the following areas:

Transmission, Distribution, and Utilization
Electric transmission and distribution technology
High temperature superconductivity
—Power cables
—Transformers
—Motors
—Generators
—Fault current limiters
Control systems security
Cogeneration
Cryogenic systems
Distributed generation
Efficient utilization of electricity
Electromagnetic compatibility
Operation and control
Power quality
Utility power electronics
Transmission congestion studies

Grid Reliability
Reliability technology
High temperature superconductivity
Fault current limiters
Renewable and distributed systems integration
Smart grid applications and systems
Demand response

Applications of Nanotechnology for Terrestrial Electricity Delivery and Grid Reliability
Policy, Environmental, and Historical Perspectives of Terrestrial Electricity Delivery and Grid Reliability

AEROSPACE POWER SYSTEMS

Technical papers are being sought on power systems and subsystems developed specifically for aerospace applications. Papers may include concepts, development initiatives, testing, simulations, and mission requirements addressing the broad range of power for aircraft and space applications. Papers discussing aerospace-specific power technologies, operational performance, requirements, and system designs are highly desired. Topics include, but are not limited to:

Space Power System Designs and Operational Performance
New power technology for space applications
Space station
Space exploration missions
Spacecraft solar
Spacecraft radioisotope
Space environment interactions

Aero Power System Design and Operational Performance
New power technology for aero applications
Aircraft
Unmanned Aerial Vehicles (UAVs)
Balloon

Specific Space Power Systems
Spacecraft solar arrays
Radioisotope power systems
Space nuclear reactors
Solar thermal power for spacecraft
Spacecraft tether power systems
Space solar power concepts
Energy and power architectures for lunar exploration
Mars surface power systems
Power systems for deep space exploration

Directed Energy Power
Missile Power Systems
Power Systems Architecture

Electrical Power System Management and Distribution
In-orbit battery management and calibration
Space power system fault protections
High voltage systems
New power components
Superconductors
Diagnostics, prognostics and health management

Aircraft Wiring Systems
Aircraft Auxiliary Power Systems
Aircraft Engine and Control Systems
Aircraft Propeller Systems
Defense Nuclear Power Systems
Energy Efficient Vehicles
Electric Actuation for Aircraft
Hydraulic Actuation for Aircraft

High-Temperature Electronics
Advanced materials
Power converters and inverters
Packaging
Commercial applications

Military Aircraft Power Systems and Studies
Power System Modeling, Simulation and Analysis
Power System Control

Systems Integration and Optimized Vehicle Energy UseAdvanced Concepts
Terrestrial Applications of Aerospace Power Systems Technology
Weapon Power Systems and Studies
Applications of Nanotechnology for Aerospace Power Systems
Policy, Environmental, and Historical Perspectives of Aerospace Power Systems

ENERGY CONVERSION DEVICE TECHNOLOGY

Technical papers are sought that discuss the details of various types of energy conversion devices, including, but not limited to, the specific devices listed below. Papers should address specific characteristics, processes, and methodologies. Topics may include initial concepts, device component fabrication, modeling, analysis, testing, operation and applications.

Direct Energy Conversion Devices and Components
AMTEC
Magnetohydrodynamics (MHD)
Photovoltaic devices
Thermionics
Thermoacoustic engines
Thermoelectrics
Thermophotovoltaics (TPV)

Thermodynamic Devices, Components and Systems
Advanced cycles
Brayton and Rankine cycles
Heat engines and heat pumps
MEMS
Stirling engines

Advanced Energy Conversion Concepts
Combined Heat/Electrical Power Concepts
Applications of Nanotechnology for Energy Conversion Device Technology
Policy, Environmental, and Historical Perspectives of Energy Conversion Device Technology

ENERGY STORAGE TECHNOLOGY

Technical papers are being sought that discuss all primary or secondary devices or mediums utilized to store, charge, recharge, or regenerate a source of energy for immediate or delayed utilization. Of great interest are papers discussing innovative methods, materials, and processes, including lessons learned. Topics may include initial concepts, device component fabrication, analysis and testing, and energy storage system testing, operation and applications.

Capacitive Energy Storage
Supercapacitors
Ultracapacitors

Flywheel Energy Storage
Device components
System operation, test and analysis

Primary Batteries
Lithium cells and advanced batteries
Active primary batteries
Reserve batteries
Thermal batteries

Rechargeable Cell and Batteries
Lithium ion
Lithium polymer
Nickel cadmium
Nickel hydrogen
Nickel metal hydride
Electric vehicle batteries
Special purpose batteries

Fuel Cells
Components and system designs
Regenerative

Superconducting Magnetic Energy Storage
Applications of Nanotechnology for Energy Storage Technology
Policy, Environmental, and Historical Perspectives of Energy Storage Technology

THERMAL MANAGEMENT TECHNOLOGY

Technical papers are being sought that illustrate the delicate balance of temperature, results of practical applications, tests, simulations, and R&D initiatives of thermal management. Papers discussing operational performance, current limitations, and study results of thermal management components and systems for aircraft, spacecraft, and terrestrial applications are encouraged.

Micro Chemical and Thermal Systems (Micro CATS)

Heat Transfer and Transport
Advanced materials
Heat exchangers
Heat pipes, loop heat pipes and capillary pumped loops
Phase change heat transfer
Spray Cooling

Thermal Energy Storage (TES)
Advanced materials
TES applications and issues

Thermal Systems and Components
Cooling electronic components
Cryogenic cooler systems
High conductivity thermal straps
Modeling, simulation, and analysis of thermal systems
Thermoelectric cooling
Power systems cooling
Solar collector thermal design
Thermal control coatings
Thermal interface materials
Thermal testing
Variable emittance electrochromatic devices

Thermal System Applications and Unique Environments
Aircraft
Building heating and cooling
Fuel cell thermal management
Ground vehicle thermal management
Lunar/Martian surface and deep space applications
Missiles
Spacecraft
Thermal control of machinery and electronics
Waste heat utilization

Applications of Nanotechnology for Thermal Management Technology
Policy, Environmental, and Historical Perspectives of Thermal Management Technology

AIAA Guidance, Navigation, and Control Conference
AIAA Atmospheric Flight Mechanics Conference
AIAA Modeling and Simulation Technologies Conference
AIAA Infotech@Aerospace 2013 Conference

19–22 August 2013
Marriott Boston Copley Place
Boston, Massachusetts

Abstract/Draft Manuscript Deadline: 31 January 2013

Abstract/Draft Manuscript Submittal Guidelines and Procedures

Abstract submissions will be accepted electronically through the AIAA website at **www.aiaa.org/boston2013**. Once you have entered the conference website, click "Submit A Paper" and follow the instructions listed. ***Please note: Each conference has a different set of abstract/draft manuscript submission requirements. Please follow the abstract/draft manuscript submission requirements for the conference to which you are submitting.*** The deadline for receipt of abstracts via electronic submittal is **31 January 2013, 2359 hrs Eastern Time Zone, USA**.

The electronic submission process is as follows.

1) Access the AIAA website at **www.aiaa.org/boston2013**.
2) On the right-hand side, click the "Submit Paper" button.
3) You will be prompted to log in. If you do not have an AIAA account you will be asked to create one.
4) After you log in, you will be in the ScholarOne Abstracts submission site.
5) Click the Submission tab at the top of the page to begin your submission. Select the appropriate conference to submit to on the following page.
6) Once you have selected the appropriate conference, 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 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.

Special Notes

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

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

Authors will be notified of paper acceptance or rejection on or about **24 April 2013**. Instructions for preparation of final manuscripts will be provided for accepted papers.

"No Paper, No Podium" and "No Podium, No Paper" Policies

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

Publication Policy

AIAA will not consider for presentation or publication any paper that has been or will be presented or published elsewhere. Authors will be required to sign a statement to this effect.

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

Final Manuscript Guidelines

Detailed instructions and guidelines for submitting papers will be made available to authors of accepted papers. Authors must submit their final manuscripts via the conference website no later than **30 July 2013**.

Warning—Technology Transfer Considerations

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

International Traffic in Arms Regulations (ITAR)

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

Meeting Site

Boston may be the most historic city in America—a significant player in American history for more than 300 years. Boston was founded in 1630, nearly 150 years before the colonies formed a new nation, and has been the site of many significant historic events, such as the Boston Tea Party and Paul Revere's ride. The capital of the state of Massachusetts, Boston is now a thriving metropolis, but it has retained its historic landmarks and its charm. Boston sites and landmarks include the Massachusetts State House, Paul Revere House, Bunker Hill Monument, numerous museums, galleries, and gardens, and of course, Fenway Park—home of the Boston Red Sox. Do you know why Boston is called "Beantown"? For more information on Boston, visit **www.bostonusa.com**.

Hotel Information

AIAA has made arrangements for a block of rooms at the Boston Marriott Copley Place, 110 Huntington Ave, Boston, MA

02116, Tel: +1 617.236.5800. The Boston Marriott Copley Place is located in the desirable and vibrant Back Bay neighborhood with a direct connection to Copley Place and Prudential Center. The hotel is within walking distance of a wide range of restaurants, cultural institutions, theaters, and nightlife. We have negotiated special event rates of $203 per night for single or double occupancy. Book your rooms early! Rooms will be held until **27 July 2013** or until the block is full. You must mention AIAA when you make your reservations to receive this special rate.

Help Keep Our Expenses Down (and yours too!)

AIAA group rates for hotel accommodations are negotiated as part of an overall contract that also includes meeting rooms and other conference needs. Our total event costs are based in part on meeting or exceeding our guaranteed minimum of group-rate hotel rooms booked by conference participants. If we fall short, our other event costs go up. Please help us keep the costs of presenting this conference as low as possible—reserve your room at the designated hotel listed in this Call for Papers and on our website, and be sure to mention that you're with the AIAA conference. Meeting our guaranteed minimum helps us hold the line on costs, and that helps us keep registration fees as low as possible. All of us at AIAA thank you for your help!

Airport Information

Boston Logan Airport (BOS) is located approximately 3.2 miles from the conference hotel.

Transportation to the hotel: taxi—$35 USD; subway service—$2 (one-way). Please note, the Marriot does not provide a shuttle service.

Event Synopsis

The AIAA Guidance, Navigation, and Control Conference, AIAA Atmospheric Flight Mechanics Conference, AIAA Modeling and Simulation Technologies Conference, and AIAA Infotech@ Aerospace Conference will combine in 2013 to provide the world's premier forum for presentation, discussion, and collaboration of science, research, and technology in these highly related fields as they relate to the aerospace industry. It will bring together experts from industry, government, and academia on an international level to cover a broad spectrum of issues concerning flight mechanics, modeling, simulation, information systems, and the guidance, navigation, and control of aerospace vehicles.

Event participants will:

- Present recent advances before a knowledgeable international audience
- Educate industry customers and providers on their latest research and product developments
- Draw lessons learned from past system applications and programs to result in increased technical success, cost savings, and schedule savings for current or ensuing projects or programs
- Network to engage new contacts and refresh old ones
- Recognize significant achievements from within the community

The co-location of these related AIAA events provides attendees with a unique opportunity to expand their knowledge of technological advances of these interrelated disciplines and explore areas of common technical expertise.

