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ENTERING SPACE

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IN ORBIT

NOTES ON A NEW BOOK

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President's Message

What a year it was! In 2004, the American Astronautical Society celebrated the fiftieth anniversary of our founding by a handful of visionaries at the dawning of the Space Age in 1954. We still have visionaries among us. In fact, vision is what the space program has always been about: a vision of exploration, of scientific discovery, of enhanced national security, of saved lives, and of improving the quality of life for all humankind. This is a great business to be in!

In our golden anniversary year, we were witnesses to both success and failure in space, thankfully much more of the former than the latter. We were given a new national vision for space, as announced by President Bush last January and as debated – and debated and debated – throughout the year. As a professional society, we played a tangible role in that debate, and we can be proud that we did so. It would appear that we're on our way from Earth to the Moon, Mars, and destinations beyond. Outgoing National Aeronautics and Space Administration Administrator Sean O'Keefe, in his recent essay in the *National Geographic Encyclopedia of Space*, gave this vision an apt name: "an adventure without end." What a great place to start our fifty-first year in the AAS!

In this issue of *Space Times*, we will look at a subject that has not received enough attention by the Society or by the nation during this past year of excitement over the prospects of space exploration: our planet. The space voyages engendered by the new vision will originate from Earth, and we must begin to fully comprehend the complex system of systems which comprises our planet, from solid earth geophysics to weather and oceanography to climate. Remote sensing space systems and supercomputers in our labs are providing the tools for government and private sector researchers to study Earth as never before. And as we contemplate the horrendous impact upon South Asia of the tsunamis of December 26, we can ask ourselves how such tragic loss of life can be prevented in the future by tapping the technology we have in our hands today.

But whether it's Earth science, space science, human space exploration, national defense, or civil or commercial satellites, the AAS is about *Advancing All Space*. The year 2005 will present all these challenges and more for the entire space community. Welcome along for the ride! And stay tuned to the Society's web site, www.astronautical.org, to follow – and participate in – the activities and the voice of the best professional space society on Earth.

Jon Malay

ON THE COVER

In this side-by side comparison of two satellite images of Hurricane Jeanne, the fourth major hurricane of the 2004 season to strike Florida, the black-and-white image on the left offers a familiar view of swirling clouds from space. On the right, enhanced multispectral imagery reveals a two-dimensional map of cloud-top heights; blue/green sections indicate cloud heights of up to ten kilometers, while those in orange/red represent cloud heights of fifteen to twenty kilometers. These images were captured by the Multi-angle Imaging SpectroRadiometer, built by the Jet Propulsion Laboratory and flown on NASA's Earth observation spacecraft, Terra. (Source: NASA)

INTERNATIONAL SPACE UNIVERSITY

The International Space University is again offering its popular Introductory Space Course, which will be held at the ISU Central Campus in Strasbourg, France, May 23-27, 2005. The course, taught in English, provides an overview of space and space-related subjects for professionals of diverse backgrounds, including marketing, finance, law, and contracts management. See www.isunet.edu for registration information.

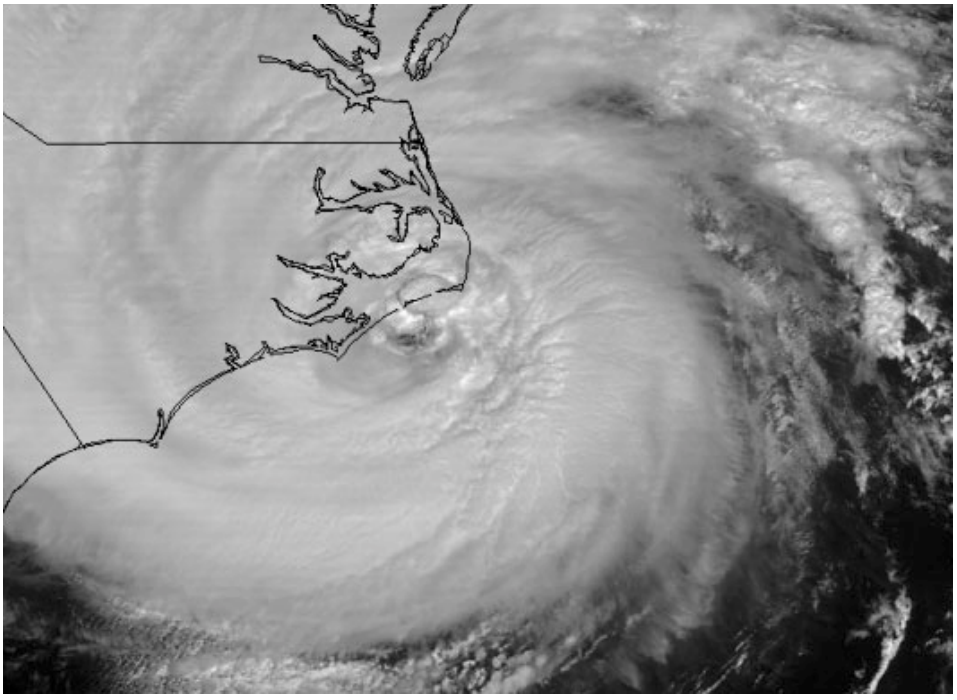
Earth Science and Earth Observations from Space: An Update on Current Activity and Accomplishments

The U.S. government continues important programs to observe the Earth and its environment, returning societal benefits and advancing scientific understanding of the planet we call home. Earth observations are, increasingly, a truly interagency and international effort and represent a challenge to the space community as it looks outward to the Moon, Mars, and beyond.

by Jonathan T. Malay

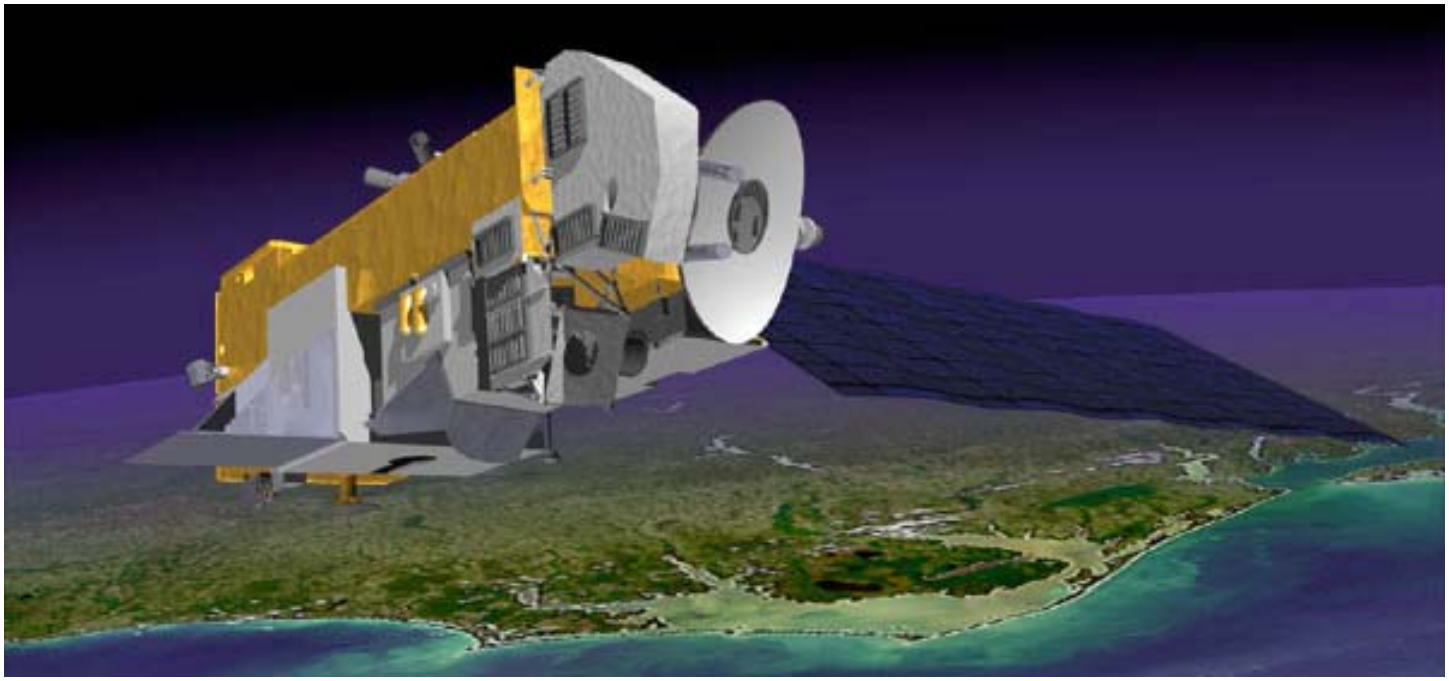
Earth science and Earth observations from space remain on the minds of our national leaders, sharing in the attention to President Bush's announcement on January 15, 2004, of the vision for space exploration as well as the headline-grabbing news coming back from the Mars rovers Spirit and Opportunity, the Cassini probe now orbiting Saturn, and even the rough but on-target recovery of solar wind samples from the Genesis mission. Science news enabled by key instruments deployed on spacecraft offers more than a few additional inches of print space in the trade press and popular news media, alongside stories covering human space flight, military space activities, and of course, the recent and exciting news of Burt Rutan and his SpaceShipOne team winning the X Prize. With the impressive portfolio of activity and accomplishments associated with space, there is value in focusing on what is going on specifically in Earth science and remote sensing from space.

