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PROFILE/22>

GARY PAYTON

DEPUTY UNDERSECRETARY FOR SPACE PROGRAMS
U.S. AIR FORCE



President's Revised NASA Plan Makes Room for Reworked Orion

AMY KLAMPER, COLORADO SPRINGS, Colo.

U.S. President Barack Obama's revised space plan keeps Lockheed Martin working on a lifeboat version of a NASA crew capsule previously slated for cancellation, potentially positioning the craft to fly astronauts to the international space station and possibly beyond Earth orbit on technology demonstration jaunts the president envisions happening in the early 2020s.

Between pledging to choose a heavy-lift rocket design by 2015 and directing NASA and Denver-based Lockheed Martin Space Systems to produce a stripped-down version of the Orion crew capsule that would launch unmanned to the space station by around 2013 to carry astronauts home in an emergency, the White House hopes to address some of the chief complaints about the plan it unveiled in February to abandon Orion along with the rest of NASA's Moon-bound Constellation program.

"There are ... those who criticized our decision to end parts of Constellation as one that will hinder space exploration beyond low Earth orbit," Obama said in a much-anticipated April 15 speech at NASA's Kennedy Space Center in Florida. "It's precisely by investing in groundbreaking research and innovative companies that we will have the potential to rapidly transform our capabilities, even as we build on the important work already completed through projects like Orion, for future missions. And unlike the previous program, we are setting a course with specific and achievable milestones."

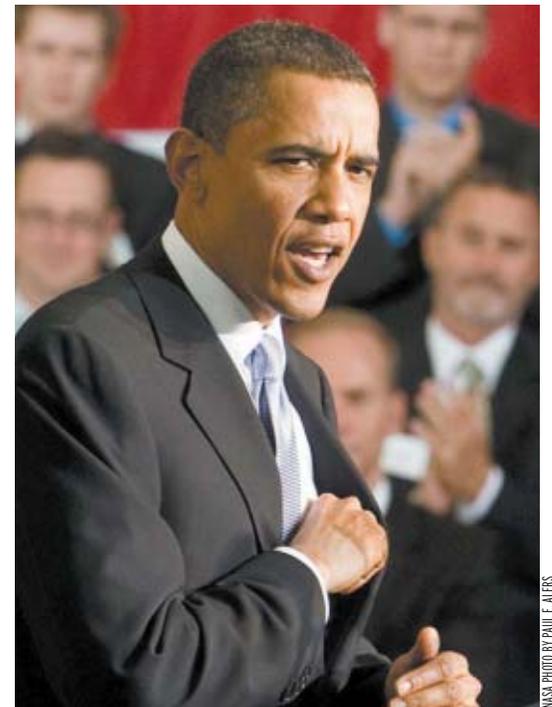
But while Obama said the effort to build a smaller Orion would form the "technological foundation for advanced spacecraft to be used in future deep space missions," he offered few details beyond pledging to commit NASA to undertake "a set of crewed flights" in the early 2020s to "test and prove the systems required for exploration beyond low Earth orbit."

Whether the White House envisions that job ultimately falling to a variant of Orion or some other vehicle was not clear.

"It's crew escape today, and preserving a foundation for the future in the future," White House spokesman Nicholas Shapiro said April 15, adding that the nearly \$6 billion Obama is proposing to help foster development of commercial space taxis over the next five years would not be used to fund such a capability. "It's not being funded to compete with commercial," Shapiro said.

A senior NASA official said Obama's plan could mesh well with a recent Lockheed Martin proposal to restructure the Orion contract as an incremental development program in order to get by with less money in the near term.

"We see significant potential merit to the Lockheed Martin proposal to develop a Block 0 version of



U.S. President Barack Obama

Orion, because it offers the possibility of dealing with a large 2010 funding shortfall without widening the U.S. human spaceflight gap following the cancellation of the space shuttle," a senior NASA official said April 13.

John Stevens, director of strategic development for Lockheed Martin's human spaceflight business, said under the proposed restructuring, the company would develop variants of the crew capsule in a series of increments beginning with Block 0, which would include flight tests of a stripped-down capsule in 2013 and 2014. Block 1 would follow in 2015 and 2016 with crewed demonstration flights to the space station and potentially an Apollo 8-style mission to orbit the Moon. Block 2, Stevens said, would be able to conduct longer-duration missions well beyond low Earth orbit starting in 2017 and 2018.

"The notion here is that initially you spend days in orbit and then you spend weeks in orbit and you extend that to months in orbit," Stevens told *Space News* April 12. "We're actually looking at Block 2 to go on near-Earth object missions or a mission to L2 [the second Lagrange point] ... that would be six months' duration. We can actually handle those in 2017 or 2018."

Under the timeline Obama outlined in his speech

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NEWS BRIEFS

MDA Plan Entails Prototype Missile-tracking Satellite

The U.S. Missile Defense Agency (MDA) on April 13 unveiled its long-awaited acquisition strategy for a constellation of missile-tracking satellites, which includes the development and launch of a prototype system in 2015 prior to beginning work on as many as a dozen operational satellites.

The MDA for years has been interested in the so-called birth-to-death tracking of ballistic missiles from space. Last year the agency launched three demonstration satellites — one classified and two unclassified — under a program called the Space Tracking and Surveillance System. The unclassified satellites are going through on-orbit check-out activities and have yet to observe a ballistic missile flight test.

For the new Precision Tracking Space System (PTSS) announced by the agency in 2009, the MDA will rely on the Johns Hopkins University Applied Physics Laboratory of Laurel, Md., to lead a prototyping effort, according to a posting on the Federal Business Opportunities Web site. As many as five industry teams will be chosen in 2011 to provide input for the design of the system. Other opportunities may exist to provide hardware for the PTSS prototype, the posting said.

A single contractor will be chosen in 2014 to build between nine and 12 operational PTSS satellites and ground-segment software for integrating the satellites into the national ballistic missile defense architecture, the posting said. Production will not begin until after the prototype is launched and demonstrated on orbit.

Unlike the Space Tracking and Surveillance System that operates in low Earth orbit, each PTSS spacecraft will stare continuously at one region from a position along the geostationary belt, Army Lt. Gen. Patrick O'Reilly, the MDA's director, told lawmakers during an April 15 hearing. The MDA has requested \$67 million for PTSS in 2011.

Ball Aerospace Tapped for Naval Oceanography Satellite

Ball Aerospace & Technologies Corp. was awarded a U.S. Navy contract that could be worth as much as \$500 million if the service opts to proceed with construction of a new ocean-altimetry satellite, according to an April 14 Defense Department announcement.

Boulder, Colo.-based Ball Aerospace received a \$5.5 million contract from the Naval Space and Naval Warfare Systems Command to design a satellite dubbed Geosat Follow-On (GFO)-2 that will measure ocean height and thermal properties. Ball built and launched the first GFO satellite at a cost of \$85 million. The satellite operated from 1998 to 2008.

The firm's design work is expected to be completed in November, the press release said. If all options are exercised, the contract to build GFO-2 would be worth \$499.6 million through 2019. The satellite would launch in January 2014 either on a commercially procured or government-provided launch vehicle, and have a six-year design life, Ball spokeswoman Roz Brown said. The radio altimeter instrument would

be provided by Thales Alenia Space of France; the water vapor radiometer would be supplied by ITT Electronic Systems of Clifton, N.J.; and the GPS precision receiver would be provided by Broad Reach Engineering of Golden, Colo., Brown said.

Meanwhile, the Navy said last year it has worked out a deal with NASA and the French space agency, CNES, to use data from their two jointly operated oceanography satellites, Jason 1 and Jason 2, until GFO-2 is operational. The stopgap capability is a downgrade from what the first GFO satellite provided, but is good enough for now, the Navy said.

No Luck in the Final Attempt To Raise Silent Mars Lander

NASA detected no signals during a third and final attempt to listen for any signs that the Mars Phoenix Lander survived the long winter that brought its five-month mission to an end in late 2008, U.S. space agency officials said the week of April 12.

Phoenix landed on Mars on May 25, 2008 and operated two months longer than its planned three-month mission, which confirmed the presence of water ice under the martian surface. But once the sun and temperatures dropped and winter set in, the spacecraft did not have enough power to keep operating. The lander went silent in November 2008.

Phoenix was not designed to withstand the extremely low temperatures and icy conditions of the martian arctic winter. But in the unlikely event that the lander's components survived and the spacecraft received enough energy from the rising spring sun, mission managers planned on listening for any signals that Phoenix was waking itself up.

Two attempts at listening were conducted by NASA's Mars Odyssey orbiter in January and February, neither of which turned up any signals. The latest listening attempt was made the week of April 5.

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CORRECTION

The story "NASA Plans to Refuel Mock Satellite at the Space Station" [April 5, page 12] should have said geosynchronous orbit is approximately 36,000 kilometers above the Earth.

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STROBE/APPRETTY IMAGES

GSLV-D3

ISRO's Cryogenic Stage Fails in Maiden Flight

India's space program suffered a major setback April 15 when the maiden flight of a satellite launcher outfitted with the nation's first home-built cryogenic upper stage veered off course, sending its payload — the experimental GSAT-4 communications satellite — into the sea.

The Geostationary Satellite Launch Vehicle (GSLV) lifted off at 4:27 p.m. local time from the Satish Dhawan Space Centre on India's southeastern coast and reached an altitude of 65 kilometers before plunging downward. Telemetry was lost about 8 minutes into the flight that was expected to last 20 minutes until payload separation.

Indian Space Research Organisation (ISRO) Chairman K. Radhakrishnan said in a televised statement that the first two stages performed well and that the rocket's cryogenic third stage also might have fired, but that the launch was done in by a failure of the upper stage's two vernier control motors to ignite. However, at a subsequent press conference, Radhakrishnan said it was not certain that the rocket's upper-stage engine fired during the ill-fated flight.

"A detailed failure analysis will be carried out," Radhakrishnan said. "We will put all efforts to ensure that the next flight with the indigenous cryogenic engine takes place within a year."

ISRO has spent 3.36 billion rupees (\$76 million) over the last 17 years developing a domestic alternative to the Russian-built cryogenic upper stage used on the GSLV's five flights since 2001.

ISRO began its program to develop and build its own cryogenic engine in 1993 after Russia — under pressure from Washington — refused to transfer the technology.

The April 15 launch failure is likely to impact the proposed 2012 launch of the Chandrayaan-2 lunar orbiter mission and planned communications satellite launches.

The cryogenic stage was built at ISRO's Liquid Propulsion Systems Centre in the southern state of Tamil Nadu. Nambi Narayanan, a former head of the center who was involved in the development of the cryogenic engine, told *Space News* that the likely cause of failure is an explosion that can occur during a so-called hard start when a rich mixture of fuel and oxidizer is suddenly ignited in the vacuum of space. While the cryogenic engine had been extensively tested and reviewed by experts within and outside ISRO, it was not tested in conditions simulating high altitude, he said.

The GSAT-4 satellite that fell into the Indian Ocean carried a Ka-band transponder and a payload for a GPS-aided navigation system for civil aviation.

The failed GSLV launch originally was intended to carry the Tel Aviv University Ultraviolet Explorer (TAUVEX) space telescope under a 2003 agreement between ISRO and the Israel Space Agency, but the payload was subsequently manifested for a later GSLV flight.

"With hindsight I am obviously relieved that it (TAUVEX) remained safely on the ground," Noah Brosch, principal investigator for the mission, told *Space News* in an e-mail. "I have no idea when the alternative launch will happen; I understand that this is being discussed by the Indian Space Research Organization and by the Israel Space Agency. From my part, and on behalf of my scientist colleagues, I certainly hope that the launch will take place shortly so that the Indian and Israeli astronomical communities would benefit from the data gathered by TAUVEX."

Brosch said that he and his TAUVEX colleagues watched the launch on their computers. "We prayed for a successful launch but instead saw the launch failure as it happened," he said. "We understand that such happenings are encountered by every nation that develops launchers and satellites in the early stages of a program and are to be expected."

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The mobile gantry for Soyuz will enable vertical integration of payloads atop the launch vehicle



ASCENDING

The world's most reliable medium-lift launcher is one step closer to its introduction at the Spaceport. Soyuz' new mobile gantry is taking shape as preparations continue for the workhorse vehicle's maiden liftoff from French Guiana in the second half of this year.

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April 19, 2010

Obama Pledges 2025 Mission to Asteroid

BRIAN BERGER, WASHINGTON

Pledging to send astronauts to an asteroid by 2025, U.S. President Barack Obama defended his decision to pull the plug on NASA's proposed return to the Moon, saying the new course he is setting for the U.S. space agency promises to take people beyond Earth orbit farther and faster than the old plan.

"I understand that some believe we should attempt a return to the surface of the Moon first, as previously planned," Obama told an invitation-only audience in an April 15 speech at NASA's Kennedy Space Center in Florida. "But I just have to say pretty bluntly here. We've been there before. ... There's a lot more of space to explore, and a lot more to learn when we do. So I believe it's more important to ramp up our capabilities to reach and operate at a series of increasingly demanding targets while advancing our technological capabilities with each step forward. And that's what this strategy does. And that's how we will ensure that our leadership in space is even stronger in this new century than it was in the last."

Obama's 2011 budget request, submitted to Congress in February, proposes the cancellation of the Moon-bound Constellation program in favor of extending NASA's support of the international space station through at least 2020 and investing in "game-changing" technologies aimed at speeding the human and robotic exploration of deep space. Obama's initiative also puts a strong emphasis on relying on an emerging commercial space sector for launching astronauts and their gear to the international space station.

Obama said that under his plan, U.S. as-

tronauts will venture beyond Earth's orbit in 2025, starting with a crewed mission to an asteroid.