AIAA GUIDANCE, NAVIGATION, AND CONTROL CONFERENCE

AIAA Guidance, Navigation, and Control Conference

General Chair
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Technical Program Chairs
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Draft Manuscript Submittal Requirements for the AIAA Guidance, Navigation, and Control Conference

Paper selection for this conference will be based on a full draft manuscript of the proposed technical paper. No exceptions will be made. Draft manuscripts and final papers must not exceed a total length of 25 pages. Each draft must begin with a 100- to 200-word abstract, and an introduction that includes a brief assessment of prior work by others and an explanation of the paper's main contributions. The body of the manuscript must include sufficient detail to allow an informed evaluation of the paper.

Technical Topics

Papers covering all aspects of guidance, navigation, and control (GNC) of aerospace systems may be submitted. Specifically, papers should describe novel analytical techniques, applications, and technological developments in areas such as the guidance, navigation, and control of aircraft, spacecraft, missiles, robotics, and other aerospace systems; general aviation; in-flight system architecture and components; navigation and position location; sensors and data fusion; multidisciplinary control; and GNC concepts in air traffic control systems and high-speed flight. Please refer to the following individual technical area descriptions to determine the topic that most closely aligns with your paper. Please contact the Technical Area Chairs or Co-Chairs with questions.

Control Theory, Analysis, and Design

Papers are sought that develop new theories, generate new algorithms, derive new analysis techniques or design tools, or modify and improve existing techniques for general application to control of flight vehicles. Topics of interest include robust control, nonlinear control, optimal control, multivariable control, adaptive and intelligent control, fault detection, redundancy management and bio-inspired control. Papers describing new analysis and synthesis techniques with illustrative realistic aerospace control examples are strongly encouraged. Papers discussing applications of control theory should be submitted to the area that most closely matches the application. Examples of specific topics within the broad subject areas include:

- Robust Control: techniques for control design of systems with uncertainty; feedback stability, mu analysis and gain scheduling; multivariable stability margins and multiplier theory; mu-synthesis and H-infinity-optimal control.
- Nonlinear Control: techniques and methods for control of nonlinear models; Lyapunov techniques and their extensions; linear matrix inequalities; applications of nonlinear control methods, such as sliding mode or feedback linearization techniques.
- Optimal Control: optimization algorithms; objectives and issues in optimal control of nonlinear systems; dynamic programming; solution methods; case studies in analysis and design of optimal controllers for MIMO plants; robustness and stability margins; design tradeoffs.

- Adaptive and Intelligent Control: Model Reference Adaptive Control and variants, Lyapunov stability analysis of adaptive control laws; direct and indirect adaptive control for linear and nonlinear systems; computational challenges; adaptation rules; verification of margins for flight critical systems; models and learning rules in artificial neural networks; neural networks in system identification and control.
- Fault Detection: algorithms to detect sensor and effector faults; switchover control laws; simulations with fault injection and recovery performance.
- Redundancy Management: redundancy management of multiple sensors and effectors used by the control laws; voting, selection, and tests; verification and validation of redundancy management schemes; implementation in real-time software.
- Bio-Inspired Control Methods: control and optimization algorithms inspired by natural existing phenomena; genetic algorithms, evolutionary algorithms, and swarming algorithms.

Technical Area Chair
Leena Singh
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Technical Area Co-Chair
Andrew Fleming
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Novel Navigation, Estimation, and Tracking Methods

Papers are sought that develop new theory, approaches, and applications associated with navigation, estimation, and tracking. Broad subject areas include navigation techniques; path planning; tracking methods; and estimation. Examples of specific topics within the broad subject areas include:

- Navigation Techniques: biologically-inspired navigation; vision-based navigation; X-ray source-based navigation; terrain-guided navigation; radio navigation; autonomous navigation and control (including integrated GPS and inertial navigation); simultaneous localization and mapping.
- Path Planning: path optimization; trajectory prediction; formation flying.
- Tracking Methods: nonlinear and multi-hypothesis tracking; data association; combined detection/tracking; sensor management; situational awareness; geolocation.
- Estimation: parameter estimation; robust and adaptive filtering; nonlinear filtering and smoothing; nonlinear observers; distributed estimation; hybrid estimation; integrated estimation/control.

Papers that emphasize missions and systems should be submitted to the Aircraft, Spacecraft, Missile, or Mini/Micro Air Vehicle GNC topic areas.

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Technical Area Co-Chair
Lorenzo Pollini
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Aircraft Guidance, Navigation, and Control

Papers are sought that address the development, simulation, and flight testing of GNC systems for aircraft and helicopters. Papers that emphasize experimental results from flight test or nonlinear simulation will be considered preferentially. Areas of interest within the broad subject of aircraft guidance, navigation, and flight control applications include:

- Augmented Flight Control Systems: stability augmentation; automatic flight path and speed control; auto pilot control; integrated guidance and control; trajectory generation and energy management; interdisciplinary flight control and vehicle performance; nonlinearities; structural control and vibration suppression; aeroservoelasticity saturation of control effectors.
- Fault Tolerance and Recovery Systems: self-repairing or reconfigurable systems; situational awareness; decision support; flight envelope protection; trajectory recomputation and reconfiguration; fault detection and isolation.
- Navigation and Flight Management Systems: navigation algorithms; GNSS positioning; alternate navigation sensors; autonomous navigation; GPS performance and status; trajectory design; flight director design.
- Flight Control Analysis and Flight Test Evaluation: aircraft handling qualities; human-machine interface; pilot-in-the-loop; integrated vehicle ground testing; taxi testing; robustness and performance analysis on flight controlled systems.

Technical Area Chair
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Technical Area Co-Chair
Hugh Liu
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Spacecraft Guidance, Navigation, and Control

Papers are sought that deal with topics specific to GNC of on-orbit flight of single space vehicles. Areas of interest include:

- Attitude and Orbit Dynamics, Determination, and Control: applications of attitude estimation and control; orbit estimation and control; momentum control, payload pointing and articulation; adaptations of computer software for spaceflight use; and sensor and actuator selection and distribution. Theoretical discussions should be supported by simulation, test, and/or flight performance data where possible.
- Innovative Techniques to Improve Performance: applications involving existing sensors and actuators; reduction of structural dynamic interaction resulting from instrument articulated mass motion, GNC actuation, and thermally induced disturbances; tolerance to failures in sensors, actuators, and structural integrity. Discussions on system-level error sources affecting GNC functions are also encouraged.
- GNC Systems for Space Missions: International Space Station and its resupply and servicing vehicles; Earth and space science missions; unclassified topics concerning defense and surveillance satellites; small satellites; low-Earth-orbiting and geostationary communications satellites; and small satellites of the future.

For papers that concern multiple vehicles, such as formations, constellations, and rendezvous and docking, authors should submit to the Multi-Vehicle Control topic area. For papers that concern ascent and entry, authors should submit to the Space Exploration and Transportation GNC topic area. For papers that primarily focus on the sensor component of the GNC problem, authors should submit to the Sensor Systems topic area.

Technical Area Chair
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Technical Area Co-Chair
Uday J. Shankar
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Missile Guidance, Navigation, and Control

Papers are sought that relate to GNC of missiles, launch vehicles, and reentry vehicles. Topics include design, analysis, simulation, and test of complete systems or subsystems. Examples of specific topics within the broad subject areas are:

- Modern Autopilot/Guidance Approaches: applications of modern robust and adaptive control algorithms to missile control, guidance, and integrated guidance and control.
- Estimation and Filtering Algorithms: novel approaches to estimation in missile applications, particularly for achieving high performance with lower fidelity sensors or multiple dissimilar sensors.
- Trajectory Optimization: design and analysis of control laws to achieve optimum trajectories for intercept guidance and reentry applications.
- Computer-Based Design and Analysis Techniques: advances in numerical guidance and control design and analysis methods including adjoint simulations.
- Missile Applications: GNC designs for specific applications such as ship defense and national or theater missile defense systems.

Technical Area Chair
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Technical Area Co-Chair
Kamesh Subbarao
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Multi-Vehicle Control

Papers are sought that address the challenges and missions associated with multi-vehicle control. Broad subject areas include cooperative decision and control of autonomous agents, formation flight of air/space vehicles, and mixed initiative control of semi-autonomous teams. Platforms include UAVs, Unmanned Combat Air Systems (UCAS), Unmanned Ground Vehicles (UGVs), Unmanned Underwater Vehicles (UUVs), Wide Area Search Munitions (WASMs), and satellite constellations and/or clusters. Examples of specific topics within the broad subject areas are:

- Cooperative Decision and Control of Autonomous Agents: cooperative task assignment and trajectory optimization; biologically-inspired group behavior and control schemes.
- Formation Flight of Air/Space Vehicles: aircraft formation flight for drag savings; distributed aperture satellite formations; swarming, platooning, mobile sensor networks.
- Mixed Initiative Control of Semi-Autonomous Teams: team auto-routing and coordinated rendezvous.
- Cooperative Control with Uncertainty: effects of realistic atmospheric conditions on flight control; noisy navigation or unreliable propulsion systems.

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Technical Area Co-Chair
Eric W. Frew
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Space Exploration and Transportation Guidance, Navigation, and Control

Papers are sought that address GNC design and challenges for space exploration and space transportation systems. Broad areas include mission studies for human exploration, unmanned missions, GNC algorithms for ascent, entry and on-orbit phases of flight, GNC architecture and rapid prototyping, novel sensors, novel actuators and grappling mechanisms, multidisciplinary design and optimization. Examples of specific subjects within these broad areas include:

- Human Exploration Missions: NASA Human Spaceflight Exploration (MPCV, etc); new capabilities required for manned asteroid, lunar, and Mars missions; ascent or entry flight phases on Earth (for the MPCV, SLS), the moon, asteroids, and other planets (for exploration missions).
- Unmanned Missions: COTS/CRS, or general improved autonomy, capability, and reliability.
- Reusable Vehicles: CCiCap, next-generation systems involving hypersonic entry vehicles, reusable launch vehicles (RLVs), or systems with reusable stages.
- GNC Algorithms: entry, ascent, rendezvous, on-orbit, and landing.
- GNC Architecture and Rapid Prototyping: new guidance, control, or mission planning approaches that will reduce development costs, reduce turnaround time for planning and redesign, or present synthesis tools that support rapid trade-space analysis for new vehicle concepts.
- Novel Sensors: sensing systems for rendezvous, ascent, landing, and deep-space operations.
- Multidisciplinary Design and Optimization: novel optimal trajectory design and/or online trajectory reshaping methodologies; coupling between the propulsion system, aerodynamics, thermodynamics, control system, and vehicle structure.