While the world attempts to grasp the magnitude of destruction caused by the horrific tsunamis in South Asia and as Florida and much of the eastern United States pick up the pieces after multiple direct hits from hurricane after hurricane, it might be easy to take for granted the critical role played by environmental satellites in monitoring the development and path of these killer storms. It also might be easy to overlook the many efforts of U.S. federal agencies to understand climate change, improve weather predictions, and prepare for hazards using not only operational Earth observation satellites, such as the National Oceanic and Atmospheric Administration (NOAA) polar and geostationary satellites, but also the largest constellation of remote sensing satellites to conduct research of Earth system science the world has ever seen: the National Aeronautics and Space Administration's (NASA) Earth Observation System with the Terra, Aqua, and now Aura satellites successfully deployed on orbit, along with the Tropical Rainfall Measuring Mission, QuikScat, Landsat 7, and other Earth observation satellites.



Hurricane Isabel approaches the North Carolina coast in September 2003 on the eve of its destructive pass through the central Atlantic states and up into Canada. This image was captured by NOAA's Geostationary Operational Environmental Satellite (GOES) East. Isabel was the first hurricane to have threatened the Atlantic seaboard since the 1999 tropical storm season. GOES imagery is the primary tool used by forecasters to observe and predict the path of hurricanes. (Source: NOAA)

Several very interesting new Earth observation missions are also coming, including the soon-to-be-launched Cloud-Aerosol LiDAR and Infrared Pathfinder Satellite (CALIPSO) and CloudSat missions, to be followed by the Orbiting Carbon Observatory, the ocean salinity measurement mission Aquarius, and the Hydrosphere State Mission (HYDROS). Each of these new missions under the Earth System Science Pathfinder program will provide scientists and decision makers with important measurements to increase understanding of our complex and dynamic home. NASA is also devel-



An artist's rendering of the Aura spacecraft, the last of three major multi-instrument missions in the NASA Earth Observation System. Aura was launched on July 10, 2004, joining NASA's Terra and Aqua missions in a long-term research program designed to provide a comprehensive understanding of Earth's complex environment. (Source: NASA)

oping, with its international partners, the Global Precipitation Measurement mission. We are also looking forward to the next-generation operational satellites in the National Polar-orbiting Operational Environmental Satellite System (NPOESS), with its predecessor, the NPOESS Preparatory Project, and, in the next decade, the Geostationary Operational Environmental Satellite (GOES)-R series missions. Anyone who says not much is happening in Earth remote sensing is not paying attention.

The parallel effort of NASA to develop research satellites and of NOAA to extend those results to operational satellites is a well-trod path. But this path needs to be carefully planned, nurtured, and then followed as clearly spelled out in 2003 by the National Academy of Sciences/National Research Council in a wryly-titled report: *From Research to Operations in Weather Satellites and Numerical Weather Prediction: Crossing the Valley of Death*. This report is often cited in defending the continued close collaboration between agencies and, among its several recommendations, stated unequivocally that "NASA and NOAA should work together to ensure that the continuity of critical climate and weather observations is maintained."

Agency Affairs

NASA, NOAA, and the U.S. Geological Survey are all members of the Committee on Earth Observation Satellites, comprised of various agencies around the world that operate remote sensing satellites. Let us look closely at the first two agencies, in light of the changes going on today in and around them in the federal government and the research community.

First NASA. The obvious questions are: What about the vision for space exploration? Is Earth science compatible with this vision? Is Earth science being lost in the shuffle in being combined with space science under NASA's new Science Mission Directorate? Is the federal government going to shift responsibility for this science area to another agency?

The answer to all these questions, to those paying attention, seems to be a resounding "no." In remarks to the Forum on Earth Observations in Washington, D.C., on September 23, 2004, NASA Administrator Sean O'Keefe re-affirmed his agency's intent to continue its Earth science mission in saying: "We're convinced it's only by getting a better understanding of the complex dynamics of Earth's climatic system that we will be able to truly study and understand our neighboring planets as we extend our exploration reach throughout the solar system in the decades ahead. Indeed, Earth observations are a vital component of our space exploration agenda. … By combining Earth and space science in this one Mission Directorate, we intend to link the exploration of planetary bodies, chart the best route of discovery through the solar system, and reap the benefits of Earth and space exploration for society."

Are societal benefits really at the core of NASA science? In responding to the vision and executing a transformation of the NASA organization, many things at this agency have changed, but not its vision and mission statements. The first line of each points directly to the relevance of Earth science to the agency's reason for existence: "To improve life here…" from the vision statement and "To understand and protect our home planet…" from the mission statement.

Determined to more fully articulate this intent to continue the Earth science program, NASA has recently pro-

duced a brochure entitled *The View from Space: NASA Earth Observations Serving Society*. This twenty-eight-page booklet is well worth reading because it captures the essential connection between observations and applications in a dozen very valuable areas: agricultural efficiency, air quality, aviation, carbon management, coastal management, disaster management, ecological forecasting, energy management, homeland security, invasive species, public health, and water management. The brochure makes very clear that many other federal agencies, particularly the Environmental Protection Agency, the Department of Energy, the Department of the Interior (particularly the U.S. Geological Survey), the Department of Agriculture, and Federal Emergency Management Agency, are directly benefiting from NASA's Earth science program. You can find this well-written and beautifully illustrated report online at www.earth.nasa.gov.

The bottom line for NASA seems to be that Earth science remains very much part of its mission. Hopefully, the agency will build upon the success of its Earth observing programs with new opportunities to look carefully at our own planet while we reach out to the Moon, Mars, and beyond.

NOAA is, as its leadership correctly point out, one of the world's largest operational space agencies. The agency's National Environmental Satellite, Data, and Information Service currently operates two satellites each in its Geostationary Operational Environmental Satellite and Polar Operational Environmental Satellite programs, plus many residual assets and stored-on-orbit spare spacecraft for those programs, in support of the National Weather Service, other federal agencies, and the American public. The societal benefits of the nation's investment in these satellite systems is obviously enormous because, by some estimates, at least 80 percent of the gross national product of the United States is affected by the weather, ocean conditions, and climate. Investments of hundreds of millions of well-spent dollars on operational environmental satellites leverage tens of billions of dollars of national productivity, not to mention the priceless protection of lives due to better severe weather prediction and search-and-rescue services provided by NOAA satellites and services.

Earth observations from space play a key role in all elements of the NOAA mission, which is also phrased in terms of societal impact: "To understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs." The agency parses this mission into four themes: ecosystems, climate, weather and water, and commerce and transportation. In its recently published strategic vision document, NOAA also lists several cross-cutting themes including the development of an integrated global environmental observation and data management system. This subject has been getting a great deal of attention lately.

Sean O'Keefe, outgoing NASA administrator, addresses several hundred attendees at the Forum on Earth Observations in Washington, D.C., on September 23, 2004. O'Keefe, along with NOAA Administrator Conrad Lautenbacher and a number of speakers from government, academia, and industry, spoke on the challenges and opportunities of the interagency and intergovernmental effort to establish a Global Earth Observation System of Systems. (Source: Institute for Global Environmental Strategies)

Worldwide Progress

In a June 2002 speech, President Bush spoke about the importance of science in making decisions which can have important economic ramifications. He affirmed his administration's commitment to doing this science because, as he said, "The Earth's well-being… is an issue important to America – and it's an issue important to every nation and in every part of the world." Building upon this commitment, the administration reoriented the multi-agency U.S. Global Change Research Program beginning in summer 2002 into a new Climate Change Research Program with the Department of Commerce taking a lead role. A year later, the United States hosted the first Earth Observation Summit, a ministerial-level meeting of thirty-nine nations. What began at that event, held at the U.S. Department of State in Washington, D.C., has become an international program to establish a Global Earth Observation System of Systems. This initiative is not yet

defined but is expected to include virtually all U.S. and international observing systems, be they space-based, airborne, on Earth's land surfaces, or in the oceans. One such activity which would be subsumed is the conceptual Global Ocean Observing System, which has been under discussion for several years.

NOAA Administrator Conrad Lautenbacher is serving as U.S. co-chair of the Group on Earth Observations, which now includes fifty-three nations and twenty-nine international organizations. At a June 2004 meeting of the United Nations Intergovernmental Oceanographic Commission Executive Council, Admiral Lautenbacher said: "Social, economic, and scientific benefits drive the need for building an integrated Earth information and data management system. Put simply, improved observational capabilities will provide information to enable decision-makers to make better decisions regarding sustainable development and the wise use of our limited natural resources. The Global Ocean Observing System provides a strong foundation and will be a key component of a successful Global Earth Observation System of Systems."