"Early in the next decade a set of crewed flights will test and prove the systems required for exploration beyond low Earth orbit," he said. "And by 2025 we expect new spacecraft designed for long journeys to allow us to begin the first ever crewed missions beyond the Moon into deep space. So we'll start by sending astronauts to an asteroid for the first time in history."

Obama also gave a specific timeline for embarking on human expeditions to Mars.

"By the mid-2030s I believe we can send humans to orbit Mars and return them safely to Earth," Obama said. "And a landing on Mars will follow, and I expect to be around to see it."

Turning to jobs, Obama said his plan "will add more than 2,500 jobs along the [Florida] Space Coast in the next two years compared to the plan under the previous administration" and more than 10,000 jobs nationwide. He also said he has asked for a plan by Aug. 15 for a \$40 million initiative for economic growth and job creation in areas of Florida expected to be hard hit by the looming retirement of the space shuttle.

Some key details of the president's address were released by the White House April 13, including a decision to continue development of a stripped-down version of the Orion Crew Exploration Vehicle to serve as a crew lifeboat at the international space station. The White House also said NASA will select by 2015 a design for a heavy-lift launcher that most experts agree is necessary for human exploration beyond low Earth orbit.

Comments: bberger@spacenews.com

ORION FROM PAGE 1

at Kennedy, NASA would not send astronauts to a relatively close-in asteroid — often referred to as a near-Earth object — until around 2025.

NASA Deputy Administrator Lori Garver said April 13 that while Orion's focus for now is crew escape, the capsule could eventually play a role in NASA's exploration plans.

"Ultimately beyond low Earth orbit, absolutely, and as decisions are made on heavy [lift] then you have that capability," she said. "But not immediately, because within the budget we're focused on the technology development and so forth for heavy-lift as well as the crew transportation for commercial."

Rather than canceling the Orion contract Lockheed Martin won in 2006, Garver said NASA would modify it to meet the government's new requirement for a crew-escape variant, a plan that could save the agency from having to pay the company hundreds of millions of dollars in termination fees.

Garver said it would be up to Lockheed Martin to decide whether to compete for NASA commercial crew development funding with a variant of the Orion design.

Having worked on Orion for more than four years now, Lockheed Martin would seem well positioned for that work, but Stevens said Lockheed Martin might be reluctant to bid, especially if NASA intends to use a fixed-price contracting vehicle that is typical of commercial procurements. He said such an arrangement could put a large, experienced aerospace contractor like Lockheed Martin at a competitive disadvantage against a relatively new entrepre-

neurial outfit that might not have a firm grasp of what it might cost to safely launch astronauts to the space station.

John Gedmark, director of the Washington-based Commercial Spaceflight Federation, said the plan to use Orion for crew escape could ease requirements for would-be commercial crew providers such as Hawthorne, Calif.-based Space Exploration Technologies (SpaceX), which is developing the Falcon 9 medium-lift launcher and Dragon capsule for both cargo and crew missions to and from the space station.

"Commercial crew vehicles can now be a simpler, more straightforward development effort and could potentially be much faster at closing the gap" in U.S. human spaceflight capability that will follow the space shuttle's upcoming retirement, Gedmark said April 14. "If NASA separates the lifeboat capability from the crew taxi capabilities, it will reduce some of the requirements and technical complexity on commercial crew vehicles."

But Obama's revised plan invited fresh complaints that restructuring the Orion contract is not a wise investment of taxpayer funds.

"Developing an Orion-based lifeboat-only is a costly, unnecessary capability that would do nothing to reduce our dependence on the Russian Soyuz," a congressional aide said April 14. "Soyuz is still required to ferry crews to the station, where it remains docked until the crews are ready to return even in an emergency situation. An unmanned Orion does not contribute to advancing the goal of exploration beyond low Earth orbit, and is a wasteful use of resources at a time when NASA has a very constrained budget."

April 19, 2010

Intelsat Accused of Engaging in Anti-competitive Practices

PETER B. de SELDING, PARIS

Four companies that purchase satellite capacity from Intelsat are accusing the large fleet operator of anti-competitive practices, including price manipulation on a recent U.S. Navy contract that favored an Intelsat subsidiary's winning bid over competing offers that included Intelsat satellite links.

The companies, two of which have filed separate protests of the Navy contract, are asking the U.S. Federal Communications Commission (FCC) to take a fresh look at Intelsat's status a decade after the fleet operator was privatized, and specifically to consider a forced divestiture of the Intelsat General subsidiary that handles government contracts.

The FCC makes an annual report to Congress on whether the privatization of Luxembourg-headquartered, Washington-based Intelsat and mobile satellite services operator Inmarsat of London has promoted "a fully competitive global market for satellite communications services," as it was intended to do under the Open-market Reorganization for the Betterment of International Telecommunications (ORBIT) Act that accompanied the privatization. In preparation of its annual report, the FCC asked for comment on how privatization has affected "U.S. industry, jobs, and industry access to the global marketplace."

Intelsat and Inmarsat, established as intergovernmental cooperatives, were privatized about a decade ago.

Officials from two of the companies that have complained to the FCC said they would not rule out separate appeals to the U.S. Justice Department based on what they allege is Intelsat's misuse of a dominant position.

"Intelsat is engaging in a number of strategic business practices ... causing price escalation, directly manipulating the procurement process and restricting competition," satellite services provider CapRock Communications Inc. of Fairfax, Va., said in an April 7 filing to the FCC.

In a separate FCC filing, Artel Inc. of Reston, Va., said Intelsat in the past two years has substantially changed the way it deals with outside companies, viewing them now more as competitors to Intelsat General than as longstanding Intelsat customers.

Intelsat General, Artel says, "has aggressively taken steps that restrict other users from directly accessing the legacy" satellite fleet that Intelsat built as an intergovernmental organization before it was privatized.

Artel says it has been blocked from accessing Intelsat's in-orbit capacity directly, and instead has been forced to deal exclusively with Intelsat General, which competes with Artel for some of the same government business.



Abbas Yazdani



David Hershberg

Intelsat General, in turn, "has begun to discriminate against, and deny access to, independent distributors."

Artel and CapRock further allege that Intelsat has taken retaliatory action against companies that protest Intelsat General's practices by refusing to renew satellite leases and by quoting above-market prices to the protesters.

In an April 15 interview, CapRock officials reiterated that since their protest earlier this year of the large Navy contract, Intelsat has made it difficult for CapRock to get access to Intelsat satellites.

In its filing to the FCC, Artel says Intelsat has asked satellite services distributors to refrain from bidding on contracts being sought by Intelsat General. When these companies have refused, they have been "denied pricing for later opportunities, apparently as retaliation for failing to comply" with Intelsat General's request.

Artel and CapRock are among the losing bidders for the Navy's Commercial Broadband Satellite Program (CBSP), potentially worth more than \$500 million. The two companies have since filed protests of the award to Intelsat General, and the contract is stalled awaiting U.S. government review.

The CBSP protest documents have not been made public, but Artel and CapRock officials said their FCC filings summarize what they view as the most striking example of Intelsat General's alleged anti-competitive practices.

The companies in particular say that when they requested Intelsat capacity as part of their separate CBSP bids, Intelsat General responded by insisting that the companies purchase a bundle of services, including Intelsat capacity that they did not want. They say Intelsat General refused to permit the companies to pick and choose the Intelsat capacity they would include in their bids.

CapRock, in its FCC filing, says it wanted to include in its

Navy bid satellite links from other fleet operators, both to save money and to meet the contract's requirements. An optimal proposal, CapRock says, would have included a mix of satellites from several operators and fewer Intelsat satellites.

CapRock estimates that accepting Intelsat General's forced bundling of capacity added about \$40 million to the cost of the CapRock bid.

"Despite multiple appeals and complaints to Intelsat and Intelsat General management that this practice was ... tantamount to price-fixing, Intelsat General forced and insisted on the approach," CapRock says in its FCC filing.

"This bundle was so sub-optimal that Intelsat General's own direct bid did not employ it," the CapRock filing says.

Intelsat General's winning bid featured more capacity from SkyPerfectJSat Corp. of Japan than from Intelsat's own fleet. Also included was capacity from SES of Luxembourg and, in the military X-band frequency, from Paradigm Secure Communications of Britain.

David Myers, executive vice president and general manager of CapRock Government Solutions, said the Navy contract was "the straw that broke the camel's back. It has gotten to a point where it's really untenable." He said CapRock has turned to the FCC and may seek U.S. Justice Department assistance because the company has no choice. "Why would we want to irritate them?" he said. "This is not because of one contract loss."

Globecom Systems of Hauppauge, N.Y., also a losing bidder in the Navy competition, says in its FCC filing that Intelsat General has become increasingly opaque in its pricing policy in the past two years. Globecom Chief Executive David Hershberg said a full FCC review should be undertaken.

"We are not going to make allegations without proof," Hershberg said April 15. "We have to

live in the world with Intelsat. But we want to know what's going on. We see smoke and we want to find out if there's fire. We'd like the FCC to take a look at it, because our concern is that all of us are going to end up on the outside looking in."

Hershberg said Globe-comm's dealings with other satellite fleet operators "have felt like they were giving the same price to everybody."

Abbas Yazdani, chief executive of Artel, echoed Hershberg's remarks.

In an April 15 interview, Yazdani said Intelsat "has been our partner — up until about a year and a half ago, when they started acting as a competitor, not a supplier. Now they are taking on the role of a dominant power. They say they make the rules, and the rules made the day before they have broken the day after. It has become difficult to work with them because they change the rules."

"When CBSP came, they [Intelsat] flipped 180 degrees. They started to control the market and they blocked everybody so that they became the only viable provider. I believe the intent was to prevent any competition for the U.S. Navy contract. That was not good for us, for the taxpayer, or for the Navy. They controlled the pricing. I am not saying they fixed prices, but the end result is the same. They had said [post-privatization] that they would continue their equal-access and non-discrimination practices. They obviously have violated both the spirit and the letter of that. So we filed our comments with the FCC to bring some of these practices to light."

Intelsat officials declined to respond to the allegations in detail, but Intelsat Chief Executive David McGlade said in a March interview that the company has set up firewalls that separate those parts of Intelsat General that bid on contracts from those that sell raw satellite capacity.

Intelsat issued the following statement April 15: "The com-

ments filed at the FCC by the unsuccessful bidders for the CBSP have no merit and reflect a fundamental lack of understanding of the requirements of the ORBIT Act. Intelsat is fully compliant with the ORBIT Act, as the FCC has repeatedly found. We will respond in due course in the FCC proceeding. We believe that our solution for the CBSP program will provide the Navy with an efficient and technically outstanding solution, and we look forward to the expeditious resolution of the CBSP protest process."

One industry official knowledgeable of Intelsat's post-privatization regulatory status said the company is not a common carrier and generally is not obligated to sell capacity to anyone. If Intelsat had restricted its satellites to the Intelsat General bid for the Navy contract, this would be permitted under the law, this official said. The fact that Intelsat General appears to have offered to other bidders on the program a package of capacity might be considered evidence that the company wishes to maintain a competitive market, the official said.

The fourth company filing Intelsat-related comments to the FCC is Spacenet Inc. of McLean, Va., which did not bid on the Navy contract but is concerned that Intelsat has gotten too big to serve the general interest.

"When Intelsat was privatized it had 22 satellites and was forced to divest itself of some of its orbital positions and satellites," Spacenet Chief Executive Andreas Georghiou said April 16, referring to the creation of Intelsat spin-off New Skies Satellites, since purchased by SES. "Now they have around 50 satellites. So with 22 satellites they were considered too big, and with 50 satellites they are not too big?"

Georghiou said Spacenet, which uses Intelsat capacity to provide data links to corporate customers, is urging the FCC to force Intelsat and other U.S.-licensed satellite operators to stop what he called "orbital slot warehousing," a practice in which operators refuse to return the orbital position for use by someone else, but also refuse to develop the slot.

"You can't claim the liberties of a free market when it suits you, and then ask regulators [who govern access to radio spectrum and orbital slots] to protect you," Georghiou said. Spacenet, which recently created its own government services division, is likely to have more dealings with Intelsat General in the future.

Georghiou said firewalls are difficult to maintain when "it is supposed to separate people who work in offices next to each other, who visit the same cafeteria and socialize together. If you want a true wall to be there, spin the company off."

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Official Details 11-year Path to Developing China's Own Space Station

AMY KLAMPER,
COLORADO SPRINGS, Colo.

A top Chinese space official shared new details of an ambitious human spaceflight agenda that includes plans to conduct on-orbit rendezvous and docking experiments and development of a new heavy-lift launch vehicle in preparation for assembling a 30-ton space station on orbit by 2022.

Wang Wenbao, director of the China Manned Space Engineering Office, said the effort would begin with the launch of a Tiangong 1 docking-target spacecraft slated for early 2011.

"According to our schedule, we will launch Tiangong 1 target spacecraft in the first half of 2011 and then the Shenzhou 8 spacecraft in the second half of 2011 to carry out China's first docking and rendezvous of spacecraft in orbit," Wang told an audience of government and industry officials at the 26th National Space Symposium here April 14.

Wang said in addition to serving as a platform for autonomous rendezvous and docking experiments, Tiangong 1 would form the basis of a "simple space laboratory" on orbit, conducting additional

rendezvous and docking maneuvers with China's Shenzhou 9 and 10 spacecraft in 2012.

Launch of the Tiangong 2 and Tiangong 3 space labs would follow, using crewed missions to conduct additional rendezvous and docking experiments with the space labs as well as regenerative life support and cargo supply experiments, Wang said.

"Between 2014 to 2016, we are planning to launch the Tiangong 3 space lab, two manned spacecraft and one cargo spacecraft to have docking and rendezvous with the target spacecraft in orbit and to carry out regenerative life support technology experiments as well as the space cargo supply experiments," he said.