Technical Area Chair
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Technical Area Co-Chair
Erwin Mooij
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Guidance, Navigation, and Control Concepts in Air Traffic Control Systems

Papers are sought that describe innovative methods for implementing GNC concepts in air traffic control (ATC) systems, and for modeling, simulation, and analysis of such systems. Near-term implementation issues such as the development and testing of new ATC decision support tools, and advanced ATC concepts for automated separation assurance, weather integration, planning and scheduling, and reducing environmental impact of aviation are of interest. Papers that describe operational issues for existing ATC systems, lessons learned from past experience, or field test/evaluation activities are also encouraged. Example areas of application are:

- Development and Testing of New ATC Decision Support Tools: decision support tools for integration of new vehicles (e.g., unmanned aerial systems); surface traffic management; conflict detection and resolution; traffic flow management at regional and national levels; airspace configuration for capacity management; integration of capacity management, traffic flow management, and separation assurance; human-in-the-loop evaluation of decision support concepts and tools.

- Advanced ATC Concepts for Automated Separation Assurance: concepts and algorithms for ground-based and airborne separation assurance; integrated air-ground separation assurance; guidance using cockpit display of traffic information; benefit assessment of data-link communication, GPS-based navigation, surveillance, and four-dimensional trajectories; methods for conflict detection and resolution on the airport surface.
- Weather Integration: analysis of forecasted weather accuracy; improved prediction of weather; translation of weather information into air traffic impact; algorithms for routing around weather; accounting for weather prediction uncertainty in flow management decision making, separation assurance, and scheduling.
- Planning and Scheduling: trajectory-based taxi planning and runway scheduling algorithms; gate departure time prediction; methods for improved forecasting of airspace demand and capacity; aggregate flow models; traffic flow management algorithms; techniques for including airline preferences in traffic management decisions; integrated en route and terminal area traffic management.
- Reducing Environmental Impact of Aviation: assessment of the environmental impact of aviation; predicting impact based on environmental conditions; relating contrail avoidance and extra fuel consumption; models and algorithms for estimating and reducing fuel consumption and exhaust gases.

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Technical Area Co-Chair
Moshe Idan
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Sensor Systems for Guidance, Navigation, and Control
Papers are sought that describe novel stand-alone sensors, integrated sensor systems, and innovative sensing techniques for GNC of surface, maritime, air, or space vehicles. Papers may address sensor systems for crewed or uncrewed vehicles. Papers describing innovative research, development, design, and integration work with illustrative GNC sensor systems applications are highly encouraged. Examples of specific subjects within these broad areas include:

- Sensor Design, Testing, and Performance Improvement: testing and performance evaluation results from actual hardware; new GNC sensor concepts; new techniques for designing, modeling, simulating, and prototyping sensors; sensor factory or in-situ calibration techniques; and fielding of sensor systems that support GNC.
- Miniaturization of Sensor Systems: miniaturization of hardware and applications of relevant micro and nano-technologies; integrated sensor suites (e.g., sensor-on-chip).
- Application Areas: autonomous navigation in GPS-denied environments; novel inertial guidance and control sensors; mobile ad hoc networks for swarming unmanned vehicles; networked sensors for vehicle control and navigation; computer vision for autonomous navigation, obstacle avoidance, collision avoidance and autonomous landing; and GNC sensors in pointing, alignment, and robotic manufacturing applications.

Papers submitted to this area should primarily focus on the sensor component of the GNC problem. Due to the broad application of sensor systems in GNC, some papers may be better suited for presentation in application-specific technical areas such as Aircraft GNC, Spacecraft GNC, Multi-Vehicle Control, and Mini/Micro Air Vehicle GNC. Please refer to individual technical area descriptions for further details and feel free to contact the technical area chairs with questions on which area would be best for specific topics.

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Technical Area Co-Chair
John Y. Liu
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Mini/Micro Air Vehicle Guidance, Navigation, and Control
Papers are sought that address the challenges and missions associated with mini and micro air vehicles (MAVs—vehicles that are small enough to be human-portable). Fixed wing, rotary wing, and flapping wing developments are all of interest. Main topic areas include:

- Flight Dynamics and Control: dynamic modeling of fixed, rotary and flapping wing MAVs; effects of realistic atmospheric conditions on modeling and flight control; implications of low Reynolds numbers on the mechanics and control of flight; flight control architectures for MAVs; bird and insect inspired flight.
- Experiments: new empirical unsteady aerodynamic models; low Reynolds number aerodynamic force and moment characterization; identification of actuator characteristics; fluid-structure interaction characterization and implications for control design.
- New Designs/Capabilities: sensor processing and control algorithms that enable autonomous perching; atmospheric energy harvesting, new vehicle designs, and the interaction between the vehicle design and control synthesis process.
- Sensors and Data Fusion: state estimation algorithms suitable for implementation on MAVs vehicles; navigation in GPS-denied environments is of particular interest.
- Trajectory Planning: effects of realistic atmospheres on flight trajectories; planning algorithms suitable for implementation on mini/micro air vehicles.
- Power Systems and Actuators: high-voltage low-current power conversion for piezoelectric actuators for MAVs; battery or fuel cell improvements.

Please note that papers dealing with large UAVs or human/UAV interaction should be directed to the Human and Autonomous/Unmanned Systems technical area, and papers dealing with multiple unmanned vehicles (large or mini/micro) should be directed to the Multi-Vehicle Control technical area.

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Technical Area Co-Chair
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Human and Autonomous/Unmanned Systems
Papers are sought that describe the principles and methodologies for effective collaboration of humans and autonomous/unmanned systems (e.g., ground/air/space-based platforms).

Proposed advances should include theoretical foundations and autonomy technologies for design, implementation, verification and validation of unified human and autonomous/unmanned systems that are capable of distributed intelligent sensing, onboard planning and execution, and collaborative distributed decision making. Papers that address the R&D challenges pertaining to future flexible autonomous/unmanned systems in support of human-centered missions, in simulation, laboratory implementations, or flight-testing will be considered preferentially. Examples of specific topics within the broad areas include:

- Distributed Intelligent Sensing: temporal and functional multi-layered hierarchies and decision support approaches; processing, exploiting, and disseminating information for comprehensive and continuous domain awareness; metrics guiding distributed autonomous/unmanned systems and network resources; as well as active and compressive sensing.
- Onboard Planning and Execution: hierarchical decompositions of autonomous dynamic teams; open and distributed architectures of diverse resources including tactical autonomous/unmanned systems and/or theater-level human systems; multi-level concepts and frameworks with cross-domain interaction strategies and peer-to-peer tactics and actions.
- Collaborative Distributed Decision Making: integrating mission planning, human-centered systems, capabilities and effects of autonomous/unmanned systems to determine effective employment strategies for autonomous/unmanned systems and assets in response to high-level user needs; distributed resource management frameworks and network optimization strategies for resource allocation (including communications resources); and efficient computational algorithms to evaluate new metrics for near real-time optimization tactics and mixed initiative control and coordination.

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Intelligent Control in Aerospace Applications

Papers are sought that deal with the theory and application of all aspects of intelligent control within aerospace GNC. Papers are sought that present innovative developments; implementation and certification issues; planner, controller, and estimator design; and intelligent control and estimation for a variety of aerospace applications.

- Planner, Controller, and Estimator Design: planners, controllers, and estimators designed using rule-based and model-based techniques, artificial neural networks, fuzzy logic, machine learning, reinforcement learning, evolutionary algorithms, and bio-inspired control techniques.
- Applications: intelligent control and estimation applications for aircraft, missiles, spacecraft, smart autonomous vehicles, mission-planning management, multi-objective control, system integration, fault detection, identification, and accommodation issues.

Particular interests are the stability and robustness of complex distributed control tasks, as well as real-time implementation. Papers focusing on adaptive control theory should be submitted to the Control Theory, Analysis, and Design technical area.

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Aerospace Robotics and Unmanned/Autonomous Systems

This area includes GNC design and challenges related to robotics and unmanned/autonomous systems, as well as research related to handling and operations. In particular, papers that relate to autonomous systems such as cooperative ground-based vehicles, UAVs, planetary rovers, and robotics for spacecraft servicing missions are welcome. Broad subject areas include: sensor/data fusion for navigation and perception; trajectory planning and tracking; and dynamical modeling and control of robotic vehicles and manipulators.

- Sensor/Data Fusion: sensor-based navigation, including simultaneous localization and mapping (SLAM) concepts; vision-based navigation systems using optical flow, occupancy grids, potential fields, and global and inertial navigation systems.
- Trajectory Planning and Tracking: methods of trajectory planning and tracking for single or multiple vehicles in uncertain environments, including optimal trajectory planning and probabilistic methods.
- Dynamical Modeling and Control: equations of motion for unique robotic or unmanned/autonomous vehicles or robotic manipulators, including the treatment of motion or dynamic constraints, and control challenges related to the dynamics of the vehicles or robotic manipulators.

Papers specifically related to the design and control of Mini/Micro Aerial Vehicles (MAVs) may be better suited in the Mini/Micro Air Vehicle GNC technical area unless they have a strong robotics aspect, and papers specifically related to distributed and cooperative control of multi-vehicle systems may be better suited in the Multi-Vehicle Control technical area unless they have a strong robotics aspect.

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Invited Sessions (Proposal Deadline is 16 December 2012)

Invited session proposals are solicited in any of the topic areas listed above as well as in new or emerging technical areas. Papers in an invited session should form a cohesive focus on the relevant topic. Inclusion of a reasonable diversity of viewpoints is encouraged.

Procedure: The procedure for submitting an invited session proposal is different from the normal paper submission procedure. The invited session organizer will submit the entire session as a whole to *BOTH* the technical chair and co-chair below by **16 December 2012**. Invited session organizers should invite authors to participate, collect the required information, assemble the Session Proposal Packet, and submit the Session Proposal Packet as one file to the technical chair and co-chair listed below.

Session Proposal Packet: The Session Proposal Packet should be submitted as a single document and include a one- to two-page Session Title and Summary Statement that describes the motivation and relevance of the proposed session. The document should also include session organizer contact information and provide a few sentences that describe each invited paper. The technical chair and co-chair will notify each organizer of the acceptance or rejection of their session by **6 January 2013**. The organizers of the accepted sessions will also receive instructions for building their invited sessions once all individual papers have been submitted.

Individual Paper Submission: Following the acceptance of an invited session, the individual extended abstracts for a session must be electronically submitted to the "Invited Session" area by the session organizer, or the individual contributing authors, and must include each author's name, affiliation, address, phone number, and email address. The individual extended abstracts must be submitted by the conference abstract deadline of **31 January 2013**, and final manuscripts are due **30 July 2013**. Authors of individual papers should send their paper tracking number to the organizer of their session.

Evaluation of Individual Papers: Please note that at the discretion of the Technical Program Committee, individual papers may be rejected and/or removed from proposed sessions and replaced by an appropriate contributed paper. Likewise, selected papers from rejected Invited Sessions may be placed into the regular program.

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GNC Graduate Student Paper Competition

Papers are sought from graduate students on GNC technical research topics, from which six finalists will be elected by a panel of judges for inclusion in the AIAA GNC Conference. Finalists will make two presentations at the conference: once in the Graduate Student Paper Competition session on **Sunday, 18 August 2013 from 1800–2200 hrs**, and again in an appropriate regular session. During the submission process, select the presentation type as Technical Paper Eligible for Student Competition. Do NOT submit your manuscript twice.