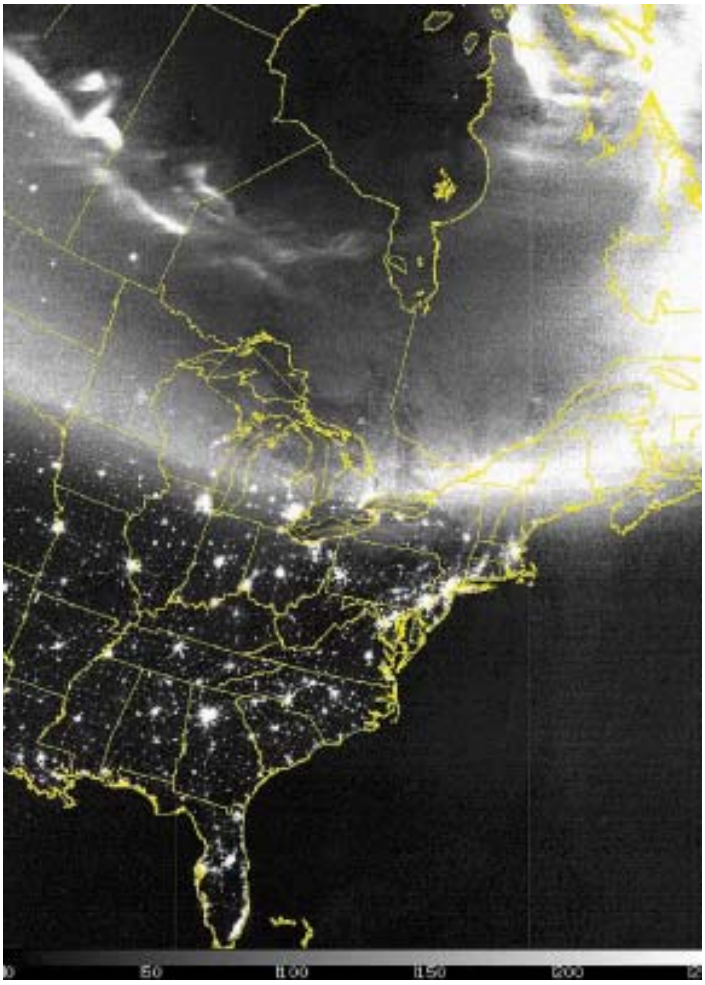
The United States has engaged the world in Earth science and in Earth observations. Now, how will we proceed as a nation? Briskly, it seems. In August 2004 the National Research Council held a workshop at Woods Hole, Massachusetts, to assess Earth science and applications from space. Every ten years for the past many years, the National Research Council has produced prioritized lists of space science objectives for the nation that represent the voice of the various scientific communities, such as in astronomy, astrophysics, or planetary science. The Earth science community has never yet spoken with such a voice, and the Woods Hole workshop was challenged to organize a study, to be carried out over a two-year period, and produce a report called: *Earth Science and Applications from Space: A Community Assessment and Strategy for the Future*. An executive committee and seven theme panels are being established under the overall leadership of Dr. Richard A. Anthes, president of the University Corporation for Atmospheric Research, and Dr. Berrian Moore, III, of the University of New Hampshire. A final report is expected by spring 2006 with an interim report in spring 2005.

In September 2004, the White House-led Committee on Environment and Natural Resources released a draft *Strategic Plan for the U.S. Integrated Earth Observation System*. This report was the result of the Interagency Working Group on Earth Observations co-chaired by Ghassem Asrar of NASA, Cliff Gabriel of the Office of Science and Technology Policy, and Greg Withee of NOAA. It defines the foundation for a practical focus on Earth observations, linking observations to societal benefits; establishes a U.S. governance structure for such activities; and lays out a prototype architecture for a U.S. Integrated Earth Observation System. The "next steps" chapter is clearly the key as the U.S. government moves ahead in implementation of the U.S. system.

In another development, while the space community has been focusing on the Commission on the Implementation of U.S. Space Exploration Policy (also known as the Aldridge Commission), another commission appointed by the president has been working on a report which may also have a profound effect on the Earth science community. The U.S. Commission on Ocean Policy, under the chairmanship of former Chief of Naval Operations Admiral Jim Watkins, released its interim report, *An Ocean Blueprint for the 21st Century*, on September 20 and sent it to the White House. As mandated by the Oceans Act of 2000, the president must submit to Congress his statements of proposals to implement or respond to the Commission's findings within ninety days.

Why is this relevant to a discussion of NASA-NOAA relationships? Because the Commission recommended that "program consolidation be pursued in

NOAA Administrator Conrad C. Lautenbacher welcomes Dr. John H. Marburger, III, science advisor to the president, to the podium at the Forum on Earth Observations on September 22, 2004. (Source: Institute for Global Environmental Strategies)



The lights of U.S. and Canadian cities and the Aurora Borealis (Northern Lights) as seen in a low-light image taken by a U.S. Defense Meteorological Satellite Program spacecraft. (Source: U.S. Air Force)

areas such as area-based ocean and coastal resource management, invasive species, marine mammals, aquaculture and *satellite-based Earth observing*." Many in the remote sensing community immediately saw this as a call to somehow combine the Earth science satellite programs of NASA and NOAA under NOAA leadership. In actuality, however, this is unlikely based on comments by NASA and NOAA leadership and Dr. John H. Marburger, III, science advisor to the president, in a recent discussion with industry representatives.

What should the astronautics community draw from these developments? To many, it is a "wait and see" situation. To those of us who are watching and listening to the NOAA and NASA leadership, it is more appropriate to say we are looking forward to what happens next! The community is very interested in seeing NOAA keep both the NPOESS and GOES-R programs on track, both currently having growing budget requirements, and to see NASA be successful in obtaining White House and congressional support for a major new Earth science mission in the fiscal year 2006 budget request. These are, still, exciting times to be in the Earth observation satellite business.

In going back to the Moon, on to Mars, and beyond, it's very clear that all paths lead from the Earth. ■

Jonathan T. Malay **is AAS president and director of civil space programs in Lockheed Martin Corporation Washington Operations. He is also the author of the novel *Seraphim Sky* (www.seraphimsky.com) and co-author of National Geographic Encyclopedia of Space (National Geographic, 2004).**

The Political Legacy of Sean O'Keefe: Strategy, Legislation, and the Shaping of Space Policy

The history books have yet to be written, but already NASA Administrator Sean O'Keefe's impact on NASA and its future can be seen, most recently in terms of the ability to work closely with the White House and Congress to secure 2005 funding to begin to pursue President Bush's space exploration vision.

by Frank Sietzen, Jr.

Next to his desk at National Aeronautics and Space Administration (NASA) headquarters in Washington, former NASA Administrator Sean O'Keefe kept an ejection seat. A product of Great Britain's Martin Baker Corporation and real right down to its rocket-activating, yellow and black striped handles, the seat was made for the occupant of a fighter plane. But on the ninth floor of the NASA headquarters building, the seat was meant not as an escape device but as a constant reminder. O'Keefe, like every presidential appointee, served at the pleasure of the man who appointed him, which means, in stark but simple terms, that he could have been "called home" on the whim of a political hiccup.

During his three-year tenure, the space chief set upon a course that has never been followed in the forty-six-year storied history of civil space. To win the right to be blessed with a broad new space exploration agenda, the Irishman from New Orleans pledged to reinvent his agency. No less than a transformation is underway that, according to O'Keefe, will give NASA the internal tools and reinvigorated management structure to sustain a new, long-term human space flight agenda. In this pursuit of reinvention both the president and the Congress are complicit, for it is the entire political leadership of the country that must approve and preserve the pathway to transformation. At times, this proposed restructuring of NASA has been more popular with political leaders than the Moon-Mars program that transformation is supposed to enable.

But the fidelity of the agency to this cannibalization has yet to be determined. With the report of the Aldridge Commission as his roadmap, O'Keefe spent the summer trying to forge a consensus for the next steps back to the Moon. As of this writing, it is not yet clear if a transformation will actually take root, especially with O'Keefe's departure for private life, or instead wind up as small changes masked by good intentions. The outcome may well be the survival of NASA itself, as well as any dream of more advanced space goals for the nation.

No less than a transformation is underway that, according to O'Keefe, will give NASA the internal tools and reinvigorated management structure to sustain a new, long-term human space flight agenda.

NASA Administrator Sean O'Keefe (left) introduces Vice President Dick Cheney to the fighter aircraft ejection seat in his office. O'Keefe used the seat as a reminder that his appointment perpetually hung in the balance of possible political change. (Source: NASA/Bill Ingalls)

For much of the past three and a half decades since Neil Armstrong and Buzz Aldrin set Apollo 11's Eagle spacecraft on the Moon's ancient soil, many have longed for a presidential space policy commitment that would rival the Apollo era. Embedded within such a call was the belief that the president would play the major part in whatever political drama a new space goal would create. But as we pass the first anniversary of the presidential speech that forms the latest attempt at sending Americans beyond Earth orbit again—the third political try since May 25, 1961—it might be a useful exercise to look at how NASA and pro-space legislators, with a major boost from the occupant of 1600 Pennsylvania Avenue, achieved nearly full funding for the first year of George W. Bush's space vision. For most of 2004 it looked as if the space plan, like Bush's father's bold space proposal of 1989, would wind up in the same place: dead on arrival in Congress.

In our present political climate, maneuvering a space bill through Congress is as much an art form as it is the stuff one learns in political science classes.

Coalitions as Key

That the younger Bush's plan survived required deployment of a complex and largely hidden political and legislative strategy that involved not just the president that started it all, but more importantly—and less well understood by some—a host of political leaders in Congress that quietly shepherded the NASA budget through the minefield-strewn thicket. At any point from spring until November, it appeared on the surface that the space plan was in deep trouble. It was…and it wasn't. The author had the chance for most of 2004, as during the year before, to be an inside witness to the unfolding political and legislative strategy that yielded success, albeit at the last minute. It is a tale of how, in our present political climate, maneuvering a space bill through Congress is as much an art form as it is the stuff one learns in political science classes. The influence of such political craftsmanship cannot be overstated; the role of the American president is but one act of a multifaceted play.