Wang said the 3.35-meter diameter space lab would weigh about 8.5 tons and have two sections.

"One is the experiments module, the other is the resource module, and the space lab will have the capability of in-orbit refueling of the hosting of fuel," Wang said, adding that the space lab would operate at 400 kilometers with an inclination of 42 to 43 degrees relative to the equator.

Wang said the spacecraft and space labs would be launched on Long March 2F rockets.



Wang Wenbao, China Manned Space Engineering Office director, said in addition to being a platform for autonomous rendezvous and docking experiments, Tiangong 1 would form the basis of a simple space laboratory.

From 2016 to 2022, China is planning to construct a 30-ton space station consisting of three pressurized modules to be launched on China's heavy-lift rocket currently in develop-

ment. Wang said the station will operate at 340 to 450 kilometers above the Earth at an inclination of 42 to 43 degrees.

"The crew members will be three, and the astronauts can

stay in the station for long term to carry out in-space application experiments of a larger scale," he said, adding that the station's service life would be about 10 years.

Wang said China has established "a good working relationship" with space agencies in Russia, France, Germany and other countries, and that Beijing looks forward to working with the United States to pursue cooperative space science and manned exploration efforts in the future.

"In November 2009, President [Barack] Obama visited China, and both leaders signed the American communiqué among which it is specifically stated that the United States and China look forward to expanding discussions on space science cooperation and starting a dialogue on human spaceflight and space exploration based on the principles of transparency, reciprocity and the mutual benefit," Wang said, adding that China is looking forward to a visit from NASA Administrator Charles Bolden later this year.

"This forms an important foundation for both sides to carry out manned space cooperation," he said.

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With High Launch Rate in Tow, China Great Wall Courts Western Business

PETER B. de SELDING, PARIS

China's launch-service provider expects to conduct more than 10 missions per year over the next two years on the strength of continued strong demand from Chinese satellite owners and what appears to be a growing, if still modest, business of launching Chinese-built satellites aboard Chinese rockets for foreign governments, Chinese launch officials said.

Twenty years after its first commercial launch — a U.S.-built telecommunications satellite — and more than a decade after its participation in the international commercial launch market was sharply curtailed by U.S. technology-export restrictions, China Great Wall Industry Corp. (CGWIC) is making a fresh attempt to attract Western business.

Beijing-based CGWIC on April 8 held a conference for current and prospective users and insurers of China's Long March rocket series at the Xichang Satellite Launch Center in China's Sichuan Province, the launch base for the heavy-lift Long March 3A, Long March 3B and Long March 3C versions that deliver commercial telecommunications spacecraft to geostationary transfer orbit.

Space insurance officials say the record of the heavy-lift end of the Long March series — 29 successes in 31 launches since 1996, including a maiden-flight failure and one partial failure in 2009 — has helped reduce insurance premiums for Long March launches to rates not far from what is offered by the

two dominant commercial launch vehicles — Europe's Ariane 5 rocket and Russia's Proton.

The company says satellites are exempted from Chinese customs inspection, and that CGWIC literally gives foreign satellite customers the keys to the Xichang satellite processing facility where the non-Chinese-built satellites are prepared for launch.

"When the customer satellite team arrives at the launch site, the satellite processing facility is handed over for their control," CGWIC Vice President and General Manager Fu Zhiheng said in an April 15 e-mail following the users conference. "Without their permission, no one can enter the facility. Video monitoring is also available for the satellite team while the satellite is in the processing facility as well as on the pad."

In the event of a launch failure in which the satellite debris falls on Chinese territory, a joint Chinese and customer team would be sent to collect it, in keeping with a U.S.-Chinese technology safeguards agreement signed in the mid-1990s.

From its first launch, in April 1990, of a U.S.-built commercial satellite — the AsiaSat 1 manufactured by Hughes, whose satellite plant has since been purchased by Boeing — to 1999, CGWIC launched 26 U.S.-built satellites, including 12 Iridium satellites placed into low Earth orbit and manufactured by Motorola and Lockheed Martin.

In 1999, the U.S. government, concerned that China's commercial launch

business was benefiting China's missile development, made it all but impossible for U.S.-made satellite components to be exported to China.

Reinforced by the U.S. International Traffic in Arms Regulations (ITAR) regime that restricts technology exports, the ban remains in effect. But it has had limited effect on China's launcher development because it occurred just as China's domestic satellite market was moving into takeoff position.

According to the CGWIC presentation made during the users conference, it took 28 years, to 1998, for China's domestic market to launch its first 50 satellites aboard Long March vehicles. The next 50 Chinese satellites were launched in just nine years, to mid-2007.

Since July 2007, another 23 Chinese domestic launches have occurred.

CGWIC said the surge in domestic demand has enabled the company to order Long March vehicles in larger batches, streamlining the production cycle. The time needed from contract signing to launch today is about 24 months. A typical launch campaign, which took 50 days a decade ago, is now 25 days.

Domestic demand shows no sign of slowing. In addition to telecommunications operators, Chinese customers include the operator of China's Compass/Beidou satellite navigation constellation, which is designed to include 30 satellites in medium Earth orbit and five in higher geostationary orbit. CGWIC said Compass/Beidou is a major component of its launch forecast for the

next two years.

European and Asian satellite manufacturers for various reasons have not seen fit to attack the market opening and throttle up production using so-called "ITAR-free" parts built outside the United States. Thales Alenia Space of France and Italy has modified its Spacebus production line to accommodate customers seeking a Chinese launch option, but only four ITAR-free Spacebus satellites have been launched since 2005.

Two more — one each for Eutelsat of Paris and APT Satellite Holdings of Hong Kong — are under construction and scheduled for launch in 2011 and 2012.

In parallel with the development of the Long March rocket series, China Aerospace Science & Technology Corp. (CASC) has developed the DFH-4 telecommunications satellite for domestic and international customers, including Nigeria and Venezuela in 2007 and 2008, respectively.

Four DFH-4 platforms coupled with Long March launches are in CGWIC's export backlog following agreements with Pakistan, Laos and Bolivia, plus a second Nigcomsat satellite for Nigeria following the in-orbit failure of the first model.

The Nigerian and Venezuelan satellites each weighed about 5,100 kilograms at launch. But CGWIC says that given their optimized orbits, the Long March 3BE has been qualified to lift a satellite weighing up to 5,500 kilograms into geostationary transfer orbit.

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<26th National Space Symposium>

NRO Chief Aims To Restore Technology Development Funding

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The budget for science and technology development programs at the U.S. National Reconnaissance Office (NRO) has been drastically reduced in recent years, and the spy satellite agency's top official will push to reverse that trend starting with the 2012 federal budget request.

NRO Director Bruce Carlson, a retired Air Force general, now has nine months under his belt leading the development and operation of the nation's classified spy satellites. In that time, he has focused on some of the agency's toughest problems, including a relatively young and inexperienced work force and bottlenecks at the U.S. satellite launching ranges.

Though the NRO's budget is classified, Carlson has said funding for science and technology development programs was cut in half over the last five years. The NRO's 2012 budget request will begin down a path to fully restoring that funding, Carlson said April 14 at the National Space Symposium here. He did not say whether that correlates to requesting a top-line budget in-



SPACE NEWS PHOTO BY TOM KIMMEL

NRO Director Bruce Carlson said funding for NRO science and technology development programs was cut in half over the last five years, but the 2012 budget request will begin down a path to restoring that funding.

crease for the NRO.

"Over that half a decade, through a number of reductions and taxes and other things, that investment has slackened, and that's the seed corn of the future," Carlson said. "We just simply cannot allow that continued erosion in our science and technology base. So when I submit my 2012

budget, it will have a road map to get us up to the level we have historically been at the National Reconnaissance Office."

Like other U.S. defense and space agencies, the NRO has struggled with cost growth on its satellite programs in recent years, which has exacerbated the budget pressures it faces.

Meanwhile, the NRO over the next 18 months will pursue its most aggressive launch campaign of the last 25 years, Carlson said. This will be a challenge because the nation's space launch capability has been scaled back in many ways, he said.

"There are a number of very large and very critical reconnaissance satellites going to orbit in the next year, year-and-a-half," Carlson said. "We simply have to get these off and get them off on time.

"Now we will do that at a time when the launch infrastructure is not what it used to be. Through a series of conscious decisions, this country has downsized the industrial base in the launch business. We've downsized the number of locations from which we can launch. We've downsized the number of crews to take care of and operate that equipment. We have literally no or very little backup capability in the launch business."

Moreover, he said, the U.S. government has "made national decisions to spend very little money on the development of new facilities and the recapitalization of the ones that we have. We're not building new engines. We're not building new rocket cores. In fact, we're not even spending money to

upgrade the ones that we have."

Carlson said the NRO is working with Air Force Space Command to stabilize or potentially expand U.S. launch infrastructure, but he provided no specifics.

The NRO is also making changes to how it is staffed. Established as a hybrid Defense Department-intelligence community organization, the NRO is staffed by military and intelligence personnel on loan from their respective organizations. This is sometimes troublesome for program continuity, so Director of National Intelligence Dennis Blair recently approved a program that will allow for a limited number of personnel to be directly employed by the NRO, Carlson said.

In addition, the NRO has initiated a scholarship program in which it pays for university graduates with general science and engineering degrees to go back to school for space-specific degrees. In exchange, each student will owe six years of service to the NRO after graduation. The office recently selected its first class of four scholars, to be followed by six next year and eight in the years after that, Carlson said.

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Commercial Firms Press Case for More Government Space Work

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Commercial firms are poised to offer U.S. government agencies a variety of new products and services to meet growing demand for imagery, communications and launch capabilities, but their efforts are being impeded by restrictive acquisition rules and budget policies, according to industry executives speaking April 14 at the National Space Symposium here.

"I am absolutely convinced there is a golden opportunity here," said Michael Hamel, a retired lieutenant general and former commander of the U.S. Air Force Space and Missile Systems Center who is now senior vice president for strategy and development at Orbital Sciences Corp. "Federal budgets aren't going to grow, but the government's appetite for space capability will grow inexorably. It is imperative for the commercial sector to deliver more government services."

U.S. government agencies already rely on private companies to provide high-definition satellite imagery as well as 80 percent of the satellite bandwidth used for communication in military theaters of operation, said Josh Hartman, a senior fellow for technology and public policy at the Center for Strategic and International Studies in Wash-

ington. In the future, commercial firms may offer additional services to help government agencies monitor weather on Earth, space weather or satellites in orbit, Hartman said.

When the government relies on private industry for products and services, one of the primary advantages is rapid access to new capabilities, according to members of the panel. "Despite the Defense Department's dependence on military frequency communications, it cannot procure capacity in the right bandwidths fast enough to meet its needs," said retired Air Force Maj. Gen. Craig Weston, chief executive of U.S. Space LLC of Dulles, Va., a business established last year to build and launch satellites to provide communications on dedicated military frequencies.

An increasing reliance on commercial firms also would free up government agencies to focus on those projects they are uniquely qualified to tackle. Private industry is not going to build the James Webb Space Telescope, Hamel said. "The government should focus on state-of-the-art," added retired Gen. Lance Lord, former commander of Air Force Space Command and chief executive of Astrotech Space Operations of Titusville, Fla. "Industry should do the rest."

Several speakers pointed to NASA's plans to pay commercial firms to ferry cargo to the international space station as an example of

a successful public-private partnership. "There is no question that we have found success in the marketplace largely because of the investment that the government provided," said Gwynne Shotwell, president of Space Exploration Technologies Corp. (SpaceX) of Hawthorne, Calif. NASA is paying SpaceX and Dulles, Va.-based Orbital to develop new launch vehicles under the Commercial Orbital Transportation Services program. The space agency also awarded the two companies Commercial Resupply Services contracts with a combined value of approximately \$3.5 billion to conduct space station cargo flights.

That initial government support has helped SpaceX develop launch vehicles to serve both government and commercial customers. "We are seeing sales coming through," Shotwell said. "We have got 32 Falcon 9 missions on our manifest." The Falcon 9 is scheduled to make its inaugural flight in May. SpaceX also has seven missions on its manifest for the Falcon 1, a smaller rocket that has conducted two successful flights, Shotwell said.

In spite of the government's strong support of commercial launch providers, industry officials said there remain significant obstacles to selling new products and services to government agencies, including detailed federal acquisition regulations and budgetary guidelines that discourage agen-

cies from making multiyear commitments.

"The government spends \$600 million a year to purchase commercial satellite bandwidth on the spot market—a very expensive proposition," Weston said. "But they find it very hard to get their heads around committing to leasing a military-frequency satellite that will be built two-and-a-half years from now. Somehow the government is not able to make that shift in contracting."

Another obstacle is the government's aversion to risk, members of the panel said. While commercial firms buy insurance to cover launch losses or premature failure of a spacecraft, government customers try instead to structure programs to guard against any possible failure. That approach adds to the complexity of spacecraft designs, lengthens development cycles and increases cost, Hamel said.

Nevertheless, strong leadership in Washington could help pave the way for greater government reliance on commercial products and services, the panelists said. There are creative ways to structure long-term programs while still complying with federal acquisition regulations, Hamel said. Weston added that Congress could help smooth the way for new public-private partnerships by including language in support of those projects in authorization bills. "I think the Congress can certainly provide some encouragement," he said.

NEWS FROM THE 26TH NATIONAL SPACE SYMPOSIUM

Public-private Partnership Targets Cyber-security Threats

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To address the threat that cyber attacks pose to space- and ground-based telecommunications networks, the commercial firms that make up the National Security Telecommunications Advisory Committee (NSTAC) are testing new mechanisms for sharing information on specific threats.