Manuscript submission eligibility requirements:

- Primary or sole authorship by a graduate student enrolled at an institution of higher learning (any second author must be the graduate advisor; no more than two authors are permitted)
- Author in good academic standing at the time of submission
- Manuscript content represents the work of the author
- Full draft manuscript not exceeding a total length of 15 pages
- Manuscript submitted by **31 January 2013**.

Finalists will receive:

- Complimentary student registration
- Awards Luncheon ticket
- Recognition at the Awards Luncheon
- $1,200 award after attending and presenting at both sessions

The overall best paper and presentation will be selected from the GNC Graduate Student Paper Competition session; this winner will be presented with a $2,500 award and recognition at the Awards Luncheon. Questions should be referred to the Technical Area Chair or Co-Chair below:

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Technical Area Co-Chair
Puneet Singla
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AIAA ATMOSPHERIC FLIGHT MECHANICS CONFERENCE

Draft Manuscript Submission Guidelines for the AIAA Atmospheric Flight Mechanics Conference

Paper selection for this conference will be based on a full-length draft manuscript of the proposed technical paper. Drafts of proposed papers must be unclassified and not exceed a length of 36 standard-size, double-spaced, typed pages (including equations, figures, and tables), where each normal-sized figure counts as one page. Each draft must begin with a 100- to 200-word abstract, and an introduction that includes a brief assessment of prior work by others and an explanation of the paper's main contributions. The body of the manuscript must include sufficient detail to allow an informed evaluation of the paper. At a reduced chance of acceptance, in lieu of the full-length draft manuscript, authors can submit an extended abstract of at least 1,500 words that includes major results of the work backed by illustrative figures. A few succinct data figures that clearly show actual results are mandatory. Submissions not meeting the above criteria will not be considered for acceptance.

Technical Areas

Technical papers discussing any and all areas of interest in atmospheric flight are solicited for the AIAA AFM Conference. Student papers are also eligible for the AFM Best Student Paper Competition, which has a $500 prize. Papers are invited that address new findings and/or innovative approaches in computational, experimental, or theoretical development; flight testing; research and development; or simulation results. Areas of interest for this conference include, but are not limited to: aerodynamic performance; trajectories, attitude dynamics, and evaluation of conventional aircraft as well as vehicles of unusual configurations, including unmanned systems and unmanned combat aerial vehicles (UCAV), expendable and reusable launch vehicles (ELV/RLV), and short take-off vertical landing vehicles (STOVL); hypersonic platforms; flying qualities and aircraft-pilot coupling phenomena; missiles; spacecraft; reentry vehicles and vehicles moving through planetary atmospheres; response to atmospheric disturbances; and bio-inspired flight mechanics. In addition, papers are encouraged that deal with education and design in the field of atmospheric flight mechanics, multidisciplinary efforts, and international collaboration projects.

- UAVs and Unmanned Systems: All aspects of UAVs and MAVs, particularly those addressing innovative control effectors, operator interface flying qualities throughout the flight envelope, trajectory and flight path optimization, flight test results, and related subjects.
- Aircraft Dynamics: Interaction between aerodynamics and aircraft motion across the flight spectrum (subsonic, transonic, supersonic, and hypersonic). Subtopics include: effects of configuration changes on aircraft stability, control, and air data systems; store separation; determination of stability

AIAA Atmospheric Flight Mechanics Conference

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and control derivatives and analysis; departure prevention and spin characteristics; flight mechanics of aircraft upset and upset recovery; atmospheric disturbance response and control of such disturbances; trajectory optimization; flow-field effects; and aeroservoelasticity. All airframe types, from general aviation to trans-atmospheric, are appropriate topics for consideration.

- Aircraft Flying Qualities: Flying qualities of aircraft. Topics of interest include aircraft-pilot coupling phenomena, controllers with associated aerodynamic and feel characteristics, displays with associated lag characteristics/placement/adequacy, and pilot-vehicle interface in general. Because pilot opinion is the final determination of flying qualities, papers are sought on the design of specific simulation and flight test maneuvers for flying-qualities evaluation. Other topics include: development and validation of criteria; design tools and procedures to satisfy criteria; techniques to analyze and verify compliance on highly augmented and highly maneuverable aircraft; flying qualities of UAVs, UCAVs, and MAVs; and flying qualities of STOVL aircraft transitioning between powered flight and wing-borne flight and flying qualities guidelines for STOVL-mode flight.
- Projectile and Missile Dynamics and Aerodynamics: Dynamics and aerodynamics of missiles and projectiles, both powered and unpowered. Subtopics include: bodies with circular and noncircular cross sections; roll-stabilized and spin-stabilized missiles and projectiles; the application of computational methodologies to the prediction of aerodynamic characteristics, especially roll-coupling and high-angle-of-attack effects; launch dynamics of both surface- and air-launched missiles; measurement, numerical computation, and estimation of dynamic stability and control derivatives; incorporation of analysis, experimental results, and computational predictions into six-DOF trajectory simulations; and analysis of flight test data.
- System Identification and Parameter Estimation: Papers are desired on techniques for extracting aerodynamic data from flight-test, dynamic wind tunnel, or free flight model experiments. Topics of interest include: modeling of nonlinear or time-dependent aerodynamic effects; techniques for model structure determination; the effects of active controls; incorporation of results into simulation and analysis databases; vehicle flexibility; techniques for the high-angle-of-attack flight regime; flight path reconstruction techniques; estimation of air data and flow-field parameters; identifiability issues; experiment design; and results obtained for conventional as well as new or unusual vehicle configurations.
- Reentry and Aeroassist Vehicle Technology: Dynamics of entry into the Earth's or other planetary bodies' atmospheres. Subtopics include computational aerothermodynamics, aeroassist orbit transfer vehicles, tethered satellite applications, technology concerning development of high L/D vehicles, hypervelocity and impact technology, trajectory optimization, maneuvering of reentry vehicles, ablation and erosion effects, and low density atmospheric flight mechanics.
- Launch Vehicles and Launch Abort Vehicles: Flight mechanics throughout the flight envelope, innovative design concepts, trajectory optimization, aerothermal environments, and reusability. Topis of interest include: stability and control; performance in difficult environments (transonic, high dynamic pressure, high alpha, aero/plume interactions); and analysis techniques.
- Unsteady and High-Angle-of-Attack Aerodynamics: Aerodynamic characteristics of aircraft and missiles operating in a nontraditional part of the flight envelope (e.g., high angles of attack or sideslip, large angular rates). Of particular interest are unsteady and nonlinear aerodynamic characteristics, concepts for improved aerodynamic control effectiveness, dynamic lift and super-maneuverability, symmetric and asymmetric vortex wake structures, vortex breakdown, computational fluid dynamics techniques applicable to vortical and separated flows, and mathematical modeling approaches to represent the dynamic characteristics in simulation studies.
- Linear and Nonlinear Equations of Motion: Classes of ordinary differential equations; nominal and perturbation solutions; axis systems, Euler angles, rotations, and transformations; integration of nonlinear differential equations; stability and control derivatives; unsteady aerodynamic effects; separation of equations into longitudinal and lateral-directional sets; and numerically implemented qualitative methods, their applications, and the results of these applications.
- Atmospheric Flight Mechanics Education: Papers are sought from industry, government agencies, and universities that deal with all aspects of atmospheric flight mechanics education at both undergraduate and graduate levels in aerospace engineering curricula. Topics include: the needs of industry and government agencies; support needed to advance the state of the art; techniques for keeping up with the fast pace of research, especially at the undergraduate level; case studies of design projects; relating academic education to internships and professional experiences; and innovative and realistic approaches to education.
- Vehicle Flight Test: All aspects of testing atmospheric and exospheric flight vehicles, particularly as they pertain to the vehicle flight mechanics. Topics of interest include: flight evaluation of novel control systems or vehicle configurations; development and implementation of new maneuvers, methods, or tools for testing that provide new insight into flight mechanics; presentation of data analysis and testing results for important or unique vehicles; and modeling and simulation techniques used in support of flight test.
- Bio-Inspired Flight Mechanics: Flight mechanics of bio-inspired flight technologies and concepts, such as micro and nano air vehicles (MAVs, NAVs). Such vehicles present unique technological challenges on multiple levels including aerodynamics, performance, mission endurance, sensors, and flight GNC. Topics of interest: include flight mechanics of birds, insects, and bio-inspired air vehicles; and modeling of coupled unsteady aerodynamics and flight dynamics for maneuvers such as flapping, hovering, and perching.
- Airships and Hybrid Airships: All areas of flight mechanics related to airships and hybrid airships.

Invited Sessions and Workshops

Invited sessions and workshops are solicited in any of the areas listed above and in related and new or emerging technical areas. Such an invited session or workshop should form a cohesive focus on the particular topic. It will be the job of the invited session/workshop organizer to contact and confirm the expert speakers in advance. Any potential invited session/workshop organizer should contact the Technical Program Chairs well in advance of the submittal deadline for approval. Workshops may be conducted on an informal basis and limited to presentations without written manuscripts, if deemed appropriate by the organizer. The proposal for the invited session or workshop must contain 200- to 300-word abstracts of the papers, and each author's name, affiliation, address, phone number, and email address. Authors must submit all appropriate information to the invited session organizer by **12 January 2013**. Upon approval of a special session, the session organizer will notify authors of the invited papers to upload their draft manuscripts or short abstracts electronically to the invited session area of the conference website by **31 January 2013**. Please note that incorporation of the proposed Invited Session or Workshop at the AIAA AFM Conference will be at the discretion of the Technical Program Chairs. Furthermore, in consultation with the prospective organizer, individual papers may be removed from the proposed invited session and/or put in the regular session. Likewise, normal contributed papers may be put in the invited session.

Best Atmospheric Flight Mechanics Student Paper Competition

The AIAA Atmospheric Flight Mechanics Technical Committee, with the support of Calspan Corporation (**www.calspan.com**), is sponsoring a Best Student Paper Competition at the 2013 AIAA AFM Conference. Entrants will be judged by Technical Committee members and the winner will receive a certificate and $500 award to be presented at the conference awards luncheon.

To be eligible for this award, the student must be the primary author of the paper and the work must have been performed while the author was a student. Please note that prior winners of the AFM student paper competition are not eligible. The student author must also:

1) be a member of AIAA;
2) present the paper at the conference;
3) indicate "Technical Paper Eligible for Student Competition" at the time of electronic draft manuscript submittal (by **31 January 2013**; refer to submittal guidelines);
4) send an electronic copy of the final paper by **2 July 2013** to the competition administrator, Brad Burchett (812.877.8929), at burchett@rose-hulman.edu;
5) and, along with the final paper, include a cover letter from his/her advisor stating that the student did the majority or a significant amount of the research in question.