Like John Kennedy before him, Bush relied upon a bipartisan coalition in Congress to manage his NASA budget, which became the forum and down payment for the space vision announced on January 14, 2004. Unlike Kennedy, though, Bush's congressional coalition received the space policy proposal with a mixture of indifference and support. And, also unlike Kennedy, Bush was attempting to bring the new space policy into fruition in the middle of a presidential and congressional election year. And unlike in 1961, the two political parties were deeply polarized and the budget climate even worse: Bush was proposing to add a small amount to NASA's budget, about 5.6 percent, in 2004 and about three percent the following year, until the civil space budget became essentially flat when indexed for inflation. Indeed, NASA was one of a few non-defense and non-homeland security domestic agencies targeted for any increase at all. This fact made NASA as a Bush administration priority clear. It also served to paint a legislative bull's-eye on the space agency — a tempting target for budget cutters.

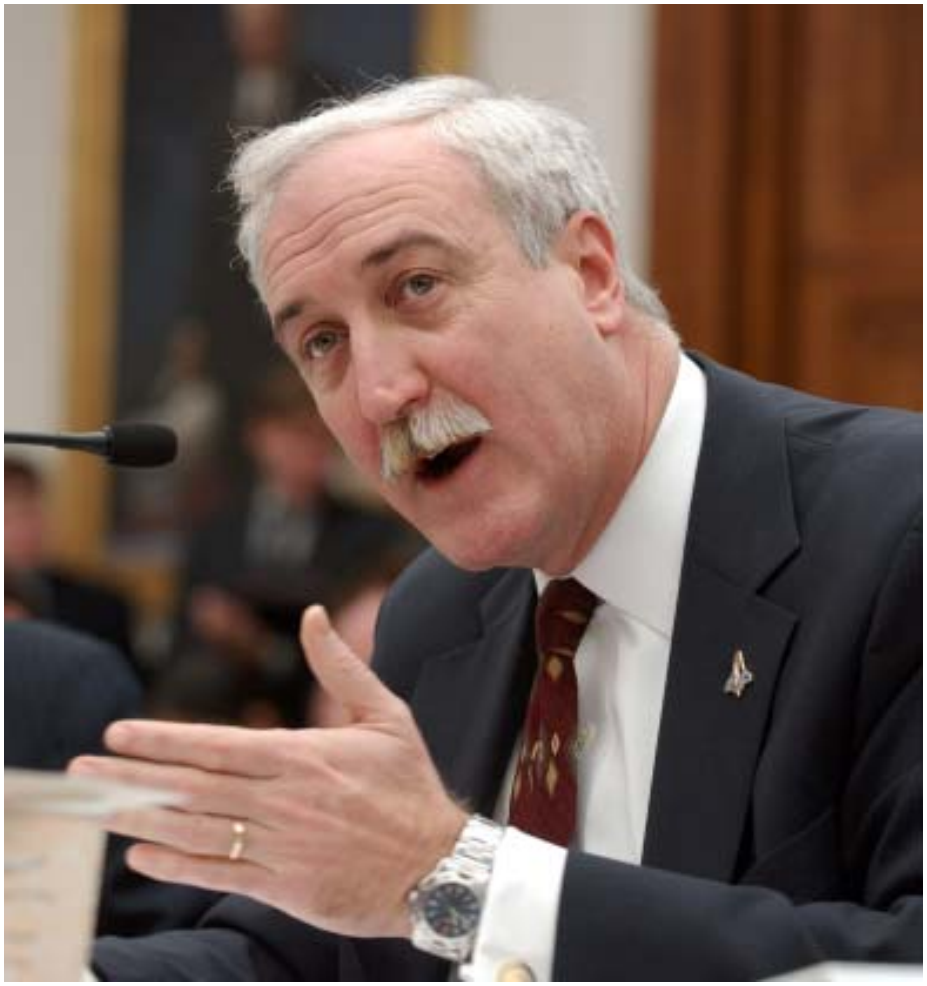
Thus a year ago, as the fiscal year 2005 budget dance began, NASA

President Bush (left) and Sean O'Keefe demonstrate agreement and partnership after Bush announces his new vision for space exploration in January 2004. The vision entails exploration of the Moon, Mars, and destinations beyond. (Source: NASA/Bill Ingalls)

supporters were trying to align themselves with a host of political coalitions in Congress not normally friendly to the space program. Conservative Republicans balked at this increase, tiny though it was in relation to either the deficit or the cost of the Iraq war. Democrats, seeing the prospect for recapturing the White House from a president many of them loathed, hardly were inclined to embrace new human explorations of the Moon or Mars. Looking across this political landscape, a geography far different from the one that faced either Kennedy's 1961 Moon proposal or Bush's father's 1989 Moon-Mars dream, one could hardly conjure up a more hostile political environment in which to start a renewal of the civil space program.

But two elements gave the Moon-Mars plan more support than one might have imagined, not because of the renewed exploration missions it contained, but, initially, in spite of them. The first element was part of the price that NASA was prepared to pay for the project: a massive restructuring—a transformation—of the agency itself. This measure had been vetted by a commission appointed by the president that made its recommendation within a sixty-page report released as last summer started. NASA program management and overall structure had been the subject of bipartisan complaints long before the February 1, 2003, *Columbia* accident. Critics who had never supported civil space spending had lambasted the space agency for its history of cost overruns on signature programs, or failure to see its major initiatives through to completion, such as the X-33, X-34, and X-38 spaceplane programs. Now the political leaders were offered a revamped, "transformed" NASA structure as part of the whole Moon-Mars effort. The transformation, if not the Moon-Mars plan itself, was received with a mix of skepticism and relief.

The second key item was the strong bipartisan support for the space shuttle's return to flight. Support for the shuttle, technically the first element of the new space vision, was deep in places where initial enthusiasm for the Moon-Mars parts was lukewarm. For example, Democratic Senators Mary Landrieu of Louisiana and Bill Nelson of Florida, both of states where there were hundreds of shuttle-related jobs, supported the shuttles and their safe return to flying in space. The bulk of the $866 million budget boost requested by Bush for NASA's 2005 budget would go toward bringing the shuttles back. Only a small amount, far less than $200 million, would be spent on the new vision plan. So as spring 2004 got underway, and congressional hearing after congressional hearing was held in which Democrats as well as Republicans expressed doubts about the plan, nearly all said they supported at least the first two elements of the proposal: returning the shuttles to space and using them to complete the International Space Station.



NASA Administrator Sean O'Keefe outlines the new vision for space exploration at a hearing before the House Science Committee on February 12, 2004. (Source: NASA/ Bill Ingalls)

But as summer began, signs appeared that funding for the space plan might be lacking on the House side. House Appropriations Subcommittee for Veterans Affairs, Housing and Urban Development, and Independent Agencies Chairman James T. Walsh of New York and his boss, full House Appropriations Committee Chairman C.W. "Bill" Young of Florida, warned O'Keefe that finding the $866 million for NASA, which was just one of several agencies for which the subcommittee had budget responsibilities, might prove impossible. Pressure grew as summer went on to increase spending on Veterans Affairs, which was lumped together in the same bill as NASA. When Walsh's subcommittee reported out the spending plan, it slashed $1.1 billion from the space agency—all of the pro-

On a visit to Johnson Space Center, Congressman Tom DeLay of Texas meets NASA's "Robonaut," a humanoid robot that engineers have designed and are testing to perform the activities typically completed by spacewalking astronauts. Part of the space center lies within DeLay's district. (Source: NASA)

posed increase and even deeper cuts. The full committee was poised to endorse the bill as well.

Political Forces at Work

O'Keefe called the House Appropriations Committee's budget mark a game of "political chicken." Publicly, he decried the House action but expressed confidence in the ultimate outcome. But beneath the game face, forces were gathering that would serve to bolster his conviction. Largely unprecedented steps for a NASA bill, the elements of the unusual summer space politics maneuver lay at the doorstep of House Representative Tom DeLay, Republican of Texas.

As a result of redistricting in Texas, whose new congressional map was largely drawn by DeLay himself, part of Johnson Space Center now lay in DeLay's district. DeLay had already been a strong supporter of NASA and civil space; the redrawn political map increased his emphasis on space affairs. Following Bush's January 14, 2004, space policy announcement, DeLay became its most vocal backer in the House of Representatives. The added fact that DeLay was the House majority leader was not lost on space supporters, either.

Now, in the aftermath of the House Appropriations Subcommittee action, DeLay and the Bush White House huddled. The meetings resulted in the emergence of a multi-pronged strategy. The first was a power play by DeLay himself. Should anything remotely resembling the subcommittee's version of the NASA bill actually pass the full committee and head to the House floor, he, DeLay, would block it from ever receiving a vote. No House political leader with the capability to back up such a threat had ever pledged to block a funding bill because it had deep cuts to space spending. But equally as stunning was the Bush White House's next move. Josh Bolten, head of the Office of Management and Budget, sent a letter to Young and Walsh. Should the worst happen, with a bill arriving at Bush's desk without funding for his space vision, White House staff would urge Bush to veto it.