NSTAC, which includes top executives from network service providers and telecommunications, information technology, aerospace and finance companies, began a pilot program the week of April 12 to create a central repository for information on cyber-security threats in specific sectors. That central repository will acknowledge receipt of information received and maintain a list of liaisons from companies involved, said Kay Sears, president of Intelsat General Corp. of Bethesda, Md., and NSTAC co-chairwoman.

The pilot program is the first step in establishing a government-industry partnership to identify and respond to any activity that threatens communications networks, Sears said April 12 during the National Space Symposium's first full-day session addressing cyber-security issues. "Enhanced space situational awareness will provide a clear and accurate understanding of what is happening in the environment and

allow timely and successful decision-making over a broad range of scenarios," she added.

Ultimately, the NSTAC seeks to establish a Joint Coordinating Center to operate around the clock and assist government and industry in preventing, mitigating and responding to cyber-security incidents of national consequence. "The Joint Coordinating Center will be an authoritative venue for operational coordination between government representatives and private-sector owners and operators of critical infrastructure and key resources across all sectors," Sears said.

This effort underscores the growing concern among government and industry officials that space-based communication networks are becoming increasingly vulnerable to attack from adversaries. "Our use of space can be severely limited through intentional and non-intentional jamming, interference and through unauthorized access to our telemetry, tracking and control systems, our teleports, our power systems and denial-of-service interruptions at the data level," Sears said. "The threat picture has really expanded, and cyber is at the foundation."

Moreover, those communication networks underpin critical elements of U.S. financial operations, transportation networks, energy infrastructure and military operations, said Mike McConnell, former direc-



Intelsat's Kay Sears, National Security Telecommunications Advisory Committee co-chairwoman, said the pilot program will create a repository for information on cyber-security threats in specific sectors.

tor of national intelligence and senior vice president of Booz Allen Hamilton of McLean, Va.

Last year, the U.S. Air Force gave responsibility for addressing threats in cyberspace to Air Force Space Command. In addition, the service established the 24th Air Force at Lackland Air Force Base in Texas to oversee the cyberspace mission. As part of the initial operational

capability declared in January, the 24th Air Force commander gained authority over the Air Force network, which means he can determine what hardware and software will be used to improve the network's ability to support ongoing operations as well as to defend against cyber threats, said Gen. Robert Kehler, commander of the Air Force Space Command. Full

operational capability will come this fall, he said.

By giving the Air Force Space Command authority over cyber-security issues, the Air Force is recognizing the nexus between the space and cyber-security missions, according to government and industry officials attending the conference. "Space is largely about information flow," said Air Force Lt. Gen. Larry James, commander of the Joint Functional Component Command for Space. "It's making sure the right information gets from the right sensor with the right content to right person at right time."

Cyber-security means keeping that information flowing and protecting the networks that operational commanders rely upon, including communications networks, GPS, missile warning networks and space surveillance networks, James said. In addition, military officials need up-to-date information on the status of their networks, whether they are under attack and how to protect them, he said.

However, that does not mean that the military will be able to defend all communications networks at all times, Kehler said. Instead, the officials will focus on mission assurance by determining which elements are critical to the success of a mission and how those specific elements can be protected, he said.

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Lockheed To Submit Proposal for Fourth U.S. Air Force AEHF Satellite Contract

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Having completed construction and testing of the first of a new generation of super-secure military communications satellites, Lockheed Martin is preparing to submit a proposal to build the fourth spacecraft in the series, with an option for a fifth, a company official said.

Kevin M. Bilger, vice president and general manager of global communications systems at Sunnyvale, Calif.-based Lockheed Martin Space Systems Co., said there was a four-year break in production between the third Advanced Extremely High Frequency (AEHF) satellite and the fourth. As a result, there will be only about 70 percent parts commonality between the two satellites due to obsolescence and the closure of component production lines.

Bilger recently took over management of Lockheed Martin's reorganized communications satellite business, a move that combined the company's government and commercial programs. Marshall Byrd, who previously headed

Newtown, Pa.-based Lockheed Martin Commercial Space Systems, is retiring this summer, company officials said.

Lockheed Martin's \$6 billion AEHF contract covers the first three satellites plus long-lead components for the fourth. The reason for the gap in production — such gaps typically create inefficiencies that drive up the cost of programs — was that the U.S. Air Force previously intended to buy just three AEHF satellites before moving on to the far more ambitious Transformational Satellite (T-Sat) communications system, but that program was canceled last year.

In an interview here, Bilger said Lockheed Martin expects to be under contract for the fourth AEHF spacecraft sometime this summer. The Air Force intends to buy at least six AEHF satellites, and Bilger said Lockheed Martin could save the government money by ordering the components for the fifth and sixth satellites simultaneously, but currently that is not part of the plan.

Lockheed Martin also is studying upgrades to the AEHF satellite platform based on the research and development

work done under the T-Sat program, Bilger said. The upgrades would support applications including communications for troops on the move, and could be incorporated beginning with the fifth satellite, he said.

Meanwhile, the first AEHF craft is in Sunnyvale awaiting shipment to Cape Canaveral Air Force Station in Florida for a scheduled July 30 launch aboard an Atlas 5 rocket. The second satellite is undergoing final testing, Bilger said, while the third is in environmental testing. The AEHF satellites are planned for launch at eight-month intervals, he said.

Lockheed Martin also is prime contractor on the U.S. Navy's Mobile User Objective System, a constellation of four geostationary satellites that will provide communications to ships at sea and troops operating beneath vegetation canopies and other hard-to-reach areas. Bilger said Lockheed Martin expects the Navy to exercise an option late this year or early next year for a fifth satellite, which would serve as a spare.

On the commercial side, Bilger said Lockheed Martin over the past five years has averaged about two communica-

tions satellites per year and hopes to increase that to up to four over the next five years. Although the major satellite operators are winding down their recent fleet-recapitalization cycles, Bilger said Lockheed Martin's relationships with current and past customers, coupled with recent White House statements on export-control reform, bode well for the company's commercial business.

Lockheed Martin also is competing to build a next-generation constellation of 66 low-orbiting satellites for Iridium Communications of McLean, Va. Lockheed Martin built the platforms for the current Iridium satellites in Nashua, N.H., and is eyeing potential manufacturing locations in the southwestern United States should it beat out Thales Alenia Space of France and Italy for the contract to build the Iridium Next system, Bilger said. He added that the company is looking at locations in Nevada, Arizona and New Mexico and that incentives provided by these states would be a factor in the company's selection.

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NEWS FROM THE 26TH NATIONAL SPACE SYMPOSIUM

NASA Must Initiate Transition Plan for Heavy Lift, Maser Says

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If NASA waits until 2015 to select a design for a new heavy-lift launch vehicle, it will be extremely important for the space agency to craft an interim program in a way that does not cause irreparable harm to the industrial base for space propulsion technology, said Jim Maser, president of rocket builder Pratt & Whitney Rocketdyne.

"We don't want to see any Constellation contracts canceled until we have a transition plan and can transition the skill set," Maser said April 14 during a media briefing at the National Space Symposium here. "We think the worst thing for the industry would be if all these contracts were canceled and then there was a pause of 12 to 18 months while [NASA] considered what to do next. It would not only be devastating to us, it would be devastating to the industry in terms of the

impact on the work force and the ability to try to rebuild that once it was gone."

Moreover, the cost of propulsion would climb for the U.S. Defense Department because military customers would be forced to pay the entire cost of maintaining the U.S. propulsion infrastructure and work force. "The ramifications to the Department of Defense would be huge," Maser said. "What NASA does and the decisions it makes have a major impact on the liquid propulsion industrial base, the cost of liquid propulsion and our ability to maintain critical access to space."

In rolling out his budget request for 2011, U.S. President Barack Obama unveiled plans to cancel the Constellation program, which consists of rockets, crew capsules and other hardware needed to replace the space shuttle, slated to retire at the end of the year, and later return astronauts to the Moon. Pratt & Whitney Rocketdyne of



Jim Maser

Canoga Park, Calif., built the space shuttle main engine and was under contract to develop engines for Constellation's Ares 1 and Ares 5 rockets.

Obama announced April 15 in Florida that NASA will select a

heavy-lift launcher design by 2015.

Propulsion industry officials attending the National Space Symposium say 2015 seems like a long wait for NASA to select the future heavy-lift design, although they concede that the space agency is taking that time to explore advanced technology that could serve as the foundation of future heavy-lift systems.

"If it were up to us, we would pick an architecture today or in the near future, and evolve it with block upgrades as we mature the technology," Maser told *Space News*.

Since that does not appear to be the administration's game plan, Maser said, the space agency can still help to maintain the propulsion industrial base if it launches a vigorous technology program. "We are going to want a good portion of technology work to maintain our critical skills so we are positioned to compete when an architecture is chosen," he said.

The U.S. space propulsion industry has been faced with

uncertainty ever since the administration revealed its 2011 budget plans. In light of that uncertainty, Pratt & Whitney Rocketdyne has been working aggressively to trim costs and overhead expenses. "Over time, you can see we are bringing our capacity down as our base drops, but the base is dropping faster than our ability to rationalize capacity," Maser said.

As one step in that cost-cutting process, Pratt & Whitney Rocketdyne is consolidating its work in Canoga Park. Currently, the company has two facilities in Canoga Park, one on Canoga Avenue where the firm built the space shuttle main engines, and a more modern facility on DeSoto Avenue that housed all of the firm's missile defense and related attitude control propulsion system work. All the work will be consolidated in the DeSoto Avenue plant, said company spokesman Bryan Kidder.

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SDA Taps Analytical Graphics To Operate New Data Center

The Space Data Association (SDA), an orbital information sharing consortium of commercial satellite operators, has contracted with Analytical Graphics Inc. (AGI) to develop and operate a system to monitor satellites along the geosynchronous belt, SDA announced April 13.

The nonprofit SDA was founded in 2009 by Intelsat, SES and Inmarsat to better share information on satellite locations to avoid on-orbit collisions and radio frequency interference. Eutelsat and Telesat have announced plans to join the organization.

To date, satellite operators have relied on informal information sharing arrangements with one another and limited data supplied by the U.S. Air Force to avoid catastrophes on orbit. Exton, Pa.-based AGI was put under contract to develop the Space Data Center, which will process orbital data supplied by the firms and provide automatic notifications about possible conjunctions and interference.

The Space Data Center will reach its initial operating capability within six weeks, and full operating capability in eight months, Tobias Nassif, SDA director and Intelsat vice president of satellite operations, said at an April 13 press conference.

The value of the AGI contract was not announced.

SES World Skies Combines Government Services Units

Satellite fleet operator SES World Skies of Princeton, N.J., announced it will merge two government services divisions to form the new U.S. Government Solutions division that will focus more on bandwidth sales than end-to-end network solutions, the company said April 13.

SES World Skies, a division of Luxem-

Financial Analysts See Rise in Space Industry Mergers, Acquisitions, Stock Offerings

Merger and acquisition activity among space companies is increasing and a new round of initial public offerings may be on the horizon, according to financial analysts speaking April 13 at the Space Foundation's National Space Symposium here.

During the last six months, there has been a significant increase in mergers and acquisitions because companies that did not want to sell at the bottom of the financial cycle are beginning to see the value of their stock going back up. "They want to cash in their chips before another downturn," said Chris Quilty, senior vice president for equity research at Raymond James & Associates of St. Petersburg, Fla.

That opinion was seconded by Heidi Wood, managing director and senior equity analyst for aerospace, defense and defense electronics for Morgan Stanley of New York. Companies with strong balance sheets will be able to grow through acquisitions, she added.

As the stock market rebounds from the serious declines of the past two years, companies also are considering offering stock for the first time. "The window is open for initial public offerings," Quilty said. "Companies will rush to get through the window before the market collapses again. I would not be surprised if certain private companies go public in the next six to 12 months."

bourg-based SES, was formed last year by the merger of SES Americom of Princeton and Netherlands-based New Skies Satellites, which SES bought in 2005. The firms' government services divisions had been kept separate up to now because they had different business models, with SES Americom selling directly to the government and SES New Skies selling only through U.S. partners.



Chris Quilty, senior vice president at Raymond James & Associates, and Heidi Wood, managing director and senior equity analyst at Morgan Stanley, said space company merger and acquisition activity is increasing and more initial public offerings may be coming soon.

Those initial public offerings might be interesting to investors who are willing to consider risky bets because they see stock prices rising and they are eager to offset the dramatic declines of 2008 and 2009, Wood said.

If space companies want to appeal to a broader base of investors, however, including people who are less comfortable with risk, they should focus on steady quarterly returns, Wood said. Pension fund managers, for example, will only invest in businesses that consistently meet

their projected returns for quarterly cash flow and earnings, she said.

The government could help space companies attract more investment by reforming the acquisition process and easing export controls, Quilty said. "The value of space companies is directly proportional to the uncertainty," he said. "If you fix some of those issues, the valuation of some of those companies would go up. Their ability to raise capital and make investments is all held back in some manner by their government customer."

Tip Osterthaler, who led Americom Government Services, has been appointed chief executive for SES World Skies U.S. Government Solutions.

The U.S. government is revamping the way it contracts for commercial satellite communications services. The new program, called the Future Comsatcom Services Acquisition, starting next year will allow the

government more flexibility in how it contracts for everything from pure commercial bandwidth to managed network services.

Reflecting the coming changes in the government's acquisition model, SES World Skies U.S. Government Solutions has decided to move away from network integration activities and toward bandwidth-only sales to the government, Osterthaler said.

NEWS BRIEFS

NEWSBRIEFS FROM PAGE 3

NASA Human-like Robot To Join Space Station Crew

NASA intends to launch a human-like robot to the international space station later this year to take up permanent residency aboard the orbiting lab, the U.S. space agency announced April 14.