Students will present their papers at the conference during a regular technical session in an appropriate topic area for judging. Students should submit their draft manuscripts online to an appropriate, regular technical session (e.g., Aircraft Dynamics, Aircraft Flying Qualities), according to the conference guidelines above. Students will be contacted by a conference organizer to confirm their participation in the competition. Note that the deadline for submittal to the competition administrator is earlier than the conference final manuscript deadline.

The scoring for the award will be equally based on written paper content and on the student's presentation of the paper at the conference. The written paper will be judged on:

1) relevance of the topic to atmospheric flight mechanics (see list of sample session groupings in this call for papers);
2) organization and clarity of the paper;
3) appreciation of the technical issues and sources of errors;
4) meaningful conclusions of the research

The student's presentation of the paper will be judged for overall presentation clarity, including:

1) background and problem definition statement
2) explanation of technical approach; and
3) explanation of research results.

AIAA MODELING AND SIMULATION TECHNOLOGIES CONFERENCE

Abstract Submission Guidelines for the AIAA Modeling and Simulation Technologies Conference

Prospective authors are asked to submit their work electronically through the AIAA website prior to the published deadline. *Authors may submit either an extended abstract of 500 to 1,000 words, or a draft of the paper itself, if available.* Draft papers must include a 100- to 200-word abstract. The manuscript, whether abstract or draft paper, must include discussion on the background and motivation for the work, as well as an explanation of the paper's main contributions to the particular area(s) of interest, including examples of results. The inclusion of the paper in the conference will depend solely on the quality and detail of the submitted manuscript.

Technical Areas

Authors are invited to submit technical papers on topics related to modeling, simulation, analysis, and simulators as applied to the fields of aviation and aerospace.

- Vehicle Dynamics, Systems, and Environments: Papers are sought that describe the modeling of vehicle dynamics, vehicle systems, and the environments in which they operate. Papers are also welcome on the testing, verification, and validation of these models.
- Simulation Design and Architecture: Papers are sought in the area of simulation design and architectures. As the variety and complexity of simulations increase, so does the need for supporting changes in simulation design and architecture. Technology changes and the increased use of commercial-off-the-shelf (COTS) products have also played a major role in the modification and development of simulation designs and architectures. Papers addressing these changes are encouraged, as are papers on the development and application of networked/distributed simulations and the development of standards that facilitate interaction of diverse simulation environments.
- Modeling Tools and Techniques: Papers are sought in the area of modeling tools and techniques. As the complexity of systems has increased, so has the need to rapidly prototype multiple design concepts to reduce development risks. Papers are encouraged that discuss novel tools and techniques that decrease the development time or increase the fidelity of dynamic models. Of particular interest are papers discussing the integration of COTS tools into existing simulation development processes and PC-based simulation.
- Human Factors, Perception, and Cueing: Papers are sought in the broad area of human factors, perception, and cueing systems. Of particular interest is the human perception of the essential cues required for flight, and the reproduction of these cues in a simulator. A related topic is the application of existing knowledge on perception and cueing for understanding and measuring simulation fidelity. Papers on human fac-

AIAA Modeling and Simulation Technologies Conference

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tors related to the pilot-vehicle interface and human operator modeling are also encouraged. There is considerable past and present research in this field, and papers are greatly encouraged that involve presentation of new data, re-examination of old data, cueing algorithm and method development, novel tools and analysis, etc.

- Motion Systems: Papers are sought involving all aspects in the design, development, and use of motion systems. Motion systems play a critical role in the field of simulation. With sectors of the industry requiring their use, presentations in this field are highly encouraged. Papers are encouraged that discuss novel motion configurations and hardware as well as the application of motion for research and training.
- Visual Systems and Image Generation: Papers are sought in the area of visual systems and image generation. Visual systems play an important role in simulation. Traditionally, this includes such uses as out-the-window displays, sensor displays, control room and simulation displays, and displays for various UAV and system control stations. As remote sensors are also increasingly used for navigation, accurate, physics-based image generation is required for test of these systems. The technologies supporting this field are constantly evolving and information about the latest technologies can be leveraged to improve simulation fidelity and effectiveness. Papers are encouraged in all areas of visual system and image generation development and use.
- Simulation/Simulator Testing and Validation: Papers are sought in the area of Simulation/Simulator Testing and Validation. As simulations are increasingly becoming the preferred method to test and evaluate systems, it is critical that they be validated. Papers are encouraged that address testing and validation methodologies, regulatory issues, and experiences with simulator validation, techniques, issues, and lessons learned.
- Hardware in the Loop: Papers are sought that involve all areas of the development and use of hardware in the loop simulations. As the complexity of GNC systems increases, the need to perform more detailed, accurate, and comprehensive simulations has increased. Topics of interest include development of System Integration Laboratories (SILs) for modern fly-by-wire systems, integration and testing of modern avionics and synthetic vision systems, and autonomous flight systems integration and testing.
- Air Traffic Management: Papers are sought that describe the use of simulation in Air Traffic Management (ATM) concept development, testing, and analysis. Topics of interest include, but are not limited to, real-time and non-real-time simulation studies that investigate ATM automation concepts and decision support tools, airspace and airport traffic modeling methods, and model validation/verification experiences and methods.
- UAVs: Papers are sought in the area of UAV simulation. The variety and number of vehicles in this area are ever increasing, as are the missions they perform. This variety offers a number of new challenges to the field of simulation. Papers are sought on novel simulation techniques and technologies for UAV development, operator training, the development of operational concepts, etc.
- Space Systems: Papers are sought in the area of space systems simulation. The recent activity in the development of space exploration has resulted in considerable focus on this area of simulation. Topics of interest include real-time and non-real-time simulation in support of commercial and government space vehicle development (rendezvous and proximity operations, lunar lander, etc.) and extraterrestrial robotic vehicle development.
- Other Topics: The use of modeling and simulation in the field of aviation and aerospace is an ever expanding field. The potential topics are quite broad and papers are invited from areas of flight simulation and training not specifically mentioned in this Call for Papers.

AIAA INFOTECH@AEROSPACE 2013 CONFERENCE

Infotech@Aerospace (I@A) is AIAA's premier forum for modern aerospace applications focusing on information-enabled systems, algorithms, hardware, and software, and provides a unique opportunity for fostering advances and interactions across these disciplines. Attendees and authors span military, scientific, commercial, and academic communities that are driven by the communication of information via computers and software. These communities will shape the 21st-century development of aerospace systems.

I@A will cover scientific and engineering issues related to architecting, designing, developing, operating, and maintaining modern aerospace and defense systems: this includes aircraft, spacecraft, ground systems, robots, avionics, and sensors, as well as systems of systems. Of particular interest are autonomous, cooperative, space, and unmanned systems, communication and networked systems, robotic systems, and human-machine interactions.

Select technical papers will be considered for publication in AIAA's *Journal of Aerospace Computing, Information, and Communication* (*JACIC*).

Abstract Submission Requirements for the AIAA Infotech@Aerospace 2013 Conference

Authors must submit an abstract of at least 300 words; abstracts of 500 words or longer are strongly encouraged, including extended abstracts with figures, tables, and citations. The abstract should provide a clear and concise statement of the problem to be addressed, the proposed method of solution, the results expected or obtained, and an explanation of the significance of the contribution.

Technical Areas

Infotech@Aerospace covers a broad range of topics related to aerospace information systems. Authors are encouraged to submit abstracts in the following technical areas of focus, as well as to submit ideas for sessions and papers that feature topics not listed below. Suggestions for additional session topics should be referred to the Technical Program Chair.

Space Autonomous Systems and Robotics

Papers are sought that address innovative approaches to autonomous system development for spacecraft, including the integration of autonomy technologies into aerospace and robotic systems. Topics of interest include, but are not limited to:

- Automated spacecraft rendezvous and docking
- In-space assembly and servicing
- Space situational awareness (SSA) technologies for orbit determination, space object identification and tracking
- Real-time decision support and architecture concepts for SSA
- Hazard avoidance for automated landing on planetary bodies
- Surface mobility
- Exploration robotics and telerobotics
- Human-robot interactions
- Automated planning and scheduling systems for space missions
- Computer vision systems
- Planetary terrain mapping and feature detection

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Technical Area Co-Chair
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Unmanned Systems Applications

Papers are sought addressing unmanned air vehicle (UAV) and systems (UAS) technologies that enable new or expanded UAS applications through system integration. Topics of interest include, but are not limited to:

- UAS operational applications and experience in military, civil, and commercial missions/environs, including homeland security and disaster response
- Science applications, including climate monitoring, extreme environment diagnosis, remote sensing, exploration, and natural resource assessment
- Unmanned system-of-systems architectures, technologies, and applications
- UAS sense-and-avoid strategies and sensors
- System and vehicle survivability
- System safety and reliability
- Autonomy technologies for dynamic UAS mission planning and management
- UAS intelligent mission management
- Cooperative unmanned systems
- Spectrum management and communications advances that enable UAS integration into the airspace system, including policy and/or technology issues

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AIAA INFOTECH@AEROSPACE 2013 CONFERENCE

General Chair
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Technical Program Chair
TBD

Human-Machine Interface

Papers are sought that address innovative approaches to the human-machine interface. Topics of interest include, but are not limited to:

- Mixed-initiative intelligent systems
- Intelligent decision supports
- Pilot and controller mode awareness
- Cockpit decision aids
- Preventing display of hazardously misleading information
- Pilot and controller workload
- Crew coordination
- Air traffic management automation tools
- Dynamic airspace reconfiguration

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Technical Area Co-Chair
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Intelligent Systems

Papers are sought that describe the application of Intelligent System (IS) technologies and/or their aerospace-related applications. Of interest are papers that address fundamental topics of IS such as the nature of IS or what constitutes an artificial intelligent system. Other topics of interest include, but are not limited to:

- Evolutionary (genetic) algorithms
- Expert systems
- Fuzzy logic
- Knowledge-based systems and knowledge engineering
- Machine learning
- Model-based reasoning
- Neural networks
- Planning and scheduling algorithms
- Qualitative simulation

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System Integrity, Verification, and Validation

Papers are sought that describe recent developments, challenges, and future trends in the high-confidence design, development, certification, application, operation, and maintenance of networked information systems and software in commercial and military aviation. Topics of interest include, but are not limited to:

- Verification and validation of complex intelligent systems
- Verification, certification, and accreditation for security
- Fault management
- Software-intensive, large-scale systems integration
- System engineering and architecting for trust and high-confidence systems
- Aircraft software, data, and multimedia distribution
- Next-generation air traffic management
- Aeronautical networks and airport wireless networks
- RFID systems

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Adaptive Systems

Papers are sought that address innovative approaches to intelligent adaptive control system development. Topics of interest include, but are not limited to:

- Adaptive control
- Neural net and fuzzy logic intelligent control
- Machine learning control
- Applications in aerospace systems
- Experimental/flight validation
- Verification and validation of adaptive systems
- Analytical/experimental tools for design and validation

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Integrated System Health Management (ISHM)

Papers are sought that describe innovative approaches for determining the status and condition of all elements of a system, including individual sensors and components. Topics of interest include, but are not limited to:

- Architectures and standards for ISHM implementation
- Software environments to integrate data, information, and knowledge for implementation of ISHM capability
- Algorithms and approaches to detect anomalies
- Automated diagnostics and prognostics
- User interfaces for integrated awareness of system health by the user
- Implementations of ISHM capability
- Business case and evaluations of benefits from ISHM capability implementation
- Verification and validation of ISHM systems
- Control of ISHM-enabled systems engineering with ISHM-enabled systems

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Technical Area Co-Chair
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Sensor Systems

Papers are sought that address innovative approaches to sensor system development and their integration into aerospace systems. Topics of interest include, but are not limited to:

- New sensor technologies for unmanned and remotely piloted payload sensors, including multi- and hyperspectral sensors, active sensing with RF and lasers, multi-aperture systems, and sensors in new spectral regions
- Novel applications of distributed sensing and sensor networks
- Sensor systems for navigation, tracking, and control
- Vision-based unmanned systems for GPS-denied navigation environments
- Embedded vehicle sensor systems for autonomous operations and system health management
- New mission sensors and techniques for atmospheric, natural resource, environmental, and deep space mission applications
- Detection, recognition, and tracking of moving objects on the ground, in the atmosphere, or in space, especially for unmanned systems applications
- Fundamental technology advances for new aerospace sensor applications, including micro- and nano-technology (MEMS and NEMS), packaging methodologies, development of sensors for ground and flight testing, harsh environment applications, and integrated systems of micro-sensors and actuators

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Data/Information Fusion

Papers are sought that address innovative approaches to data processing, real-time reasoning/learning, and information fusion techniques allowing future systems to improve their performance autonomously or nonautonomously. Topics of interest include, but are not limited to:

- Knowledge extraction and update
- Data-based reasoning
- Centralized and distributed information fusion architectures and resource management for real-time and non-real-time operations
- Real-time information fusion software development, validation, and verification

- Image fusion techniques for EO systems
- Data and information fusion of sensor networks on a single vehicle or a multivehicle system for distributed sensing, navigation, and tracking
- Novel tracking and filtering techniques for target detection, acquisition, and classification methodologies
- New developments in the areas of multiple hypothesis tracking (MHT), particle filtering, and interacting multiple model (IMM) estimators
- Multi-sensor and mixed-modality sensor applications of data fusion
- Hardware and software integration issues relevant to data fusion and information extraction

Technical Area Chair
Miguel Morales
CSC
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Technical Area Co-Chair
Paul Zetocha
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Computer Systems

Papers are sought that address the theoretical and practical application of computer systems to aerospace problems. Areas of interest include, but are not limited to:

- High performance computing
- Volatile and nonvolatile memory and data storage; processing and memory applications
- Applications of commercial off-the-shelf (COTS) components, subsystems and test equipment, especially in mission and safety critical applications
- Convergence of software, hardware, and systems processes and design techniques
- Embedded signal and data processing including parallel algorithms and optimizations
- Secure computer design and information assurance

Technical Area Chair
Kevin Carbajal
NASA Ames Research Center
kevin.b.carbajal@nasa.gov

Software Systems

Papers addressing the challenges and issues that relate to software engineering and development of aerospace related programs. We are also seeking abstracts covering software aspects for the following sessions:

- There's an App for That—The Role of Mobile Computing in Future Aviation: Abstracts are solicited on a variety of topics related to the design, analysis, certification, security, and maintenance of pervasive and mobile software, including:
  — Wireless communication and security technologies for flight
  — Mobile computing in the cockpit and electronic flight bags
  — In-flight entertainment and passenger education
  — Flexible and secure passenger booking and scheduling
  — Personal in-flight electronics
- Software on the Cutting Edge (New Techniques You're Probably Not Using): We are seeking submissions on trending software tools and methodologies, their potential (or current) use in aerospace, and their benefits and liabilities, including:
  — Incremental Commitment Model / Factoring in Incremental Development Productivity Decline (IDPD)
  — Model-driven development (including SysML, AADL, Simulink, and SCADE)
  — Leveraging multicore (and/or avoiding its pitfalls)
  — Leveraging the Cloud in Design and Development
- Software Capabilities and Challenges in NextGen: We will have an overview on the current state of NextGen and a panel discussion on the gaps and likely schedule of changes in the NextGen roadmap. We invite forecasts and technical papers highlighting the capabilities and hazards inherent in NextGen software implementations.
- Software-Intensive System Architectures and Their Interfaces: We are soliciting original work that discusses architectures for safety-critical systems that contain software, hardware, and people. Some of the themes within this topic are:
  — Combining model-based development tools
  — Approaches to, benefits of, and limitations of Integrated Modular Avionics frameworks
  — Closed vs open architectures
  — Developing systems in which components have multiple design assurance levels
  — Human-computer interaction including intelligent cockpits and control towers
  — Adaptive airspace implementations

Technical Area Chair
Misty Davies
NASA Ames Research Center
misty.d.davies@nasa.gov

Technical Area Co-Chair
Stephen Blanchette
Software Engineering Institute
sblanche@sei.cmu.edu

Plug-and-Play Mechanisms

Submissions are sought for a variety of topics pertaining to systems that employ mechanisms (hardware, software, protocols, and tools) that can be considered "plug-and-play" (PnP), including but not limited to:

- Self-consistent architecture frameworks for intelligent modularity
- Self-describing components and applications
- Self-organizing/topology-agnostic heterogeneous networks
- Ontology concepts for machine understandable electronic datasheets
- Scalable self-managing processing and networking approaches
- Composable software
- Self-test/hardware-in-the-loop approaches, especially those that work with PnP architectures
- Push-button tool flow, concepts for automatic spacecraft design connecting to plug-and-play components and inventory management systems

Technical Area Chair
Robert Vick
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Real-Time Embedded Computing Technologies

Submissions are sought for a variety of topics pertaining to embedded computing systems for aerospace, including but not limited to:

- Multi-core benchmarks, usage, programming, tools, electrical, performance, and integration
- Graphical processing units, benchmarks

- COTS usage, programming, tools, performance, and integration
- Dependability approaches, implementations, tools, benchmarks, and algorithms from silicon to full processing systems
- Onboard processing hardware architectures utilizing advanced interconnect technologies
- Reconfigurable processors, support, and infrastructure along with error mitigation in harsh or space environments
- Systems mixing some or all of the above

Technical Area Chair
Joe Marshall
BAE Systems
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Focused Session Proposals

Individuals interested in organizing focused sessions should submit a Session Proposal to the Technical Program Chair. Solicited papers in the proposed session should form a cohesive set, focusing on the relevant topic with a reasonable diversity of viewpoints encouraged. The Session Proposal should contain a descriptive title of the session, a brief summary statement describing the proposed session, session organizer contact information (email and phone), and potential authors.

Infotech@Aerospace Student Paper Competition

Papers from work not previously published are sought from graduates and undergraduates registered as full-time students through spring 2013. Both individual and group-authored papers are welcome on any of the technical areas listed above. A complete draft of the paper, not to exceed 15 pages, should be submitted directly to the appropriate technical area via the abstract submission site by **31 January 2013**. Please select the presentation type as “Technical Paper Eligible for Student Competition” at the time of submission. The final manuscript of accepted abstract is due by **30 July 2013**. The winner will be recognized at the awards luncheon.

New and Forthcoming Titles

Aircraft Design: A Conceptual Approach, Fifth Edition
Daniel P. Raymer
AIAA Education Series
2012, 800 pages, Hardback
ISBN: 978-1-60086-911-2
Member Price: $84.95
List Price: $109.95

Aircraft and Rotorcraft System Identification, Second Edition
Mark Tischler and Robert K. Remple
AIAA Education Series
2012, 800 pages Hardback
ISBN: 978-1-60086-820-7
Member Price: $89.95
List Price: $119.95

Missile Design and Systems Engineering
Eugene Fleeman
AIAA Education Series
2012, 800 pages, Hardback
ISBN: 978-1-60086-908-2
Member Price: $84.95
List Price: $114.95

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

Designing Unmanned Aircraft Systems: A Comprehensive Approach
Jay Gundlach
AIAA Education Series
2011, 805 pages, Hardback
ISBN: 978-1-60086-843-6
Member Price: $84.95
List Price: $109.95

Tactical and Strategic Missile Guidance, Sixth Edition
Paul Zarchan
Progress in Astronautics and Aeronautics Series, 239
2012, 1026 pages, Hardback
ISBN: 978-1-60086-894-8
Member Price: $104.95
List Price: $134.95

Exergy Analysis and Design Optimization for Aerospace Vehicles and Systems
Jose Camberos and David Moorhouse
Progress in Astronautics and Aeronautics Series, 238
2011, 632 pages, Hardback
ISBN: 978-1-60086-839-9
AIAA Member Price: $89.95
List Price: $119.95

Introduction to Flight Testing and Applied Aerodynamics
Barnes W. McCormick
AIAA Education Series
2011, 148 pages, Hardback
ISBN: 978-1-60086-827-6
AIAA Member Price: $49.95
List Price: $64.95

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

Introduction to Theoretical Aerodynamics and Hydrodynamics
William Sears
AIAA Education Series
2011, 220 pages, Hardback
ISBN: 978-1-60086-773-6
AIAA Member Price: $54.95
List Price: $69.95

Basic Helicopter Aerodynamics, Third Edition
John M. Seddon and Simon Newman
AIAA Education Series
2011, 264 pages, Hardback
ISBN: 978-1-60086-861-0
AIAA Member Price: $49.95
List Price: $74.95

Gas Turbine Propulsion Systems
Bernie MacIsaac and Roy Langton
AIAA Education Series
2011, 328 pages, Hardback
ISBN: 978-1-60086-846-7
AIAA Member Price: $84.95
List Price: $119.95

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

Upcoming AIAA Professional Development Courses

1 July–31 December 2012
2012 Home Study Courses
To register, go to **www.aiaa.org/CourseListing.aspx?id=3200.**

Intro to Computational Fluid Dynamics **(Instructor: Klaus Hoffmann)**
This introductory course is the first of the three-part series of courses that will prepare you for a career in the rapidly expanding field of computational fluid dynamics.

Advanced Computational Fluid Dynamics **(Instructor: Klaus Hoffmann)**
This advanced course is the second of the three-part series of courses that will prepare you for a career in the rapidly expanding field of computational fluid dynamics.

Computational Fluid Turbulence **(Instructor: Klaus Hoffmann)**
This advanced course is the third of the three-part series of courses that will prepare you for a career in the rapidly expanding field of computational fluid dynamics with emphasis in fluid turbulence. Completion of these three courses will give you the equivalent of one semester of undergraduate and two semesters of graduate work.

Introduction to Space Flight **(Instructor: Francis J. Hale)**
By the time you finish this course, you 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 you an introduction to the major performance and design characteristics of conventional, primarily subsonic, aircraft. At the end of the course, you 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.