First DeLay warned that no budget bill that slashed NASA would ever get a full vote. And now the White House was threatening to veto any bill that escaped and resulted in actual legislation. Was it a serious threat or a bluff? Walsh had warned O'Keefe and NASA earlier in the summer that with budget ceiling pressures and the need for increased spending for veterans' medical programs, NASA could not get anything close to the president's request from either his subcommittee or the full committee.

But a careful reading of the tea leaves would have shown there was some light in the House for NASA. For one thing, the report that accompanied the budget bill actually had words of praise for Bush's space proposal and for O'Keefe's NASA transformation plans. What it said it lacked was funding for the plan. In other words, go find the money outside the House. Secondly, over the summer, Walsh and O'Keefe together poured over a change to NASA's 2004 operating plan. The proposal called for a release of $75 million from other NASA accounts, such as the terminated Space Launch Initiative and Next Generation Launch Technology programs, to the agency's new Exploration Systems Mission Directorate to fuel a batch of study contracts. Walsh would hardly have agreed to the move if the House truly opposed the space vision; rather, he gave his approval, yet another indication that opposition to the Bush initiative was not yet set into stone.

In the midst of the threats, the full House committee approved the cuts. O'Keefe now faced the prospect that NASA support in the House would not deliver anything into the eventual House-Senate budget negotiations that he could use as leverage. His strategy had been set at the beginning, assembled by NASA's head of legislative affairs D. Lee Forsgren and others: the House would likely vote for less than the $866 million plus-up requested by Bush, but the mark that the Senate would approve would be either the full amount or close to it. If that happened, then the resulting House-Senate conference committee might well endorse the larger of the numbers. O'Keefe's strategy was built upon favorable action in the Senate Appropriations Committee, headed for the final year by Senator Ted Stevens of Alaska. Stevens was O'Keefe's mentor

and later his boss when the NASA administrator was a Senate defense staffer. O'Keefe had kept his Senate fences mended through his climb to Navy Secretary, Pentagon budget guru, and now, in the George W. Bush administration, NASA chief. During the Republican convention in New York in late August, O'Keefe and Stevens were seen talking quietly several times at different receptions. More than politicking was going on: the final shape of NASA's Senate strategy was being drafted. And it would include not just Republicans like Stevens and Senate Appropriations Subcommittee for Veterans Affairs, Housing and Urban Development, and Independent Agencies Chair Senator Kit Bond of Missouri.

Here, one other element of the Bush space strategy played itself out. Many in the space community had been puzzled by the president's failure to mention his space plan during the campaign. Some believed that it was proof that Bush had second thoughts about the initiative, or had decided to quietly abandon it. In reality, however, the silence spoke volumes about Bush's careful and continued support for the vision plan. With a bipartisan coalition needed in the House and especially now the Senate, the White House gave orders that the space policy was not to be brought up during the campaign outside the space community. NASA had quietly worked with Maryland Democratic Senator Barbara Mikulski. When the space bill moved to the full Senate Appropriations Committee for a vote, Mikulski would add an "emergency" spending amendment for $800 million, mainly for the shuttle and for robotic servicing of the Hubble Space Telescope, a favorite program of the senator. And in late September when the appropriations committee acted, not only did Mikulski's amendment pass but it was co-sponsored by Louisiana's Landrieu.

Now the stage was set for the final act in the 2005 fiscal year budget drama: the votes of the House-Senate appropriations conference committee. The first iteration of the NASA budget legislation added more than $500 million for the agency but fell $300 million short of the Bush request. As the negotiations wound to conclusion, it appeared that $15.9 billion would be in the budget that conferees would approve and return to the two houses of Congress for passage. But, literally at the last minute, DeLay moved again to block what he called an unacceptable budget. DeLay gambled: it would be the entire Bush request of $16.2 billion or nothing. The conferees met again. In a surprise compromise, conferees exacted a "tax" on NASA and other discretionary accounts of 0.80 percent. The end result contained in the omnibus appropriations bill was to yield additional funds available for other spending priorities—including an additional $300 million for NASA's 2005 budget. O'Keefe's last-minute gambit of the summer—putting NASA's fate in the House-Senate conference committee—had worked, almost literally at the last minute. Garnering support for the shuttle and for reinventing NASA was considered a major victory. Democratic Senators John Breaux, Mary Landrieu, Barbara Mikulski, and Bill

Many in the space community had been puzzled by the president's failure to mention his space plan during the campaign. Some believed that it was proof that Bush had second thoughts about the initiative, or had decided to quietly abandon it. In reality, however, the silence spoke volumes about Bush's careful and continued support for the vision plan.

From left to right, NASA Administrator Sean O'Keefe, Vice President Dick Cheney, NASA Deputy Administrator Frederick Gregory, and David Addington, Counsel to the Vice President, discuss NASA's present and future projects. (Source: NASA/Bill Ingalls)

Nelson supported the final version of the bill, which funded NASA at $16.2 billion. Had Bush made the space plan a major issue during the presidential campaign, getting their support might well have proved difficult, if not impossible, given the political pressures of the time.

The conferees added one other element to the NASA bill: they gave the agency the unprecedented ability to move funds around without restraint. Such authority, contained in legislation, is rare for any agency, much less one with a troubled management history like NASA.

O'Keefe's Legacy

It will take successive American presidents—and members of future Congresses—to keep the evolution of the civil space program on track and the Moon, Mars, and beyond initiative on the right path to achievement. It is a task worthy of the best politicians, be they party leaders or the future residents of that E Street office that currently has a desk, models, an ejection seat—and a painting of a fighting sailing ship called the Constellation, its sails depicted as filled with the morning air. The painting inspired O'Keefe to make it the namesake of NASA's new project to build a vehicle to take humans beyond low Earth orbit. Now these artifacts mark O'Keefe's history as administrator and are headed for his new digs on the grounds of Louisiana State University in Baton Rouge.

For his part, O'Keefe was fond of saying in public that he served at the pleasure of the president, and as a result, "the public owes me nothing." It is a view he held in private as well, meaning, according to his own translation, that he had no illusions of length of service or personal expectations of his tenure. If his political masters in the White House or Congress had so decided, he could have literally been gone from that artifact-strewn office in an instant.

But as far as the public is concerned, he is at least wrong about his summation. The public does indeed owe him much. They owe much to him as well as to past, present, and future presidents and legislators, and to previous and future NASA administrators, for it is their imprint and character that will shape the civil space program for much of the first half of the twenty-first century. Their influence, strength or lack of leadership, and priorities will last long after they themselves have departed Washington.

Transformation, then, is not just a present-day political or bureaucratic fad. It literally will be the framework by which space policy implementation and its risks will be judged. O'Keefe's legacy includes the unexpected path from crafting a new space vision to making its down payment. How well his successor will pay the next installment is not yet clear. But what is of note is the remarkable coalition that yielded the NASA budget for 2005. And that is the untold space tale of calendar year 2004. ■

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***Frank Sietzen, Jr.*, is an author, lecturer, and writer on space affairs and communications strategy. The views expressed in this article are his own.**

Report on the AAS 51st National Conference
"Transformation and Vision for Space: NASA's Partnership with Industry and Government"

by Rick W. Sturdevant

The AAS National Conference and Fifty-First Annual Meeting at the Hilton Hotel in Pasadena, California, which occurred November 16-17, 2004, focused on what Charles Elachi, director of the Jet Propulsion Laboratory (JPL) and the National Aeronautics and Space Administrations's (NASA) agency-wide director of advanced planning, characterized in his welcoming remarks as an "exciting, new golden age in space exploration." Anyone questioning the validity of Elachi's assertion almost certainly became a true believer after listening to Cornell University astronomer Steven Squyres's enthusiastic Carl Sagan Memorial Award Lecture on the first morning. Professor Squyres, principal scientist on the Mars Exploration Rover team, captivated conferees with an awe-inspiring, detailed description of the Spirit and Opportunity rover adventures. He lauded the wealth of scientific data obtained from this particular mission and attributed its success to the outstanding partnership of project scientists and engineers.

Squyres received the Carl Sagan Memorial Award, which was funded by Orbital Sciences Corporation and presented jointly by AAS President Jonathan Malay and The Planetary Society President Wesley Huntress. During his acceptance speech, Squyres told the audience that his mentor, colleague, and friend Carl Sagan would have thought the Mars rover discoveries were "a hoot." Sagan was good at examining a complex problem with many parameters, Squyres remembered, and sorting out which ones were really important. Furthermore, he was always ready to have his analytical conclusions checked or changed based on new information of the sort supplied by the Mars rovers.

Session One continued the examination of scientific exploration of the solar system. JPL research scientist Gregory Wilson laid out plans for the scientific exploration of Mars with robotic platforms between now and 2020. Based on a "follow the water" strategy, further in-situ analysis will occur with the Mars Science Laboratory in 2009, followed perhaps by a Mars sample return mission in 2013. In addition to this robotic science track, President George W. Bush's vision for space exploration endorses a new exploratory track involving Mars test beds to develop the technology required for human missions.