Called Robonaut 2, or R2 for short, the 135-kilogram robot was jointly developed by NASA and General Motors and consists of a head and torso with two arms. NASA plans to launch R2 to the space station aboard Space Shuttle Discovery as part of the STS-133 mission planned for September. Once the robot is onboard the station, engineers will monitor how it operates in weightlessness.

Although R2 will be confined to operations inside the station's Destiny laboratory module, NASA said in a press release the robot eventually could be enhanced to allow it to move more freely around the station's interior and possibly one day be modified to operate outside the station.

NASA said R2 is undergoing extensive testing — including vibration, vacuum and radiation testing — in preparation for its flight.

"The use of R2 on the space station is just the beginning of a quickening pace between human and robotic exploration of space," John Olson, director of NASA's Exploration Systems Integration Office, said in the press release. "The partnership of humans and robots will be critical to opening up the solar system and will allow us to go farther and achieve more than we can probably even imagine today."

NASA Starts Downloading Japanese Radar Imagery

NASA's Tracking and Data Relay Satellite System began downloading imagery April 12 of North and South America taken by the Japan Aerospace Exploration Agency's (JAXA) Advanced Land Observing Satellite, also known as Daichi, the U.S. and Japanese space agencies announced the same day.

By combining U.S. and Japanese data-relay satellite resources, the two agencies expect to more than double the quantity of Earth observation data collected to study earthquake hazards, forest declines and changing water resources in the Americas, NASA said in a press release. Until now, JAXA Earth Observation Center has been relying exclusively on Japan's Kodama Data Relay Test Satellite to receive Daichi data.

"This is a great example of the value to be gained through international collaboration between the world's Earth-observing nations," NASA Earth Science Division Director Michael Freilich said in a statement. "By working together and sharing satellite resources like this, we can produce more data more rapidly and cost-effectively than if each of us went it alone."

The data transmission agreement concluded in 2009 gives NASA and U.S. government-affiliated scientists access to data gathered by the Advanced Land Observing Satellite's phased-array, L-band synthetic aperture radar. The instrument, known as PALSAR, precisely measures the distances to the Earth's surface under all weather conditions day and night. The Alaska Satellite Facility, a NASA data center at the University of

Alaska, Fairbanks, will process and distribute the PALSAR data, which will be used for detecting ground surface changes associated with earthquakes, volcanic eruptions and landslides, among other phenomena.

"The expanded [Advanced Land Observing Satellite] data flow will significantly improve our scientists' ability to monitor regions at risk to earthquake hazards, such as Haiti and Chile," Craig Dobson, NASA's natural hazards program manager, said in a statement. "Now we will be able to see very small changes in surface elevation associated with the build-up and release of strain in seismic zones over virtually the entire area of the Americas, with measurements made as often as every 46 days. Scientists also will be able to monitor seasonal changes in ground-water resources."

New Venture Focuses on Secondary Launch Market

Seattle-based Andrews Space announced April 14 the formation of a new company called SpaceFlight Services to focus on providing low-cost space access for small payloads through the use of standard flight interfaces and a streamlined integration process.

Andrews Space President and Chief Executive Jason Andrews said SpaceFlight Services will enable new missions and markets by making it easier for small, secondary payloads to find rides while at the same time giving launch providers additional revenue streams.

"This will enable a whole new class of missions and technology demonstration flights to rapidly mature technology as well as develop the next generation workforce," Andrews said in a statement.

SpaceFlight Services will provide standard interface options for a range of small spacecraft, including cubesats and nanospacecraft. The new company also offers low-shock payload adapter-mounts for deployed microsats and payloads sized to launch as secondary payloads on the Atlas 5 and Delta 4 Evolved Expendable Launch Vehicles.

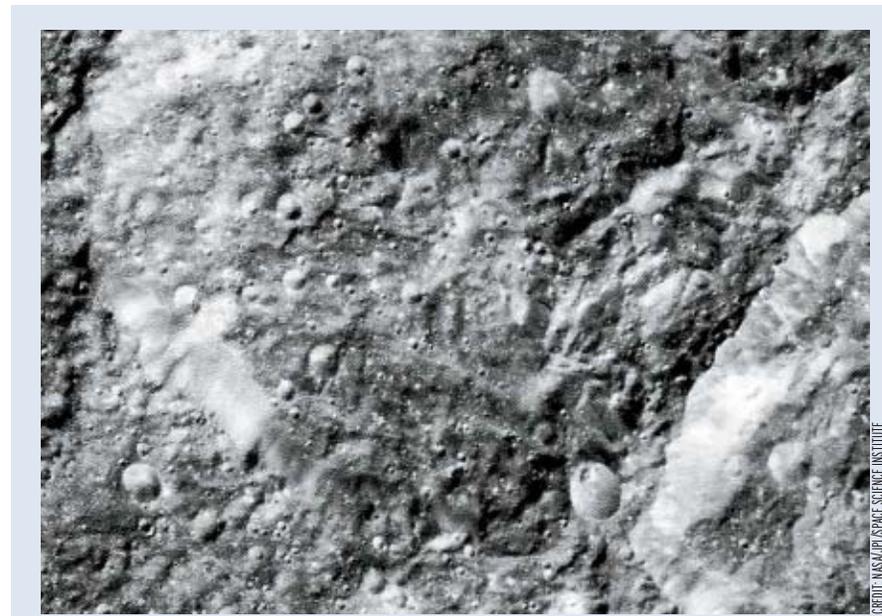
According to Andrews, SpaceFlight Services has signed an agreement with Hawthorne, Calif.-based Space Exploration Technologies (SpaceX) to manifest payloads using excess capacity on upcoming Falcon 9 launches of SpaceX's cargo-carrying Dragon capsule, with space available starting in 2012.

CSF Releases Job Numbers, Gains 2 Corporate Members

The Commercial Spaceflight Federation (CSF) released results April 13 from a study it commissioned showing that the NASA Commercial Crew and Cargo Program proposed in the U.S. space agency's 2011 budget request will result in an average of 11,800 direct jobs per year over the next five years, nationwide. The study was done by the Tauri Group, an analytic consulting firm based in Alexandria, Va.

NASA intends to spend \$5.8 billion on commercial crew and an additional \$312 million on commercial cargo between 2011 and 2015.

Brett Alexander, president of the Commercial Spaceflight Federation, said the Tauri Group analysis indicates a peak of 14,200 direct jobs in 2012 as industry devel-



Saturn's moon Dione captured April 7 by NASA's Cassini

Cassini Snaps Titan, Dione in Double Flyby

New images of the fractured terrain of Saturn's little-visited moon Dione have been snapped by NASA's Cassini spacecraft as the probe performed a double flyby of Dione as well as Titan.

The Titan flyby took place April 5, and the Dione flyby occurred April 7. The flybys were made without any maneuver in between the moons thanks to a fortuitous alignment of the two bodies.

During the Titan pass, an unexpected autonomous reset occurred and Cassini obtained fewer images of Titan than expected. But the cameras were reset before reaching the icy moon Dione, which was the primary target on this double flyby. Cassini has visited Dione only once before, in October 2005.

Cassini swooped down to within about 500 kilometers of Dione's surface. The new raw images of Dione show the moon's fractured terrain and craters big

and small.

Scientists are poring over data from Dione to discern whether the moon could be a source of charged particles to the environment around Saturn and material to one of its rings. They are also trying to understand the history of dark material found on Dione.

Cassini had made three previous double flybys, and another two are planned in the years ahead. The mission is nearing the end of its first extension, known as the Equinox Mission. It will begin its second mission extension, known as the Solstice Mission, in October. One of the last planned activities of Cassini at the end of the Solstice Mission is to fly into an orbit between Saturn and its rings in an effort to determine how much mass is in the rings, which will help scientists determine the rings' age.

ops crew capsules, human-rated rockets, upgrades launch infrastructure at Cape Canaveral, Fla., manufactures launch vehicles and conducts demonstration launches.

In a pair of separate announcements, the Commercial Spaceflight Federation announced that Raytheon Company and Jacobs Technology, a division of Jacobs Engineering Group Inc., had joined the Washington-based advocacy group as associate members.

Garnett Stowe, Raytheon vice president of national intelligence programs and space, said in an April 14 statement that commercial spaceflight "is a growth area" for Raytheon's space sector, while Jacob's Lon Miller called commercial human spaceflight "an exciting, rapidly emerging industry."

Advanced PAC-3 Intercepts Target in White Sands Test

An advanced version of the Patriot Advanced Capability-3 (PAC-3) missile intercepted a target simulating a tactical ballistic missile in a recent test conducted at the U.S. Army's White Sands Missile Range, according to an April 13 press release from Aerojet, the Sacramento, Calif.-based company that provided the advanced solid rocket motor propulsion system for the rocket.

The PAC-3 Missile Segment Enhancement missile used in the guided test flight is meant to give the interceptor more range and maneuverability against faster and more sophisticated ballistic and cruise missiles.

NASA Construction Contract Awarded to Alabama Firm

NASA's Stennis Space Center near Bay St. Louis, Miss., has awarded an indefinite-delivery, indefinite-quantity contract to Decatur, Ala.-based M&D Mechanical Contractors Inc. to provide general construction services at the rocket-testing center, the U.S. space agency said April 12.

The five-year contract is worth up to \$25 million and covers maintenance, repair, alteration, civil and mechanical engineering, piping and structural fabrication and erection, and electrical work.

NASA Picks 5 Firms for Aerospace Vehicle Work

NASA's Langley Research Center has selected five companies to support analytical and experimental research and technology development primarily for aerospace vehicles, the Hampton, Va.-based field center announced April 13.

The companies selected to support Langley under the five-year, \$400 million Structures, Materials, Aerodynamics, and Acoustics Research and Technology contract are: Analytical Services & Materials Inc. of Hampton, Va.; ATK Space Systems of Beltsville, Md.; The Boeing Co. of Huntington Beach, Calif.; Lockheed Martin Aeronautics Company of Palmdale, Calif.; and Northrop Grumman Corp. of Los Angeles.

Retrograde Planets Test Formation Views

Several extrasolar planets have been discovered to be orbiting backward — that is, they revolve in the opposite direction that their host star rotates — challenging accepted ideas of how planets form, according to the astronomers who made the discovery.

"This is a real bomb we are dropping into the field of exoplanets," said team member Amaury Triaud, a doctoral student at the Geneva Observatory in Switzerland.

The team announced the discovery of nine new transiting exoplanets April 13 at the annual meeting of the Royal Astronomical Society in Glasgow, Scotland. Transiting exoplanets are ones that were discovered as they passed in front of their host star from the perspective of Earth, causing a dip in the light coming from that star.

When the new results were combined with earlier observations of 18 other transiting planets, the astronomers were surprised to find that six out of that larger sample of 27 exoplanets were orbiting in the opposite direction of the rotation of their host star, called retrograde motion — the reverse of our solar system. Astronomers first discovered a backward-orbiting exoplanet in August 2009.

The new finding suggests that astronomers might have to revise some aspects of planet formation.

Planets are thought to form in the disc of gas and dust that surround a young star. This protoplanetary disc rotates in the same direction as the star itself, and it was thought that any planets that formed out of the disc would revolve in that same direction.

The planets found in the new study are so-called hot Jupiters, which are Jupiter-size planets that orbit very close to their parent stars, experiencing extreme temperatures. It was originally thought that hot Jupiters formed far from their star and migrated inward over a few million years as a result of gravitational interactions with the disc of dust from which they formed. But this theory doesn't account for the new observations, the team said.

To explain the retrograde motion of the six exoplanets, the hot Jupiters may have migrated in due to the gravitation tug-of-war between them and more distant planetary or stellar companions over the course of hundreds of millions of years. After these disturbances have bounced a giant exoplanet into a tilted and elongated orbit, it would suffer tidal friction, losing energy every time it swung close to the star. It would eventually become parked in a near-circular, but randomly tilted, orbit close to the star.

"The new results really challenge the conventional wisdom that planets should always orbit in the same direction as their star's spin," said team member Andrew Cameron of the University of St. Andrews in Scotland.

Suborbital Training Center Gets FAA Safety Approval

The U.S. Federal Aviation Administration (FAA) Office of Commercial Space Transportation granted April 7 the National Aerospace Training and Research Center (NASTAR) a safety pre-approval that permits the Southampton, Pa.-based firm to offer FAA-qualified training services to prospective suborbital space launch operators.

"The Safety Approval we have granted to NASTAR is the first safety approval issued by the FAA for a suborbital spaceflight training system," George Nield, FAA associate administrator for commercial space transportation, said in a statement.

NASTAR operates a space training simulator, STS-400, that the FAA says is capable of replicating the G-forces associated with subor-

bitual spaceflight. The FAA Safety Approval Order is effective until April 2015. According to the FAA Web site, "A safety approval enables launch and reentry vehicle operators to use an approved safety element within the scope specified in the safety approval without the FAA re-examining the element in a license or experimental permit applications."

Meanwhile, a Phoenix-based group called Astronauts4Hire is eager to take advantage of NASTAR's training services. The group announced April 12 it had selected 11 initial astronaut candidates from industry and academia to train and subsequently work for private firms conducting research aboard suborbital spacecraft, such as Virgin Galactic's SpaceShipTwo, which recently flew its first captive-



STS-400 space training simulator

carry flight test.

Astronauts4Hire is trying to raise \$40,000 to pay for the astronaut candidates to participate in NASTAR's three-day Suborbital Scientist Training program. As of April 13, the group had raised \$25 from one contributor. Astronauts4Hire is accepting donations through its Web site until Nov. 1.