Introduction to Computational Fluid Dynamics

	Early Bird by 1 Jun	*Standard (2 Jun–1 Jul)*
AIAA Member	$1140	$1250
Nonmember	$1245	$1355

Advanced Computational Fluid Dynamics

	Early Bird by 1 Jun	*Standard (2 Jun–1 Jul)*
AIAA Member	$1185	$1295
Nonmember	$1290	$1400

Computational Fluid Turbulence

	Early Bird by 1 Jun	*Standard (2 Jun–1 Jul)*
AIAA Member	$1245	$1350
Nonmember	$1350	$1455

Introduction to Space Flight

	Early Bird by 1 Jun	*Standard (2 Jun–1 Jul)*
AIAA Member	$1050	$1190
Nonmember	$1155	$1295

Fundamentals of Aircraft Performance and Design

	Early Bird by 1 Jun	*Standard (2 Jun–1 Jul)*
AIAA Member	$1050	$1190
Nonmember	$1155	$1295

9–10 July 2012
The following standalone course is being held at the Ohio Aerospace Institute in Cleveland, Ohio.

Optimal Design in Multidisciplinary Systems
(Instructors: Prabhat Hajela and J. Sobieski)
When you are designing or evaluating a complicated engineering system such as an aircraft or a launch vehicle, can you effectively reconcile the multitude of conflicting requirements, interactions, and objectives? This course discusses the underlying challenges in such an environment, and introduces you to methods and tools that have been developed over the years.

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

	Early Bird by 4 Jun	*Standard (5 Jun–2 Jul)*	*On-site (3–9 Jul)*
AIAA Member	$885	$1050	$1190
Nonmember	$995	$1155	$1295

14–15 July 2012
The following Continuing Education class is being held at the 42nd International Conference on Environment Systems in San Diego, California. Registration includes course and course notes; full conference participation: admittance to technical and plenary sessions; receptions, luncheons, and online proceedings.

To register for the ICES course, go to **www.aiaa.org/ICES2012.**

	Early Bird by 18 Jun	*Standard (19 Jun–13 Jul)*	*On-site (14–15 Jul)*
AIAA Member	$1288	$1388	$1488
Nonmember	$1365	$1465	$1565

Spacecraft Design & Systems Engineering **(Instructor: Don Edberg, Professor of Aerospace Engineering, California State Polytechnic Univ. Pomona, Redlands, CA)**
This course presents an overview of factors that affect spacecraft design and operation. It begins with an historical review of unmanned and manned spacecraft, including current designs and future concepts. All the design drivers, including launch and on-orbit environments and their affect on the spacecraft design, are covered. Orbital mechanics is presented in a manner that provides an easy understanding of underlying principles as well as applications, such as maneuvering, transfers, rendezvous, atmospheric entry, and interplanetary transfers. Time is spent defining the systems engineering aspects of spacecraft design, including the spacecraft bus components and the relationship to ground control. Design considerations, such as structures and mechanisms, attitude sensing and control, thermal effects and life support, propulsion systems, power generation, telecommunications, and command and data handling are detailed. Practical aspects, such as fabrication, cost estimation, and testing, are discussed. The course concludes with lessons learned from spacecraft failures.

2–3 August 2012

The following Continuing Education classes are being held at the 48th AIAA/ASME/SAE/ASEE Joint Propulsion Conference in Atlanta, Georgia. Registration includes course and course notes; full conference participation: admittance to technical and plenary sessions; receptions, luncheons, and online proceedings.

To register for one of the JPC courses, go to **www.aiaa.org/JPC2012.**

	Early Bird by 2 Jul	Standard (3–28 Jul)	On-site (29 Jul–2 Aug)
AIAA Member	$1265	$1365	$1465
Nonmember	$1343	$1443	$1543

Hybrid Rocket Propulsion (Instructor: Joseph Majdalani, Professor, Mechanical and Aerospace Engineering, University of TN Space Institute, Tullahoma, TN)
This course is essential for all professionals specializing in chemical propulsion. The mechanisms associated with hybrid combustion and propulsion are diverse and affect our abilities to advance successfully and sustain the development of hybrid technology. Our ultimate goal is to promote the science of hybrid rocketry, which is safe enough to be used in both academia and the private sector. A historical demonstration of hybrid rocket capability is the 2004 X Prize winner SpaceShipOne. This technology can also be used in outreach activities when used in conjunction with hands-on design projects and payload launches that involve student teams. Interest in hybrid rocketry can be translated into increased awareness in science and technology, helping to alleviate the persistent attrition in our technical workforce. This course reviews the fundamentals of hybrid rocket propulsion with special emphasis on application-based design and system integration, propellant selection, flow field and regression rate modeling, solid fuel pyrolysis, scaling effects, transient behavior, and combustion instability. Advantages and disadvantages of both conventional and unconventional vortex hybrid configurations are examined and discussed.

Advanced Solid Rockets (Course is sponsored and taught by the distinguished members of the AIAA Solid Rockets Technical Committee, lead by David Poe, Aerojet)
Solid propulsion is vital to tactical, space, strategic, and launch vehicles. The course examines fundamental and advanced concepts related to solid rockets. Theoretical and practical aspects of the field are covered. This course is based on the "Advanced Solid Rocket Propulsion" graduate-level mechanical engineering course taught at the University of Alabama at Huntsville (UAH). All instructors are experienced solid rocket experts and many were involved with the UAH course. The individual presentations included in this short course include broad rocket motor and system design principles, internal ballistics modeling, propellant fundamentals, component design (motor case, nozzle, and igniters), component and motor manufacturing, combustion instability, and motor failures.

Hydrogen Safety (Instructors: Steve Woods, NASA White Sands Test Facility, Las Cruces, NM; Miguel Maes, Las Cruces, NM; Stephen Mcdougle)
This course is intended to provide the student with a working knowledge of safety issues associated with the use of hydrogen. Using the aerospace industry standard, "Guide to Safety of Hydrogen and Hydrogen Systems" (AIAA G-095-2004), this course presents basic safety philosophy and principles and reviews a practical set of guidelines for safe hydrogen use. The information presented in this course is intended as a reference to hydrogen systems design and operations and handling practices; users are encouraged to assess their individual programs and develop additional requirements as needed.

NPSS: A Practical Introduction (Instructor: Paul Johnson, Wolverine Ventures, Fort Wayne, IN; Edward Butzin, Wolverine Ventures, Jupiter, FL; Dr. Ian Halliwell, Senior Research Scientist, Avetec, Heath, OH)
This course will give attendees a working knowledge of NPSS software and allow them to create and/or modify system models using this tool. The course material will discuss the object-oriented architecture and how it is used in NPSS to develop flexible yet robust models. A detailed presentation of NPSS execution options, syntax, and interfaces with external codes will be addressed. Overviews of NPSS operation (i.e., Solver, etc.) will also be included. Attendees will be interactively involved with the material by performing exercises on their personal hardware that demonstrates and clarifies the material being discussed in the lecture. All attendees will be provided with a reduced capability version of NPSS for their use during the course and will be permitted to keep it after the course is completed.

Missile Design and System Engineering (Instructor: Eugene Fleeman, International Lecturer, Lilburn, GA)
This course provides the fundamentals of missile design, development, and system engineering. A system-level, integrated method is provided for missile configuration design and analysis. It addresses the broad range of alternatives in satisfying missile performance, cost, and risk requirements. Methods are generally simple closed-form analytical expressions that are physics-based, to provide insight into the primary driving parameters. Configuration sizing examples are presented for rocket, turbojet, and ramjet-powered missiles. Systems engineering considerations include launch platform integration constraints. Typical values of missile parameters and the characteristics of current operational missiles are discussed as well as the enabling subsystems and technologies for missiles. Sixty-six videos illustrate missile development activities and performance. Attendees will vote on the relative emphasis of types of targets, types of launch platforms, technical topics, and roundtable discussion.

6–7 August 2012

The following standalone course is being held at the Ohio Aerospace Institute in Cleveland, Ohio.

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

	Early Bird by 2 Jul	Standard (3–30 Jul)	On-site (31 Jul–6 Aug)
AIAA Member	$885	$1050	$1190
Nonmember	$995	$1155	$1295

Systems Requirements Engineering (Instructor: John 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 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 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.

11–12 August 2012

The following Continuing Education courses are being held at the AIAA Guidance, Navigation, and Control et al. Conferences in Minneapolis, MN. Registration includes course and course notes; full conference participation: admittance to technical and plenary sessions; receptions, luncheons, and online proceedings.

To register for one of the GNC courses, go to **www.aiaa.org/GNC2012.**

	Early Bird by 16 Jul	*Standard (17 Jul–10Aug)*	*On-site (11–12 Aug)*
AIAA Member	$1243	$1343	$1443
Nonmember	$1348	$1448	$1548

Flight Vehicle System Identification in Time Domain (Instructor: Ravindra Jategaonkar, Senior Scientist and Group Leader, German Aerospace Center, DLR-Institute of Flight Systems, Braunschweig, Germany)
The scope of application of system identification methods has increased dramatically during the last decade. The advances in modeling and parameter estimation techniques have paved the way to address highly complex, large-scale, and high fidelity modeling problems. This two-day course will review the recent advances in the time-domain methods of system identification from flight data, both from the theoretical and practical viewpoints. Starting from the fundamentals, a systematic approach will be presented to arrive at the solution. Benefits derived from flight validated models applying system identification will be highlighted. The course will provide an overview of key methods of parameter estimation in time domain, cover many examples covering both fixed-wing and helicopter applications, and address model validation in both time and frequency domain. It will be supplemented with an overview of software tools available.

Atmospheric Flight Dynamics and Control (Instructor: David Schmidt, Professor Emeritus, University of Colorado, Monument, CO)
The course covers all five aspects of flight dynamics and control in an integrated format—the equations of motion; aerodynamic modeling; steady-state analysis and control power; dynamic and modal analyses including modal approximations; and synthesis of stability-augmentation and autopilot control laws. The course contains a clear, rigorous, yet practical treatment of conventional topics dealing with rigid vehicles, while also addressing the flight dynamics and control of elastic vehicles extensively. Key topics include the rigorous derivation of the equations of motion for rigid and flexible aircraft via Newton and Lagrange; a review/tutorial on lumped-mass vibrations including rigid-body degrees of freedom; modeling the effects of static and dynamic elastic deformation on the forces and moments; modal analysis of rigid and flexible vehicles; elastic effects on vehicle control (e.g., filtering, sensor, and actuator placement); a case study on active structural mode control; plus other examples involving a flexible hypersonic vehicle and large flexible aircraft. The material on flexible vehicles is presented from a “flight-dynamics” rather than a “structural-dynamics” perspective. An integrated treatment of linear dynamic models is used throughout. Typical autopilot control laws are synthesized using loop-shaping techniques, including discussions of typical sensors and gain scheduling. The student is introduced briefly to the classical “crossover” pilot model and its implications regarding flight control. MATLAB® and Simulink are used extensively in the many examples involving real aircraft.