Turning to exploration of the outer planets, JPL's Robert Mitchell updated attendees on the progress of the Cassini mission to Saturn from its launch on October 15, 1997, through its arrival at Saturn on July 1, 2004, and the ninety-six-minute burn for orbital insertion. The "most exciting" prospects for discovery lay immediately ahead, Mitchell explained, because the Huygens probe would explore Saturn's moon Titan, the only moon in the solar system known to have an atmosphere. Anticipating separation of the probe from Cassini around Christmas Day 2004 and entry into Titan's atmosphere on January 14, 2005, he hoped Huygens would shed more light on the moon's apparently liquid, hydrocarbon surface features. Noting that other conference sessions would focus on outreach and that the vast majority of people learn about space exploration from the on the internet, Mitchell closed by referring everyone to saturn.jpl.nasa.gov for more information about Cassini-Huygens.

Luncheon speaker Al Diaz, NASA associate administrator for science, explained how NASA is changing fundamentally without diminishing the quality of its scientific exploration. He described

AAS President Jon Malay addresses conference attendees. The event was held at the Hilton Hotel in Pasadena, California. (Source: AAS)

the situation as analogous to being in an unbelievably huge shopping center, where one needs a map to navigate efficiently. Based on the Aldridge Commission's June 2004 recommendations, NASA will develop new strategic roadmaps to guide investment decisions and priorities in time for its fiscal year 2007 budget request. In parallel, technology or capability roadmaps will point the way toward technical or programmatic solutions. Although Earth and space sciences developed somewhat independently, their accommodation within NASA's new Science Mission Directorate signals a comprehensive set of investigations into the origin, evolution, and destiny of our Earth, solar system, and universe. Diaz asserted that an equally comprehensive outreach program to educate the general public and recruit "human capital" is necessary for NASA's successful transformation.

Those remarks set the stage for Session Two on Tuesday afternoon, which focused on education. Bernice Alston, NASA deputy chief education officer, opened the session by emphasizing that because education produces the people who will replace today's graying workforce, it is a core NASA mission. Quoting NASA Administrator Sean O'Keefe, she said, "The greatest mission the agency has ever accepted is to open the mind of a child to unimagined possibilities." Alston outlined some of NASA's key educational endeavors, which can be reviewed online at education.nasa.gov/home/index.html.

Also during the session, two young professionals, Miguel Román and Carissa Tudryn, related how NASA-sponsored educational opportunities benefited them and how they, in turn, contributed to engaging and inspiring other students to pursue space-related careers. Among other things, Román developed educational models for teaching middle school students the wonders of space-based remote sensing. Tudryn devised a "customer engagement architecture" that includes educational activities unique to various age groups to involve everyone in planning for Mars exploration. This session assured listeners that the future of space exploration will be in competent hands as long as the "education pipeline" siphons in a sufficient number of highly motivated, intellectually astute youngsters.

Steven Squyres, principal investigator for the Mars Exploration Rovers and recipient of the Carl Sagan Memorial Award, stands in front of one of the rovers prior to its launch. (Source: NASA/Jet Propulsion Laboratory)

Session Three, which focused on public engagement, created a thought-provoking forum with extensive audience participation. Defining public engagement as "something that is proactive and aimed both intellectually and emotionally," moderator Blaine Baggett, executive manager of JPL's Office of Communications and Education, assembled a distinguished panel: Neal Burns, director of the Center for Brand Research at the University of Texas, Austin; Greg Hayes, director of external relations at Johnson Space Center (JSC); Steven Squyres from Cornell; and Dan McClain, communications director for Northrop Grumman. Asserting that NASA needs a strong, meaningful "brand" to overcome the present "fractured, unattended level of customer engagement," Burns emphasized that NASA must find a better way to "deliver through plans, programs, and in every intersection with its various constituencies the quintessential experience of commitment to the American people and the transformation of our world into a better place." The agency must build "product relevance" and translate that into "personal relevance" for American citizens. NASA's message must be derived from its business strategy, not its communication strategy, and must be consistent in delivery if the agency hopes to achieve "brand" recognition.

The other three panelists added to Burns's commentary from different perspectives. Coming from inside NASA, Hayes declared the agency still operates under the notion that "if we build it, they will come." He believes NASA is beginning to understand the great gap between communication, which is intellectual, and engagement, which is emotional, and this represents an important step toward building "sustainable interest" among the American people in what the agency is doing. Speaking as a contractor, McClain found marketing value in the integration of individual contractor and NASA messages under a single brand, but he acknowledged that competition among con-

tractors sometimes precludes delivery of NASA's message. Squyres cautioned that since dealing with the media is at the heart of public engagement, NASA spokespersons should help media representatives do their jobs by crafting messages to suit a particular medium, be it television, newsprint, or something else. Nearly an hour of stimulating interaction among the panelists and fellow conferees followed, with widespread agreement at the end that appealing to curiosity might be fundamental to recruitment of supporters and a future workforce. Anyone interested in learning more about the concept of "branding" will find a plethora of websites but could start with www.allaboutbranding.com.

At the awards banquet, acclaimed science fiction writer Larry Niven contemplated the probability of "death by meteorite impact" and the consequent need for planetary defense. We need to develop and test a viable spacecraft to meet the asteroid threat, he argued. While conferees heard during the third session that appeals to curiosity best cultivate public support for space adventures, Niven thought educating the public to fear the possibility of a catastrophic impact might be a better way to promote widespread support for demonstration of an "asteroid pusher." Such a craft would change an asteroid's orbit incrementally over several years, thereby preventing its collision with Earth. In addition to gaining popular support by "scaring the livers" out of people, Niven contended that no operable "asteroid pusher" could be built without "controlling the parasites" – the people involved in the project who would be inclined to add superfluous requirements to the spacecraft and thereby drive up the cost and extend the development schedule. To overcome the latter problem, he suggested a return to the early X-plane concept of building quickly and cheaply before "parasites" have an opportunity to "infect" the project.

Following Niven's speech, AAS President Jonathan Malay announced the 2004 award recipients. The Lifetime Achievement Award, which is presented only once each decade, went to E.C. "Pete" Aldridge, Jr., for his many distinguished contributions to astronautics. Harold W. "Hal" Gehman, Jr., chairman of the Columbia Accident Investigation Board, received the Space Flight Award. Colonel Yang Liwei earned the Flight Achievement Award for becoming the first person in China's human space flight program to orbit Earth. For his leadership in bringing the Ansari X Prize competition to a successful conclusion, Peter H. Diamandis received the Lloyd V. Berkner Award. John E. Naugle won the W. Randolph Lovelace II Award for his contributions to particles and fields research, and Rand H. Fisher took the Military Astronautics Award for his influential work in satellite reconnaissance and communications. The Dirk Brouwer Award went to Kathleen C. Howell for her outstanding scholarship, teaching, and service in the astronautics profession. For her advocacy of the exploration and utilization of outer space, Lori B. Garver proudly accepted the John F. Kennedy Astronautics Award. Sir Martin Sweeting, small satellite developer and director of Surrey Space Center, merited the Industrial Leadership Award. Robert Zimmerman, author of *Leaving Earth: Space Stations, Rival Superpowers, and the Quest for Interplanetary Travel*, won the Eugene M. Emme Astronautical Literature Award for 2003. To conclude the evening's festivities, a dozen new AAS Fellows were recognized: Paul J. Cefola, Eileen Collins, Charles Elachi, Peggy Finarelli, Frederick (Rick) Hauck, John Klineberg, Arun K. Misra, Roald Sagdeev, Malcolm D. Shuster, W. David Thompson, Charles Walker, and James Zimmerman.

AAS award winners pose with their trophies and plaques. From left to right: Rear Admiral Rand Fisher, U.S. Navy (retired); AAS President Jon Malay; Lori Garver, DFI International; Steven Squyres, Cornell University; and Robert Zimmerman, author. (Source: AAS)

On the second morning, attention turned in Session Four to the status of human space exploration. John Casper from JSC shared personal thoughts about the importance of the shuttle's return to flight. In some respects, he remarked, the technical challenges have been eclipsed by the emotional and psychological challenges. Casper covered the evolving return-to-flight implementation plan and explained how the Stafford-Covey Task Group independently oversees planning progress. When the shuttle returns to flight, hopefully around mid-May 2005, its primary mission will be completion

AAS welcomed a dozen new fellows at the November meeting. AAS President Jon Malay (left) stands with the following new fellows, from left to right: James Zimmerman, International Space Services; John Klineberg, retired; Peggy Finarelli, International Space University; Charles Walker, The Boeing Company; Paul Cefola, Massachusetts Institute of Technology; and Frederick (Rick) Hauck, AXA Space. (Source: AAS)

of the International Space Station (ISS). Next, outlining ISS status and future plans, JSC's Kathy Laurini described how grounding of the shuttle fleet following the loss of Columbia compelled NASA to reassess the risks associated with all potential ISS-related hazards. Determining that a crew of three could not be sustained based on the ability to deliver consumables such as water, food, propellants, and oxygen, the team dropped ISS staffing to two. Despite earlier concerns, the ISS environment remains good, and the crew has been able to conduct low-mass types of science experiments. When shuttle return to flight occurs, the focus will be on assembly of the truss structure and installation of solar arrays, followed by completion of the U.S. core configuration and repositioning of the truss in preparation for various international modules. By early 2009, the ISS should be complete and fully capable of serving as a test bed for exploration hardware and processes.