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Media Partner:



April 19, 2010

Europe May Order Two More ATVs To Fill Space Shuttle Void

PETER B. de SELDING,
BREMEN, Germany

Managers of Europe's unmanned space station Automated Transfer Vehicle (ATV) cargo-delivery spacecraft are expected to decide this year whether to order a sixth and seventh ATV as they position the program to take on greater importance with the retirement of the U.S. space shuttle.

The ATV-2 is scheduled to leave its assembly facility here in May for transport to Europe's Guiana Space Center in French Guiana to prepare for launch aboard an Ariane 5 rocket in December.

The inaugural ATV flight in mid-2008 was considered a success. ATV-2 nonetheless has been subjected to about 30 modifications to reinforce weaknesses that were noticed during that flight, and to increase its payload-carrying power.

ATV upgrades that increase its payload without increasing its total launch weight, coupled with a lighter, welded-joint enhancement to the Ariane 5 rocket's strap-on solid-rocket boosters that allow the rocket to lift heavier loads, will permit ATV-2 to deliver 6,600 kilograms of fuel, air and dry cargo to the space station — 40 percent more than the first ATV carried.

Nico Dettmann, ATV-2 program manager at the 18-nation European Space Agency (ESA), said the experience of the first ATV also will enable ESA to reduce the time needed to prepare ATV-2 for launch and to dock it to the space station once it separates from the



NASA IMAGE

Managers are expected to decide this year whether to order a sixth and seventh ATV (first ATV shown above docked to the ISS) as they position the program to take on greater importance with shuttle retirement.

Ariane 5 rocket.

ATV teams needed eight months of preparation once the first vehicle arrived at the launch site. ATV-2 will need just six months. To ease the concerns of NASA and the other space station partners about the safety of the 20,000-kilogram ATV as it moved toward the station, the inaugural mission was put through a month-long series of collision-avoidance and start-and-stop maneuvers before the successful docking.

ATV-2 will need no more than

eight to 11 days in orbit before attaching itself to the Russian end of the orbital complex.

Ten ESA governments, led by Germany, France and Italy, paid about 1.1 billion euros (\$1.5 billion) to manufacture and launch the first ATV in a multiyear development program that encountered numerous delays and cost overruns. The agency has ordered four other ATVs so far, with each mission budgeted at around 425 million euros including launch and operations.

The development of the first ATV was led by Astrium Space Transportation of Les Mureaux, France, because France paid nearly 50 percent of the program's development budget. But Germany is financing nearly 50 percent of the cost of the serial production of ATV, so the integration and test of the vehicles are done at Astrium's facility here. Several major French manufacturers of ATV parts have been replaced by German manufacturers.

The transfer of control from France to Germany has added to the normal program personnel turnover that has also occurred at ESA. In a presentation at Astrium's ATV integration facility here April 13, Dettmann said about 60 percent of ESA's current ATV-2 team is new to the program.

The proposal by the five space station partners — the United States, Russia, Europe, Japan and Canada — that the orbital complex's life be extended to 2020 from 2015 opens new possibilities for ATV that ESA governments will be asked to consider this year. The first is whether to purchase a sixth and seventh ATV for launch starting in 2014 or 2015.

With the U.S. space shuttle scheduled for retirement late this year, the ATV will be the most powerful delivery vehicle visiting the station. It also is the only vehicle in operation with enough power to de-orbit the station when its retirement date arrives, whether in 2020 or later.

ESA has ordered five ATVs so far, and the contracting team led

by Astrium Space Transportation up to now has made good on its promise to be able to produce about one ATV per year. ATV-2 was originally scheduled for launch in mid-2010 but was delayed for six months because of defects found in its latch valves. There are 48 of them on each ATV, and they had to be redesigned and then requalified for flight.

Aside from this delay, ATV-3 is on track for delivery in late 2011, with ATV-4 and ATV-5 to follow at one-year intervals.

ESA is providing ATV services to the station in lieu of paying cash to NASA for Europe's 8.3 percent use of the station's common resources for the European Columbus laboratory attached to the station.

The ATV upgrades, and its annual launch rate, will mean it can carry more fuel and other supplies to the station than what is needed to fulfill Europe's obligations to NASA as the station's general contractor. European officials have invited NASA to consider whether it wants to avail itself of this capacity, but no agreement has yet been made. NASA has contracted with two commercial suppliers in the United States, who are building ATV-type vehicles of their own, for station resupply starting in 2012.

Olivier de la Bourdonnaye, ATV program manager at Astrium, said April 13 that the company and its subcontractors will be submitting a contract proposal for ATV-6 and ATV-7 later this month.

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Orbital Likely To Use COTS Funding Boost To Augment Taurus 2 Rocket Tests

DEBRA WERNER,
COLORADO SPRINGS, Colo.

If Congress approves NASA's plan to add \$300 million to its 2011 budget to develop commercial cargo delivery systems for the international space station, Orbital Sciences Corp. likely would use its share of the funding to augment ground testing of its planned medium-lift Taurus 2 rocket and possibly conduct an additional test flight of the vehicle, according to David W. Thompson, Orbital's chairman and chief executive.

Orbital is slated to conduct a single demonstration flight of its Taurus 2 rocket and Cygnus cargo capsule next spring under NASA's Commercial Orbital Transportation Services (COTS) program. The company would then fly eight cargo-delivery missions to the space station through 2015 under a separate \$1.9 billion Commercial Resupply Services contract.

The additional test flight would loft an instrumented test payload rather than the Cygnus module, Thompson said. The test package "would better define the

physical environment for the payload and prove out the rocket before we go all the way" to the space station, he added.

Although no firm plans will be made until the budget is approved, Orbital has evaluated how any COTS budget increase could be used to reduce program risk and accelerate program milestones.

During a media briefing April 13 here at the National Space Symposium, Thompson and other Orbital executives said they were not consulted by NASA on boosting the budget of the COTS program, which is currently valued at \$500 million. That money is being divided between Dulles, Va.-based Orbital and Space Exploration Technologies of Hawthorne, Calif., both of which are contributing funding to develop their respective cargo-delivery systems.

Thompson said the proposed COTS budget increase follows logically from U.S. President Barack Obama's plan to continue operation of the space station through 2020, adding that once that decision was made, reliable cargo transportation became "even more important."

To date, COTS and follow-on Commercial Resupply Services flights account for the entire Taurus 2 manifest. But Orbital began developing the vehicle before it signed its COTS agreement to fill what company officials characterize as a gap in U.S. launch capabilities following the impending retirement of the Delta 2 medium-lift rocket.

Thompson said he expects Taurus 2 to begin launching for other customers, including NASA's Earth science program and the national security community, in 2013, possibly sooner.

Antonio Elias, executive vice president and general manager of Orbital's Advanced Programs Group, said Taurus 2 would support the national security community by launching what he called "disaggregated" missions. Typically, the U.S. national security community flies large satellites with numerous sensor payloads, but Elias said there is a trend toward dividing that payload set and flying the sensors on separate, smaller satellites.

Orbital has room on its Taurus 2 manifest to add two to three flights a year in addition to the

space station resupply missions, said Ronald Grabe, executive vice president and general manager of Orbital's Launch Systems Group.

Orbital plans to launch the Taurus 2 rocket from NASA's Wallops Flight Facility on Wallops Island, Va. The company is expanding the launch pads and ground infrastructure at Wallops to prepare for those flights, Grabe said.

The Taurus 2 includes a first-stage core design by Ukrainian rocket builders Yuzhnoye and Yuzhmash, a first-stage engine built in Russia but modified by Aerojet of Sacramento, and a stage-two motor built by Alliant Techsystems of Minneapolis.

Orbital's Cygnus module, meanwhile, is designed to deliver 2,000 kilograms of cargo to the international space station. Once on orbit, the cargo-carrying vessel, being built by Thales Alenia Space of France and Italy, would be propelled to the space station by the Orbital-built Common Service Module. Once its cargo is unloaded by space station astronauts, the module would undock and be guided back into the atmosphere, where it would burn up upon re-entry.

Elias said Orbital could develop a Cygnus variant capable of returning space station cargo safely to Earth within two years if asked to do so by NASA. He said that vehicle would have to be equipped with heat shielding and parachutes, and that the extra weight of those items would reduce by half the amount of cargo it could deliver to the space station.

"You don't use that configuration unless you absolutely, positively need that return cargo," Elias said. He said a company analysis of the type of return cargo that would be valuable enough for NASA to give up 1,000 kilograms of cargo-to-station delivery capacity identified only one item: the suits astronauts wear during spacewalks.

The re-entry module under discussion is not designed to carry astronauts to and from the space station. Orbital will not be able to provide information on the cost and capability of a commercial crew vehicle until the company knows how NASA would structure the procurement of such a spacecraft and what the requirements would be, Elias said.

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April 19, 2010

Arianespace Takes Timeout To Scrutinize Quality Control

PETER B. de SELDING, PARIS

Europe's Ariane 5 rocket likely will be grounded until May as the Arianespace launch consortium investigates a helium-pressurization issue that stopped the most recent launch attempt and conducts a parallel inquiry into quality control following delays affecting the last two launch campaigns, Arianespace Chief Executive Jean-Yves Le Gall said April 16.

The Evry, France-based company has created a board of inquiry and a separate, outside committee to review overall quality control following three postponements of the first Ariane 5 launch in 2010 and a similar series of delays in last December's launch of France's Helios 2B reconnaissance satellite.

The latest launch cancellation occurred April 9 less than a minute before the scheduled liftoff, when the helium tank that keeps the Ariane 5 rocket's main cryogenic stage pressurized showed a pressure level that was outside of permissible bounds.

A similar problem occurred in Decem-

ber and was determined to have been caused by a small leak in the helium-pressurization system. Helium is used to maintain pressure in the Ariane 5's main stage tanks that hold the liquid hydrogen and liquid oxygen the rocket burns on its way to orbit. The Helios 2B satellite was successfully launched on Dec. 18, nine days after the problem was discovered.

In an April 16 interview, Le Gall said the company has identified the defective part in the April 9 postponement as a helium pressure regulator that adjusts pressure between the Ariane 5's helium tank and its feed lines. An unacceptably high pressure reading in the feed lines forced the automatic shutdown of the April 9 launch sequence.

Le Gall said the regulator was removed from the Ariane 5 at the Guiana Space Center spaceport in French Guiana and returned to its manufacturer in Italy the week of April 12. He said the problem is unlikely to be related to the device's design insofar as it has been used on 49 previous launches without incident.

The task force looking into the issue

made an initial report April 16, but a more-precise estimation of when the Ariane 5 will resume its launch campaign will await further review the week of April 19, he said.

Nonetheless, Le Gall said the launch is unlikely to occur before the first half of May. While it will be Arianespace's first Ariane 5 launch of the year, the company still plans seven launches in 2010 and likely will shorten or eliminate a planned mid-summer break to reach the target. "Recall that we launched nine times between August 2007 and August 2008, so performing seven campaigns this year, even starting in May, is certainly within our reach," Le Gall said.

The separate quality-control audit being managed by outside experts will determine if any of Arianespace's procedures needs review following the series of launch postponements.

"In light of what happened with the Helios 2B delays and now these recent postponements, I would like to have an outside team look at our practices to see where we can improve," Le Gall said April 12. "There have been a few too many issues of late.

What I am expecting is at least a preliminary set of conclusions from the quality audit before we proceed with the launch."

In addition to its Ariane 5 schedule, Arianespace is preparing for the inaugural launch — now expected no sooner than late September — of the European version of Russia's Soyuz rocket from the Guiana Space Center.

The helium-pressure anomaly discovered April 9 forced a third postponement of the launch of the Astra 3B commercial direct-broadcast television satellite, owned by SES of Luxembourg, and the COMSATBw-2 military telecommunications satellite to be operated by the German Defense Ministry in partnership with a commercial consortium made up of Astrium Services and ND Satcom, both of Europe.

The two satellites have been insured for a total of more than \$700 million, making it the most highly insured commercial launch mission ever, according to insurance officials.

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USTR Criticizes Closed International Satellite Services Markets

PETER B. de SELDING, PARIS

The office of the U.S. Trade Representative (USTR) has singled out China, India and Mexico as nations not meeting international commitments to open their domestic satellite services markets and maintain coherent regulatory regimes.

In its annual report on how nations that have signed World Trade Organization and other agreements that liberalize trade in telecommunications hardware and services have met their commitments, USTR elected not to mention regulatory barriers to foreign-owned satellite services in Egypt, Israel and Venezuela.

These three nations, along with China, India and Mexico, were cited by the U.S. Satellite Industry Association in the association's comments to USTR.

The USTR's 2010 "Review of Telecommunications Trade Agreements," dated April, notes that India's satellite services regulations have been an ongoing concern for the United States, which has pressed Indian authorities in the past to open their market to non-Indian satellite fleet operators.

Aside from making their concerns known through satellite associations in the United States and Europe, the satellite fleet operators themselves generally have elected not to raise their voices on India's restricted market, in part out of concern that protests would backfire.

Several satellite fleet operators have been able to enter India in recent years because of that nation's exploding direct-broadcast television market, whose growth has outstripped India's Insat satellite fleet's capacity.

In these cases — when demand cannot be met by India's own satellites — India has authorized the

entry into the market of foreign satellites. But the market access occurs only through the owner of the Insat system, the Indian Space Research Organisation (ISRO), which may add its own cost to the service. ISRO also has on occasion reserved the right to terminate the foreign operator's contract once domestic ISRO-provided satellite capacity is available.

USTR says in its report that Indian regulations ostensibly "mandate non-discriminatory, reasonable access" to cable landing stations in India, but that Indian regulations continue to be difficult to understand and subject to change.