Recent Advances in Adaptive Control: Theory and Applications (Instructors: Tansel Yucelen, Research Engineer, School of Aerospace Engineering, Georgia Institute of Technology, Atlanta, GA; Eric Johnson, Professor, School of Aerospace Engineering, Georgia Institute of Technology, Atlanta, GA; Anthony Calise, Professor of Aerospace Engineering, Georgia Institute of Technology, Atlanta, GA; Girish Chowdhary, Research Engineer, Georgia Institute of Technology, Atlanta, GA)
Adaptive control is motivated by the desire to reduce control system development time for systems that undergo frequent evolutionary design changes, or that have multiple configurations or environments in which they are operated. Model reference adaptive control (MRAC) is a leading methodology intended to guarantee stability and performance in the presence of high levels of uncertainties. This course reviews a number of well-established methods in MRAC. Starting with MRAC problem formulation and an overview of classical robustness and stability modifications, the course will introduce the adaptive loop recovery approach that allows the approximate retention of reference model loop properties such as relative stability margins. We will also present Kalman filtering in adaptive control, in which a Kalman Filter framework is used to update adaptation gains that enables meeting a given performance criteria without excessive tuning. Two novel adaptive control laws are also presented: concurrent learning adaptive control and derivative-free adaptive control.

The course will also discuss emerging results in connecting machine learning with adaptive control. A special section will be devoted to implementation and flight testing of adaptive control methods, including discussion of the pseudo control hedging methods for handling actuator dynamics and saturation. The course will conclude with discussing extensions to decentralized adaptive control, output feedback adaptive control, unmodeled dynamics, and unmatched uncertainties.

Fundamentals of Tactical and Strategic Missile Guidance (Instructor: Paul Zarchan, Technical Staff, MIT Lincoln Laboratory, Newton, MA)
Whether you work in the tactical world or the strategic world, this course will help you understand and appreciate the unique challenges of each. So everyone can clearly understand the principles of both tactical and strategic missile guidance, concepts are derived mathematically, explained from a heuristic perspective, and illustrated with numerical examples. Material is presented so that participants with different learning styles can benefit. The course will be of value to both novices and experts wanting to learn more about missile guidance and to understand its importance to system design.

Optimal State Estimation (Instructor: Dan Simon, Professor, Cleveland State University, Cleveland, OH)
After taking this course, the student will be able to apply state estimation techniques in a variety of fields confidently. This course includes: 1) A straightforward, bottom-up approach that begins with basic concepts, and then builds step-by-step to more advanced topics; 2) Simple examples and problems that require paper and pencil to solve, which leads to an intuitive understanding of how theory works in practice; and 3) MATLAB®-based state estimation source code for realistic engineering problems, which enables students to recreate state estimation results and experiment with other simulation setups and parameters. After being given a solid foundation in the fundamentals, students are given a careful treatment of advanced topics, including H-infinity filtering, unscented filtering, high-order nonlinear filtering, particle filtering, constrained state estimation, reduced order filtering, robust Kalman filtering, and mixed Kalman/H-infinity filtering.

Six Degrees of Freedom Modeling of Missile and Aircraft Simulations (Instructor: Peter Zipfel, University of Florida, Shalimar, FL)
This course will introduce you to modeling aerospace vehicles in six degrees of freedom (6 DoF). Starting with the modern approach of tensors, the equations of motion are derived and, after introducing coordinate systems, they are expressed in matrices for compact com-

puter programming. Aircraft and missile prototypes will exemplify 6 DoF aerodynamic modeling, rocket and turbojet propulsion, actuating systems, autopilots, guidance, and seekers. These subsystems will be integrated step by step into full-up simulations. Typical fly-out trajectories will be run and projected on the screen. The provided source code and plotting programs lets you duplicate the trajectories on your PC (requires FORTRAN or C++ compiler). With the provided prototype simulations, you can build your own 6 DoF aerospace simulations.

13–14 August 2012

The following standalone course is being held at the National Aerospace Institute in Hampton, Virginia.

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

	Early Bird by 6 July2012	*Standard (7 Jul–3 Aug)*	*On-site (4–13 Aug)*
AIAA Member	$885	$1050	$1190
Nonmember	$995	$1155	$1295

Computational Aeroacoustics: Methods and Applications **(Instructors: Christopher Tam and Sarah Parrish)**

This course examines the computational issues that are unique to aeroacoustics. Course materials consist of three parts: introduction, CAA methods, and applications. The purpose of the introduction is to provide a brief review of the field of aeroacoustics; the issues and problem areas. CAA methods form the main component of the course. A number of applications are discussed to illustrate how CAA methods are used in realistic and practical problems. By definition, CAA problems are time dependent and usually contain high frequency components. Because of the nature of sound, one would like to be able to compute CAA problems with as few number of mesh points per wavelength as possible. These characteristics of CAA problems are very different from fluid flow problems, so specially developed CAA methods are needed. Students will be introduced to these methods.

27–29 August 2012

The following standalone course is being held at the Ohio Aerospace Institute in Cleveland, Ohio.

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

	Early Bird by 23 Jul	*Standard (24 Jul–20 Aug)*	*On-site (20–27 Aug)*
AIAA Member	$1085	$1250	$1390
Nonmember	$1195	$1355	$1495

Space Environment and its Effects on Space System

(Instructor: Vincent L. Piscane)

This course is intended to serve two audiences: 1) those relatively new to the design, development, and operation of spacecraft systems and 2) experts in fields other than the space environment who wish to obtain a basic knowledge of the topic. The topics and their depth are adequate for the reader to address the environmental effects on spacecraft instruments or systems to at least the conceptual design level. Topics covered include spacecraft failures, solar system overview, Earth's magnetic and electric fields, Earth's neutral environment, Earth's plasma environment, radiation interactions, contamination, and meteorites and orbital debris.

11–12 September 2012

The following standalone course is being held at the National Aerospace Institute in Hampton, Virginia.

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

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

Robust Aeroservoelastic Stability Analysis

(Instructor: Richard Lind)

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

9–10 September 2012

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

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

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

Systems Engineering Verification and Validation **(Instructor: John Hsu, Technical/Project Manager and Principal Investigator, The Boeing Company, Cypress, CA)**

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

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

15–16 September 2012
The following Continuing Education course is being held at the AIAA ATIO/MAO 2012 Conference in Indianapolis, IN. Registration includes course and course notes; full conference participation: admittance to technical and plenary sessions; receptions, luncheons, and online proceedings.

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

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

Optimal Design in Multidisciplinary Systems (Instructors: Prabhat Hajela, Rensselaer Polytechnic Institute, Troy State, NY; Dr. J.E. Sobieski, NASA Langley Research Center, Hampton, VA)
When you are designing or evaluating a complicated engineering system such as an aircraft or a launch vehicle, can you effectively reconcile the multitude of conflicting requirements, interactions, and objectives? This course discusses the underlying challenges in such an environment, and introduces you to methods and tools that have been developed over the years.

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

Standard Information for all AIAA Conferences

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

Photo ID Needed at Registration

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

Conference Proceedings

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

Young Professional Guide for Gaining Management Support

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

Journal Publication

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

Speakers' Briefing

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

Speakers' Practice

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

Timing of Presentations

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

Committee Meetings

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

Audiovisual

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

Employment Opportunities

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

Messages and Information

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

Membership

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

Nondiscriminatory Practices

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

Smoking Policy

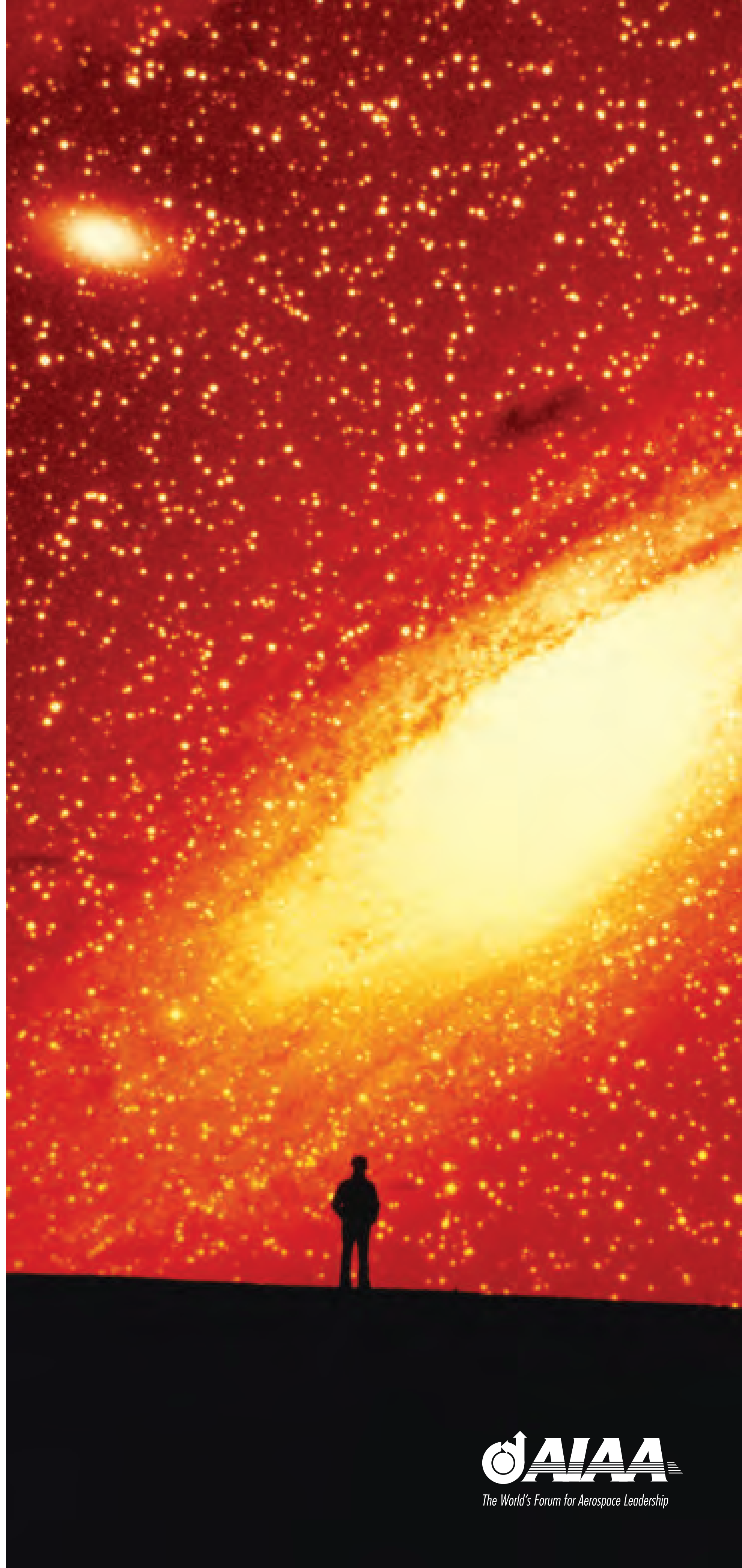
Smoking is not permitted in the technical sessions.

Restrictions

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

International Traffic in Arms Regulations (ITAR)

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