The fourth session continued with presentations by JPL's Michael Sander on the Crew Exploration Vehicle (CEV) and Beverly Cook on the Prometheus/Jupiter Icy Moons Orbiter (JIMO). With the renewed spirit of discovery expressed by President Bush in his January 2004 vision for a sustainable, affordable human presence across the solar system, development of a technologically innovative vehicle to take people beyond low Earth orbit has become essential. Sander explained that the CEV concept and architecture is still unfolding and is now in the requirements definition stage. According to the current schedule, initial flight testing will occur in 2008 with the first crewed flight in 2014. A system-of-systems conceptual approach that integrates the human element from the beginning and a crisply defined strategy-to-task-to-technology process involving "spiral development" of systems should foster sufficiently rigorous management oversight to take advantage of lessons learned and, thereby, avoid repetition of costly mistakes. Next, Cook described how Project Prometheus, a test bed for key solar system exploration technologies, hinges on successful employment of a long-term, highly reliable nuclear-electric power source for spacecraft maneuvering, payload operation, and communication. For more information about Project Prometheus and JIMO, see www.jpl.nasa.gov/jimo/index.cfm.

Wednesday's luncheon speaker, Richard Malow, consultant and distinguished advisor to the Association of Universities for Research in Astronomy, addressed the politics of space policy. He identified a variety of politics—partisan, internal NASA, contractor, science, safety, budget, and international—relevant to space exploration and warned that we must ensure these all move in the same positive direction for human space flight to survive and prosper. Malow believes the human space flight program has less sense of direction that at any other time in history but can garner the support it needs by setting a realistic, exciting goal.

Presentations ended with Session Five on transforming the model for industry-government partnerships, which could be crucial to realization of President Bush's vision for space exploration. Articulating the government perspective, JPL Deputy Director Eugene Tattini predicted greater success if people in the civil, commercial, and military arenas all learn to trust one another. From an industry viewpoint, Boeing officials Chuck Allen and Jack Chenevey used the "acquisition success story" of the F/A-18E/F aircraft to make the point that "leadership, leadership, leadership" ensured "doing what was right" to achieve the necessary alignment of the requirements, statement of work, and funding. Furthermore, they emphasized that "communication, communication, communication" fostered trust and mutual respect among members of the government-industry team—an encouraging conclusion to the national conference. ■

Dr. Rick W. Sturdevant **is deputy command historian for Air Force Space Command in Colorado Springs, Colorado.**

Presentations from the conference are available on the AAS web site at www.astronautical.org .

AAS Strategic Plan Approved by the Board of Directors

Last year marked the fiftieth anniversary of the American Astronautical Society. When we were established to promote astronautics in 1954, Sputnik had not yet flown and NASA did not exist. In its first fifty years, the AAS played a vital role in the birth and development of our profession. If we are to play a vital role in the next fifty years, the AAS must be relevant to the opportunities and challenges of a changing world that today includes a new U.S. vision for space exploration, increasingly advanced systems and technologies, growing international interdependence, Mars discoveries, corporate consolidations, new space powers, an expanding commercial space sector, and an X Prize winner.

Your board of directors commissioned the development of an AAS strategy to launch our journey into the next fifty years. A team of Peggy Finarelli, Ian Pryke, and Lyn Wigbels, headed by AAS Executive Vice President Mark Craig, was chartered to develop a strategic plan that is compelling, succinct, and actionable. The plan, approved by the board in November, took almost a year to complete with member, officer, and board involvement. This plan is a beginning. It will be modified over time to reflect our response to emerging opportunities and challenges in a continually changing world.

The AAS Strategic Plan

Vision

AAS – the *premier* network of professionals dedicated to advancing all space activities.

Mission

AAS harnesses the intellectual energies and diverse capabilities of its membership, both technical and non-technical, to:

- Strengthen the space community,
- Influence the development of space policy,
- Promote international dialogue on space activities, and
- Inspire students to undertake space-related careers while serving the professional needs and interests of its members, both individual and corporate.

Goals and Objectives

1. Enhance the robustness of the space community by broadening the capabilities of its members.
   - 1.1. Increase the relevance and quality of AAS products (seminars, workshops, conferences, publications, etc.) in order to:
     - 1.1.1. Provide increased opportunities for the development of individual professional capabilities,
     - 1.1.2. Improve information flow within the community, and
     - 1.1.3. Promote informed discussion of space-related issues.
   - 1.2. Encourage space professionals to look at issues from an interdisciplinary perspective.
   - 1.3. Help space professionals understand the broader context in which space activities take place and use that understanding to make space activities more relevant to society.
   - 1.4. Continually look for new ways to serve the broader space community.

2. Play a more influential role in the development of space policy.
   2.1. Increase the Society's impact on the space policy-making process by making AAS a "go-to" organization for policy makers.
   2.2. Hold seminars, workshops, and conference sessions on key policy issues.
   2.3. Develop position papers on significant topical issues and ensure their most effective distribution.
   2.4. Undertake longer-term policy studies that could contribute to ongoing policy debate.
3. Increase our role in facilitating international understanding and cooperation in space activities.
   3.1. Continue to conduct seminars providing information exchange about space activities and policies worldwide.
   3.2. Continue to conduct workshops facilitating dialogue on international collaboration and providing opportunities for international networking.
   3.3. Continue to participate in international conferences.
   3.4. Increase international participation in the Society's technical workshops.
   3.5. Continue and expand partnerships with non-U.S. professional societies to broaden the Society's reach overseas.
4. Increase the Society's efforts to enhance the appeal of space as a career field.
   4.1. Reach out to educators at all levels to encourage and facilitate their use of space materials in the classroom.
   4.2. Reach out to students at all levels to enhance understanding of and involvement in space and space careers.
   4.3. Seek opportunities for members to serve as role models for students.
   4.4. Involve more members in education-related public service activities.
5. Improve the service we provide for our members.
   5.1. Improve dialogue with individual and corporate members to better understand their needs.
   5.2. Tailor programs to provide clearly identifiable benefits to corporate members.
   5.3. Enhance networking opportunities for all Society members.
   5.4. Enhance opportunities for individual members to become more involved and take advantage of the membership.
6. Improve stewardship of the Society.
   6.1. Enhance recognition of AAS in the space community.
   6.2. Increase corporate, individual, and student membership.
   6.3. Strengthen the financial status of the Society.
   6.4. Ensure that planning, plan implementation, and budgeting are integrated and managed with a clear process.
   6.5. Develop strategic partnerships with other organizations that facilitate the achievement of the Society's goals and objectives.
   6.6. Ensure the highest quality of officers, board members, fellows, and awardees.

Plans are meaningless if they are not implemented. To ensure strategy implementation, the team also produced a responsibility and timeline template. At the beginning of each year, an officer will be assigned to lead development of a plan for implementing each goal, including metrics to measure progress. These goal plans will be the basis for action, and the metrics will be the basis for progress review at all executive committee and board meetings. ■

What is AAS?

In the many discussions and deliberations involved in developing the plan, certain concepts emerged that the team saw as clearly and simply stating what the AAS is, what it hopes to do, and how it can be differentiated from other organizations:

"AAS - ***A***dvancing ***A***ll ***S***pace"

AAS - America's network of space professionals:
- Network, not just an organization.
- Space professionals, technical and non-technical.

Dedicated to advancing all space activities:
- Dedicated solely to space.
- Dedicated to helping the *people*, the *profession*, and the *enterprise* flourish.
- Dedicated to harnessing the energy and capability of our members to make a difference.

American Astronautical Society

For program updates and on-line registration, visit www.astronautical.org

AAS 43rd Robert H. Goddard Memorial Symposium

"Earth and Space Science: Exploring the Possibilities"

March 29-30, 2005
Greenbelt Marriott Hotel, Greenbelt, Maryland

TUESDAY, MARCH 29, 2005

7:30 **Registration / Continental Breakfast**

9:00 **Welcome and Introduction**
Jon Malay, AAS President, Lockheed Martin

Introduction of Keynote Speaker
Edward Weiler, Director,
NASA Goddard Space Flight Center (GSFC)

9:15 **Keynote Address**
Science and Exploration
James Garvin, NASA Chief Scientist

10:00 **Break**

10:15 **Session 1: Science Planning, Implementation, Education & Public Outreach – The Big Picture**
Moderator: James Garvin, NASA Chief Scientist
Science Mission Directorate Overview
Al Diaz, NASA Headquarters
Role of Science in NASA Strategic Planning
Mary Kicza, NASA Headquarters (invited)
Education and Public Outreach
Adena Loston, NASA Headquarters

12:00 **Luncheon** – Speaker: Senator Barbara Mikulski (invited)

1:30 **Session 2: Solar System – The Neighboring Worlds**
Moderators: Andrew Dantzler, NASA Headquarters and
Richard Vondrak, NASA GSFC
Lunar Exploration Program
James Watzin, NASA GSFC
Mars Exploration Program
Douglas McCuistion, NASA Headquarters
Cassini Science Results
Michael Flasar, NASA GSFC and
Hasso Niemann, NASA GSFC (invited)
Deep Impact
Michael A'Hearn, University of Maryland

3:00 **Break**

3:45 **Session 3: Technology – The Key to Enabling Science**
Moderator: Peter Hughes, NASA GSFC
Sensor Webs - Enabling Exploration and Opportunistic Science Measurements
Stephen Talabac, NASA GSFC
Large Telescope and Observatory Technologies
Lee Feinberg, NASA GSFC
Applied Nanotechnology: Small Technology for Science
Daniel Powell, NASA GSFC (invited)
Optical Communications
Richard Fitzgerald, NASA GSFC (invited)
NASA's "Project Columbia": Supercomputing Resources for NASA Scientists
Nagi Mansour, NASA Ames Research Center (invited)

5:30 **Reception**

WEDNESDAY, MARCH 30, 2005

7:30 **Registration / Continental Breakfast**

9:00 **Opening Remarks and Award Presentation**
Conrad Lautenbacher, NOAA Administrator

9:45 **Break**

10:00 **Session 4: Earth-Sun System – Science Starts at Home**
Moderator: Mary Cleave, NASA Headquarters
Meteorology from Space
: Marshall Shepherd, NASA GSFC (invited)
Climate Change
George Withbroe, George Mason University and
Berrian Moore, University of New Hampshire (invited)
Sun-Solar System Connection and Characterization of the Exploration Environment:
Richard Fisher, NASA Headquarters (invited)
Research to Operations in NASA/NOAA Programs
Colleen Hartman, NOAA (invited)

12:00 **Luncheon and Awards –** Speaker: E.C. "Pete" Aldridge, Jr.