China operates in a similar way, with China DBSat, a satellite operator, assigned the role of gatekeeper to the Chinese market. With the exception of AsiaSat and APT Satellite Holdings, both of Hong Kong, non-Chinese satellite operators are not allowed to offer services directly to Chinese end-users.

Regulatory confusion is a problem in China as in India. "A lack of transparency in the rules governing the provision of satellite capacity in these countries is ... a concern," USTR says. "USTR will continue to raise" the issue with its Indian and Chinese counterparts, the report says.

The problem in Mexico, according to USTR, is the government's insistence that a foreign satellite service provider create a local presence in Mexico before being granted an operating license. Mexico has maintained this requirement despite signing the World Trade Organization's General Agreement on Trade in Services treaty. That treaty includes no requirement for a local presence in return for providing cross-border telecommunications services.

Mexico and India also require operators of mobile satellite servic-

es to install gateway Earth stations on their territories in exchange for landing rights, a requirement that USTR also says is contrary to international trade agreements.

The Satellite Industry Associa-

tion had called USTR's attention to the fact that Egypt, which has its own domestic satellite provider, Nilesat, apparently has no established regulatory regime for satellite services, making it difficult for

foreign providers to operate. Israel's foreign-ownership limits and the requirement of a local presence are contrary to international trade agreements, the association says, while Venezuela, which now has its own domestic satellite system, is favoring that satellite in its market-access regulations.

Formed in 1986 and comprising 24 European member states, EUMETSAT's role is to establish, operate and exploit European meteorological satellite systems. Data from these systems are essential for precise and accurate weather forecasting; they also assist global earth observation and climatological programmes and directly benefit national economies by enabling marine, agricultural, aviation and other industries to plan and act more effectively. Currently the systems include two generations of geostationary Meteosat satellites whose global overview is now complemented by the detailed observations provided by polar orbiting MetOp satellites and Jason-2.



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Closing date: 10 May 2010 (Reference: VN-10/09)



Member states: Austria, Belgium, Croatia, Denmark, Germany, Hungary, Finland, France, Greece, Ireland, Italy, Latvia, Luxembourg, The Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom

April 19, 2010

Space Hardware Firm Doubles Down On Ship Tracking Service

TURNER BRINTON, WASHINGTON

Satellite hardware builder SpaceQuest Ltd. entered the space-based services market with the launch of two ship tracking satellites last year, and has contracted to launch two more satellites for the constellation in December, a company official said.

Fairfax, Va.-based SpaceQuest claims to be the only firm in the world with a global space-based Automatic Identification System (AIS) capability, and two more satellites will allow it to deliver even more-precise ship tracking data, according to Dino Lorenzini, the company's chairman and chief executive. The company plans to launch two additional pairs of satellites in 2011 and 2012.

SpaceQuest was founded in 1994 by Lorenzini and Mark Kanawati, and has delivered satellite platforms, GPS receivers, communications payloads and other space-hardware systems to a variety of government, commercial and academic customers.

The company saw a growing market for machine-to-machine messaging and AIS data transmission so it financed the construction and launch of the AprizeSat-3 and AprizeSat-4 satellites with retained earnings and home equity loans, Lorenzini said in an interview. The satellites were lofted in July 2009 as secondary payloads on a Russian Dnepr rocket out of Kazakhstan. The next two satellites will also launch on a Dnepr, a converted ballistic missile.

AIS originally was conceived

as a way for ships to avoid collisions by providing data on other ships in the immediate vicinity. Any ship weighing more than 300 tons is required by the United Nations to carry an AIS transmitter, which sends out a signal every six seconds with information including the ship's position, direction, speed and contents. Nations also use AIS data to monitor which ships are approaching their coastlines.

The U.S. Coast Guard has a need for a space-based AIS capability to track ships in the middle of the oceans. The service contracted with Orbcomm Inc. of Fort Lee, N.J., to put AIS receivers on six satellites that were launched in 2008. Four of these satellites failed on orbit, but the other two are providing operational AIS data to the Coast Guard and Navy, Orbcomm spokeswoman Jennifer Lattif said in an e-mailed response to questions. These satellites are in inclined orbits that provide coverage between 65 degrees north and 65 degrees south latitude.

Orbcomm is building at least 18 satellites for its next-generation constellation of two-way messaging spacecraft, each of which will have an AIS receiver. The first few of these satellites are slated for launch between December 2010 and March 2011, Lattif said. Other firms have also announced plans to launch AIS satellites.

SpaceQuest's 13-kilogram AIS spacecraft are in near sun-synchronous polar orbits that circle the globe 14 times each day. From this orbit, the constel-



SpaceQuest saw a growing market for machine-to-machine messaging and AIS data transmission so it financed construction and launch of AprizeSat-3 and AprizeSat-4 with retained earnings and home equity loans.

lation covers any given mid-latitude region four or five times a day, Lorenzini said. The satellites are collecting some 460,000 AIS transmissions from 22,000 ships each day. The number of AIS transmissions collected each day should well exceed 1 million after the two new satel-

lites are on orbit, he said.

SpaceQuest has only one customer now paying for AIS data, but it hopes a larger constellation with more-frequent revisits will attract more business from government and commercial customers, Lorenzini said. The company is looking for partners

to integrate its AIS data with other information and create customized screen displays, which will be more valuable to customers than raw data, Lorenzini said.

"The thing we find most interesting is the commodity traders, who are very interested in knowing about the flow of energy around the world," he said. "There's a lot of work being done all the time looking at ships leaving and arriving at various ports, and this gives them some additional insight."

In addition to tracking ships, SpaceQuest hopes to market other capabilities, such as monitoring the levels of propane tanks. There are about 17 million propane tanks in the United States, and many of them are monitored manually by dispatched workers, Lorenzini said. Sensors could be installed on propane tanks that transmit fuel level information up to SpaceQuest's satellites, which would relay that information to a ground station and automatically send a message to the customer.

"We've analyzed some of the data from our propane tank partners, and on average the tanks are still 55 percent filled when they go to fill them," he said. "To be able to get down to 15 or 20 percent with confidence will enable them to make fewer trips."

The company estimates it needs \$3 million to \$5 million to launch the service on a large scale, and it is still looking for an investment partner.

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CSA Begins Studies for First Canadian Microsatellite Launch System

DAVID PUGLIESE, VICTORIA, British Columbia

The Canadian Space Agency is studying the possibility of developing a launch system for microsatellites, a capability that if approved by the government would be a first for the country.

Canada has facilities for launching rockets to suborbital altitudes but has relied on various other nations for launches beyond that. The Canadian Space Agency already has conducted feasibility studies that found it would be possible, but challenging, to develop an indigenous launch capability.

A plan outlining research and development into propulsion systems has now been put forward for Canadian Space Agency (CSA) management to examine, said Eric Dubuc, a manager of technology development at the agency. "We tried to design an R&D program to address very specific and very basic questions regarding those key enabling technologies," Dubuc said. "The next step is waiting for a decision on whether we as an organization decide to move forward on that."

The research and development proj-

ect would be on a subscale but would focus on demonstrating and validating that Canada could develop a propulsion system for its own launch capability, he said. CSA's focus is on a rocket sized to put a 150-kilogram satellite into an 800-kilometer sun-synchronous orbit, he added.

Dubuc said another study also is under way to examine how many microsatellites are expected to be built in the future. In addition, that study will look at the pros and cons of various ways to develop a launcher, dealing with issues such as the value of public and private partnerships in such a venture.

But Dubuc said even if Canada were to proceed — and at this point that is not a given — it could take as much as 10 years before a system was in place. "We're talking a lot of money here and very long time frames," he explained. "Developing a launcher is not easy, it's not trivial."

"There are a lot of unknowns, but we have very good minds in this country to address those. It's just a matter to make sure we do it in such a fashion that we actually build capacity and knowledge

of this."

Dubuc said the CSA study includes an indication of how much it would cost to build a launch system, but he declined to discuss those details.

Kevin Shortt, president of the Canadian Space Society, said the issue of whether Canada should build its own launch system has been discussed on and off since the 1960s. He noted, however, that the CSA's research and development plan for propulsion systems could indicate that this time the space agency is serious about the issue. "Canada could carve out a niche for itself in microsatellite launches," Shortt said, adding that the country's geographic location is ideal for particular launches such as for polar orbits.

But Shortt also said the CSA's estimate of a 10-year development is too long. He noted that there are existing facilities for suborbital launches in Churchill, Manitoba that could be quickly adapted for orbital launches.

In interviews with *Space News*, Canadian space specialists and aerospace industry members appeared divided on whether the country needed its own

launch capability.

Robert Zee, director of the University of Toronto's Space Flight Laboratory, said Canada is totally reliant on other nations when it comes to orbital launches, even though its industry is capable of developing a launch system. "I think it's a valid goal," Zee said of the development of an indigenous launch capability. "As to whether it would have sufficient political backing to see it all the way through to completion, that's another thing."

An indigenous launch capability geared specifically toward smaller satellites would be useful, Zee said.

Dan Goldberg, president of Telesat, the world's fourth-largest fixed satellite services operator, said that he is in favor of more launch capability being available to the aerospace industry.

But he noted that the costs of developing an indigenous launch capability would be very significant. "Unless there's very compelling reasons, it doesn't seem to be a fruitful endeavor," Goldberg said.

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April 19, 2010

Draper, MIT Students Test Lunar Hopper with Eyes on Prize

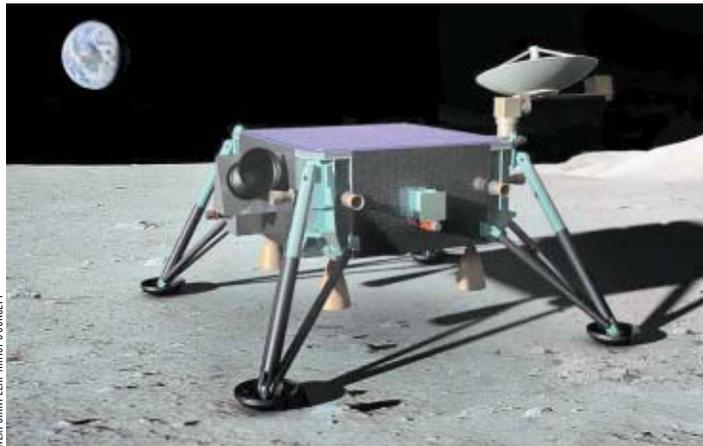
AMY KLAMPER, WASHINGTON

Students at the Massachusetts Institute of Technology (MIT) in Cambridge are testing a prototype planetary explorer that would cover large swaths of alien terrain by hopping from one landing site to another. The testing of the second-generation lunar hopper is being carried out under the supervision of engineers from the nearby Draper Laboratory with an eye toward competing for the Google Lunar X Prize in 2012.

Draper and MIT have been working with Sparks, Nev.-based Sierra Nevada Space Systems and Manassas, Va.-based Aurora Flight Sciences Corp. as part of the Next Giant Leap team, one of 20 vying for the Google Lunar X Prize, a \$20 million purse that will be awarded to the first privately funded group to send a robot to the Moon. To qualify for the prize, the robot must travel 500 meters across the lunar surface and transmit video, images and other data back to Earth.

The team's Moon hopper design is based on existing spacecraft built by Sierra Nevada, while Aurora Flight Sciences is contributing experience gleaned from developing small vertical-takeoff-and-landing aircraft. Draper Lab is offering navigation and control expertise, and the students, led by former NASA astronaut Jeff Hoffman, built the prototype vehicle.

Dubbed the Terrestrial Artificial Lunar and Reduced Gravity Simulator, or Talaris, the Moon hopper prototype uses two propulsion systems, including a primary system using an air-breathing electric ducted fan propulsion system



Next Giant Leap Moon lander

that counters the effects of Earth's gravity. A second cold-gas propulsion system uses impulsive, self-contained propellant to simulate operations in the space environment and will verify Draper Lab's guidance, navigation and control algorithm in reduced gravity.

The four large fans attached to the corners of the hopper counteract five-sixths of the Earth's gravity "such that the cold-gas control system feels like it's operating in a lower-gravity environment like the Moon," said Seamus Tuohy, director of space systems at Draper Lab.

MIT expects to complete initial test flights of the Talaris hopper this summer with the hope that the Earth-bound prototype could lead to a new class of robotic precursors capable of traversing long distances in short periods of time, gathering scientific data and even collecting samples at multiple sites.

Rather than competing with traditional orbiters, landers and rovers, hoppers could complement these vehicles, quickly cover-

ing long distances while carrying scientific payloads.

"It provides an alternate way of doing what I'll call regional science, as opposed to very local science," Tuohy said, using Spirit — the NASA Mars rover that is now bogged down in sand after six years of traversing the red planet — as an example.

"If you look at the rover that just got stuck on Mars after years of operation, one thing I think that's not commonly known is just how little distance it covered. What an achievement it was ... but it only covered kilometers," he said, adding that hopping vehicles are able to traverse much larger areas.

A hopping vehicle also does not require a complex navigation system, because unlike a surface-bound rover, the hopper has no need to navigate over and around craters, boulders or valleys.

"You could go into a crater on the Moon," Tuohy said. "So the places where we're thinking of being able to find and trap water ice on the Moon, among the many

other challenges is [the fact] that these craters are very deep. And sending a rover from the crater edge down into the crater to try to touch the ice is pretty challenging, whereas in a hopper it's just a new landing site."

Moreover, sophisticated navigation and control systems used to negotiate a lander's descent and pick up landmarks at or near the touchdown zone add "a lot of power and a lot of mass" to a spacecraft, Tuohy said. Although a hopper would land in the same manner as a traditional lander or rover, the accuracy of the landing is not as critical, Tuohy says.