1:30 **Session 5: Universe – Solving the Great Mysteries**
Moderator: Anne Kinney, NASA Headquarters
HST
Frank Ceppolina, NASA GSFC (invited)
James Webb Space Telescope
John Mather, NASA GSFC (invited)
Beyond Einstein
Nicholas White, NASA GSFC (invited)
Space Interferometers
Charles Beichman, Jet Propulsion Laboratory and
William Danchi, NASA GSFC (invited)

3:30 **Break**

3:45 **Session 6: Student Session with NASA and Industry Career Panelists – Passing the Torch**
Moderator: Vigdor Teplitz, NASA GSFC

5:30 **Adjourn**

America's Newest Rocket

Despite an imperfect maiden voyage, Boeing's Delta 4 Heavy promises to support U.S. launch needs for many years ahead.

by Anthony Young

The successful launch and demonstration flight of The Boeing Company's Delta 4 Heavy on December 21, 2004, adds an exciting new chapter to the history of American space flight. While not hitting all of the performance goals set for it on this first launch, it was still a very impressive show for a brand new and complex rocket. Conceived and built for the U.S. Air Force as part of its Evolved Expendable Launch Vehicle program with an eye toward commercial launch capability, it not only gives the Pentagon heavy-lifting capability for its satellites and other hardware to replace the aging Titan 4 but also gives hope to NASA's Exploration Systems Mission Directorate.

This Delta 4 Heavy lifts off on its inaugural flight on December 21, 2004. (Source: The Boeing Company)

When President Bush announced the new vision for space exploration in January 2004 at NASA headquarters, he stated that the space shuttle would return to flight but would be phased out after obligations to complete the International Space Station were fulfilled. At the same time, he announced the need for a Crew Exploration Vehicle (CEV) capable of taking astronauts not only back to the Moon but also on to Mars. The first "boilerplate" CEV would be launched in 2008, more capable but uncrewed flights would follow three years later, and crewed, operational capability flights would begin around 2014. The CEV would, of course, need a launch vehicle.

> Launching future astronauts aboard the CEV using the Delta 4 or Delta 4 Heavy would appear to be a viable option.

The only two existing U.S. launch vehicles with adequate capacity to do the job are the Delta 4 and the Atlas 5. The Lockheed Atlas 5 is a single core booster with strap-on solid rocket motors available, but the Delta 4 Heavy has three Common Booster Cores (CBC) and resembles the Titan 4, if only in appearance. It is a cutting-edge technology launch vehicle and features the first new American rocket engine in twenty-five years: the RS-68 built by Rocketdyne. Powered by liquid hydrogen and oxygen, it generates 2,949 kilonewtons of thrust. (One kilonewton equals 225 pounds of force.) The Delta 4 Heavy generates over 8,800 kilonewtons of thrust at liftoff, considerably more than the 6,600 kilonewtons of thrust of America's last human-rated expendable launch vehicle, the Saturn 1B.

America has an illustrious history of launching astronauts aboard rockets designed for the military. Alan Shepard was launched atop a Redstone rocket for his suborbital flight. All subsequent Mercury flights were aboard the Atlas. Project Gemini successfully employed the Air Force's Titan. Launching future astronauts aboard the CEV using the Delta 4 or Delta 4 Heavy would appear to be a viable option. And the Delta 4 Heavy has the power to get the job done. It is capable of boosting nearly 22,000 kilograms to low earth orbit – a few thousand kilograms shy of the space shuttle's cargo capacity. It is also capable of sending 9,956 kilograms to a translunar injection. Finally, it can send 8,005 kilograms to Mars. These numbers look really good to NASA.

"The biggest help we're being at this point," says Dan Collins, Boeing vice president for expendable launch systems, "is by providing [NASA] information about the system, what its growth possibilities are, where its limitations are, so that they have the best set of data to match up with planning an overall exploration program."

The Delta 4 Heavy's capabilities do not end there. Boeing literature reveals versions with five CBCs and even seven CBCs. The company has a concept for a larger, uniquely configured

Russian Spacesuits

Reviewed by Mark Williamson

Russian Spacesuits, Isaak P. Abramov and A. Ingemar Skoog. London: Springer Praxis, 2003. 366 pages. ISBN: 1-8523-3732-X. $39.95 (paperback).

There was a time, not long ago in historical terms, when information on Russian space technology poured out of the Soviet Union like blood from the proverbial stone. In recent years, however, it seems that the floodgates have opened, and now even the minutiae of the Russian space program are in the public domain. Isaak P. Abramov and A. Ingemar Skoog's *Russian Spacesuits* is a part of that flow.

The authors have been involved with the Soviet/Russian spacesuit manufacturer Zvezda since 1959, when suit development began for Yuri Gagarin's 1961 mission, and it would be difficult to find anyone better qualified to tell this story. The book is intended as a documentary history of spacesuit development, covering the suits designed for all phases of the Russian program. In fact, this history comes right up to date, as Zvezda's Orlan suits are in use today on the International Space Station.

Although the history of spacesuit design is almost as long as the Space Age itself, it is interesting to note that the first publication on the design and use of Soviet spacesuits did not appear in the Soviet Union itself until 1970. The lack of early documentation, coupled with the inherent secrecy of the Cold War era, made things difficult for the authors but does not mean the book lacks technical detail. Considering the book covers a subject about which little was known in the West just a decade ago, it features a wealth of photos, diagrams, and charts detailing this rather specialized subject.

One interesting aspect of the book is a chapter on a program for which spacesuits were never used: the L-3 Moon program. The chapter relates some of the technical arguments—similar to ones that took place in the West—that went on among proponents of soft, rigid, and semi-rigid suits. Although Soviet suits never made it to the Moon, the development effort was not wasted, as later versions were used on Mir and the International Space Station.

The number of suits and their variations—not to mention their names—could cause confusion, but the authors have thoughtfully provided an appendix giving a page of technical details and a photograph for each of some thirty different suits. For the serious student, there is also a bibliography, an index, and a tabular summary showing which suits were used on which missions and for how long.

The text is not without its relief from technicalities and includes a good deal of the industrial and political background behind the spacesuit developments. For example, the decision to paint "CCCP" ("USSR") on Gagarin's helmet was apparently made at the launch site after the cosmonaut had already donned his spacesuit! According to the authors, the last-minute decision addressed the concern that a farmer out in the Russian steppe might not be able to distinguish a returned but unconscious cosmonaut from an American spy-plane pilot. That concern was real in the 1960s: Gary Powers's U-2 had been shot down over Soviet territory the year before Gagarin's flight.

The end of the Cold War had many benefits, and one of them is the opportunity to learn about the Soviet space program. The book is a valuable addition to that relatively newfound freedom. ■

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booster with thrust to match that of the Apollo Saturn 5; it could conceivably be launched from Complex 39 – home of the space shuttle launch pads – at Kennedy Space Center.

Using existing launch vehicles like the Delta 4 Heavy would save NASA years of proprietary design engineering and development. With limited funds to achieve the new vision for space exploration, NASA is no doubt seriously considering this option. The future of the Delta 4 Heavy is bright and will provide the United States with needed launch capability for decades to come. ■

***Anthony Young* has published nine books covering transportation history. He is a regular contributor to the online weekly, *The Space Review* (www.thespacereview.com).**

UPCOMING EVENTS

AAS Meeting Schedule

March 29–30, 2005
43rd Goddard Memorial Symposium
"Earth and Space Science: Exploring the Possibilities"
Greenbelt Marriott Hotel
Greenbelt, Maryland
www.astronautical.org
See page 21 for details!

June 2–4, 2005
***Student CanSat Competition**
Plaster City, California
www.cansatcompetition.com

August 7–11, 2005
***AAS/AIAA Astrodynamics Specialist Conference**
Embassy Suites Resort
Lake Tahoe, California
www.space-flight.org

November 15–16, 2005
AAS National Conference and 52nd Annual Meeting
South Shore Harbour Resort
Houston, Texas
www.astronautical.org

February 4-8, 2006
29th Rocky Mountain Guidance and Control Conference
Beaver Run Resort and Conference Center
Breckenridge, Colorado
www.aas-rocky-mountain-section.org

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