"Once you land you can use the navigation systems you have on Earth to locate yourself very precisely," he said, adding that even if the hopper arrives a kilometer or more off target, it would be only "a hop or two" away from reaching that target.

However, the hopper concept does have at least one drawback: The distance it can cover depends on the amount of propellant it can carry.

"The bigger the tank, the bigger the hop, so there is a trade there," he said, adding that the amount of propellant required to fuel the hopper would likely affect the cost to launch it.

Tuohy said Draper and MIT evolved the hopper concept while searching for technical and engineering challenges that could spark student interest in space. Talaris, he said, combines students from a variety of engineering and science backgrounds to study "essentially cool things that haven't been done before."

Although planetary rovers are not new, the hopper concept

could add a new dimension to robotic planetary exploration, one that Tuohy said could inspire a new generation of engineers, technologists and scientists.

"Not that it's getting boring, but there is an established level of technology that is accepted and is mature," he said.

The hopper concept also has the potential to maximize science experiments and observations in a single mission. Because the hopping vehicle is designed to operate in a "very controlled hover-hop" in which it ascends a short distance above the surface and hovers at a consistent altitude to its next landing site, it could conduct experiments or make observations and measurements en route.

"The reason we went this way is you can actually do science along the way," Tuohy said, adding that Draper and MIT have demonstrated Talaris in various stages of completion to officials at NASA's Goddard Space Flight Center in Greenbelt, Md.

"They've given us some kind of hints ... it'd really be neat if you can do science along the way," he said, adding that the hopper concept "actually opened up what we think may be a new operational way of doing science that you couldn't do before, or that you wanted to do before but didn't have the mechanisms to do."

Tuohy said he hopes Talaris and the Next Giant Leap effort will breed confidence in the emerging technology and that "at some point in the near future there would be a funded mission that would incorporate this operational approach of hopping."

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Commercial Spaceflight Seen as a Potentially Lucrative, but Long-term, Investment

DEBRA WERNER, SAN FRANCISCO

A flurry of new commercial space activity is attracting interest from investors seeking to profit from the fledgling suborbital tourism trade and cargo transportation business. Space industry executives and financial analysts caution, however, that some of those opportunities are best suited for patient, long-term investors.

"In terms of making money in the short run, I think the most viable option is some of these space tourist projects where there seems to be a large number of wealthy people who want to go to the edge of space," said Armand Musey, former president of Near Earth LLC, a boutique investment bank in New York.

On March 23, Virgin Galactic's suborbital space tourism plane, the VSS Enterprise, conducted its first test flight attached to its mothership. Virgin Galactic, part of the London-based Virgin Group, is the most well-known in a pack of firms eager to offer paying customers rides in suborbital or orbital vehicles. The company already has signed up more than 300 customers for flights costing \$200,000 a piece. Virgin Galactic states on its Web site that it is not seeking outside investors. In August, Abaar

Investments of Abu Dhabi, United Arab Emirates, bought a \$280 million stake in the company.

The space tourism field also includes XCOR Aerospace and Masten Space Systems, both of Mojave, Calif., Blue Origin of Kent, Washington, and Armadillo Aerospace of Rockwall, Texas. These companies do not list stock shares on major indices, but they do welcome investors. "You can invest \$10,000, \$20,000 or \$100,000 in one of these companies," said Esther Dyson, an investor and entrepreneur with holdings in several space companies including Space Adventures of Vienna, Va., and XCOR.

Armadillo Aerospace sets the initial investment level higher. Armadillo states on its Web site that it is not seeking investors but adds, "If you have millions of dollars you'd like to spend on civilian access to space, we'll listen."

While this type of investment is not attracting institutional venture capital, it does lure patient, long-term angel investors who are eager to participate in and profit from emerging space enterprises, Dyson said. In addition, recent moves by the administration of U.S. President Barack Obama to turn the job of carrying space station-bound cargo and astronauts over to the private sector

will bring more investors to commercial space companies. "If the new NASA budget passes, there will be more investment opportunities and people will be more aware of them," Dyson said.

The 2011 NASA budget proposes spending \$6 billion over five years to seed development of commercial vehicles capable of taking astronauts to and from the international space station. The NASA spending plan also adds \$300 million to an ongoing effort by Orbital Sciences Corp. of Dulles, Va., and Space Exploration Technologies Corp. (SpaceX) of Hawthorne, Calif., to develop and demonstrate spacecraft capable of delivering cargo to the space station. In 2008, NASA awarded SpaceX and Orbital contracts with a combined value of \$3.5 billion to use their resulting vehicles to each deliver a minimum of 20 tons of cargo to the space station through 2016.

These government programs offer concrete evidence that NASA will provide the initial market for commercial space services. "The market is becoming more visible," Dyson said. "Investors can see it."

Peter Diamandis, chairman and chief executive of the X Prize Foundation of Playa Vista, Calif., also believes the Obama administration's proposed budget will draw new in-

vestors to the commercial spaceflight industry. The combination of federal government support and the emergence of new technology that could decrease the cost of space transportation makes the field ripe for long-term investors who can look far ahead to a time when asteroids are mined for precious metals and tourists visit orbiting hotels.

"Not all investors can look that far ahead, but there is a category of investors that recognizes that many of the things we hold in value on Earth — minerals, energy, real estate — are in infinite quantity in space," Diamandis said. In that category of investors, Diamandis places the 1,000 to 2,000 living billionaires. "Some of these people are long-term, patient investors," he said.

Financial analysts including Musey are skeptical of space mining projects. "There are not really any known substances that are worth the cost of going up there to get," he said.

As the cost of space travel drops, Diamandis said, that equation may change. Government support will help to create a competitive market with multiple commercial firms offering space transportation, he said. "There is no question that there is tremendous risk," Diamandis said. "But at the same time, these are huge potential markets."

EARTH SCIENCE and Climate Monitoring

NASA Researchers Aim To Keep 'Infinite CERES' Instrument Going Strong

DEBRA WERNER, SAN FRANCISCO

After more than a decade in orbit, the Clouds and the Earth's Radiant Energy System (CERES), an instrument first launched in 1997, is becoming more useful with each passing year. "Like wine, CERES gets better with time," said Norman Loeb, CERES principal investigator at NASA's Langley Research Center in Hampton, Va. "The longer your data record, the more you learn."

Four CERES instruments are gathering data aboard the NASA Earth-observing system's Terra and Aqua satellites. While those sensors continue to function well, scientists are eager to send up additional instruments to ensure a continuous data record, Loeb said.

Another CERES instrument has been integrated on a NASA-led mission set for launch in September 2011, the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project, known as NPP, said Sean Kelly, CERES program manager for instrument builder Northrop Grumman Aerospace Systems of Redondo Beach, Calif.

The final sensor being built by Northrop Grumman is scheduled for delivery to NASA Langley in 2012, Kelly added. That sensor is expected to fly onboard the National Oceanic and Atmospheric Administration (NOAA) Joint Polar Satellite System (JPSS), a mission that will take on a portion of the climate-monitoring work of NPOESS, a

joint civil and military project canceled by the White House in February. No launch date has been announced for the two JPSS spacecraft. However, the first satellite with CERES onboard is expected to be completed in 2015, according to NOAA's National Environmental Satellite Data and Information Service Web site.

CERES measures solar energy reflected by Earth and Earth's emitted thermal energy, key elements that make up the Earth's radiation budget, an important factor in helping scientists understand the complex global climate system.

Already, scientists have learned about the role clouds play in causing variations in the amount of solar energy reflected and thermal energy emitted from Earth by looking at CERES data in conjunction with measurements from the Moderate Resolution Imaging Spectroradiometer (MODIS), which also flies on both Terra and Aqua. "Coincident observations from CERES and MODIS instruments provided unprecedented data on how variations in the Earth's radiation budget are associated with variations in cloud properties such as cloud height, thickness and amount," Loeb said. "With a 10-year record we are starting to see that."

However, 10 years of data is not enough to give scientists a clear picture of global climate change because of the natural variables. For example, El Niño, a climate pattern associated with changes in Pacific Ocean tem-

peratures, floods and droughts, occurs every three to seven years, causing large fluctuations in cloud and radiation patterns that can mask cloud and radiation changes associated with increasing levels of greenhouse gases. To provide evidence of the ongoing changes in the Earth's climate, CERES needs to gather data over a much longer period of time, Loeb said.

"For climate measurements, we are talking about measuring a few tenths of a degree changes in Earth over decades," said Mark Folkman, Northrop Grumman's director of products and sensing. "To do that, you've got to make well-calibrated measurements for multiple decades."

What's more, CERES is monitoring extremely small changes in the Earth's energy budget that, over time, can lead to serious consequences, including ice caps melting and sea levels rising. One particularly useful aspect of CERES is its ability to help evaluate and refine the computer models used to predict the consequences of global climate change. "If we are going to try to have informed policy decisions, let's make sure those decisions are based on facts," Loeb said.

CERES and its predecessor, the Earth Radiation Budget Experiment, also built by Northrop Grumman, have provided a record of solar, thermal and reflected radiation stretching back to 1984. If all goes well, the CERES instrument being built for JPSS may continue gathering data for a decade or more, which

could carry the program through 2025.

The two CERES sensors launched in 1999 on Terra are providing useful data after more than a decade in orbit, and the two sensors on Aqua, launched in 2002, also continue to function well, Loeb said. The first CERES sensor flew on NASA's Tropical Rainfall Measurement Mission. That instrument collected data continuously for eight months in 1998 before problems with the instrument's power converters forced mission planners to use the instrument only sporadically.

Because of the CERES program's multi-decade, multi-sensor approach, some NASA officials attending a celebration of Terra's 10-year anniversary in December dubbed the program "infinite CERES." That's not entirely accurate, but "it would be great to go on as long as we can," Loeb said.

He compares CERES and its ongoing data-gathering mission to annual medical checkups performed by doctors. Ongoing checkups give doctors a chance to monitor vital signs and identify problems before they become serious. Similarly, CERES provides a long-standing record of the Earth's radiation budget, which helps scientists identify changes in the global climate.

Another suite of instruments designed to provide detailed data on Earth's climate is expected to fly aboard the Climate Absolute Radiance and Refractivity Observatory (CLARREO), a wide-ranging mission recom-

mended by the National Science Foundation's Decadal Survey. CLARREO, which is expected to launch between 2016 and 2019, is designed to improve the accuracy of climate models by collecting data on atmospheric, land and sea-surface temperature, cloud properties, ocean color, solar irradiance and aerosols. In addition, CLARREO will include onboard calibration to obtain highly accurate data records, Loeb said.

Nevertheless, CLARREO will not replace CERES. The two CLARREO satellites will fly in a polar orbit and will not provide the type of daily, global coverage offered by the CERES instruments carried by Aqua and Terra. "You still need CERES to continue," Loeb said. "CERES and CLARREO are complementary."

As Northrop Grumman completes construction of the CERES instrument ordered for the NPOESS program, company engineers are looking for ways to improve the technology for future sensors. Much of the CERES technology was developed during the 1990s, so it is a good time to modernize the instrument, Folkman said.

"In the process of modernizing, we want to be careful that we don't have any discontinuity in the data record," he added. "It's an interesting challenge to improve the measurements, improve the noise performance with new technology, without making a change that causes you to lose your baseline."

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GLOBAL SNAPSHOT

Location: The border of Namibia and the Republic of South Africa

Data gathered by: NASA's Earth Observing-1 (EO-1) satellite

Instrument used: Advanced Land Imager

Source: NASA's Earth Observatory Web site with data from the NASA EO-1 team and the U.S. Geological Survey

Greening the Desert

The Orange River serves as part of the border between Namibia and the Republic of South Africa. Along the banks of this river, roughly 100 kilometers inland from where the river empties into the Atlantic Ocean, irrigation projects take advantage of water from the river and soils from the flood plains to grow produce, turning parts of a normally earth-toned landscape emerald green.

The Advanced Land Imager on NASA's Earth Observing-1 satellite captured the true-

color image (at right) on Feb. 15. A network of bright rectangles of varying shades of green contrasts with surroundings of gray, beige, tan and rust. Immediately south of a large collection of irrigated plots, faint beige circles reveal center-pivot irrigation fields apparently allowed to go fallow.

Namibia is Africa's most arid country south of the Sahara Desert, according to the United Nations Environment Programme. Even though South Africa has a generally temperate climate, 65 percent of the land is too arid to support agriculture. Irrigation projects such as this support agriculture that rainfall alone could not sustain.

This irrigation project occurs along a section of the Orange River where the waterway turns north on its general westward path to the sea, and the area is not far from the eastern margin of the Namib Desert. Grapes are the primary agricultural product of this area. Thanks to local climatic conditions, grapes from Namibia are often ready for market two to three weeks before those of the main grape-producing regions of South Africa's cape.



COMMENTARY

< EDITORIAL >

Fueling Innovation

The technical wizards behind last May's fifth and ostensibly final servicing mission to NASA's Hubble Space Telescope have been keeping busy planning an in-orbit satellite refueling demonstration that with a little luck — and support from the agency's upper echelons — could be blazing an important trail by this time next year.

Engineers at NASA's Goddard Space Flight Center are working to meet an end-of-the-year schedule for delivering 300 kilograms of experimental flight hardware to Cape Canaveral, Fla., for delivery to the international space station. The hardware consists of a mock satellite and the tools needed to demonstrate that controllers in Houston can command the space station's specially equipped robotic arm to grapple and refuel a satellite with inert propellant to specified volume and pressure level. Astronauts onboard the space station will have no part in the experiment beyond that of passive observers.

Preparations for the demo, including building and testing the necessary hardware, are being led by the Space Servicing Capabilities Office established at Goddard last year to preserve the expertise NASA has built up through a half-dozen satellite repair missions, starting with a 1984 space shuttle mission to retrieve and repair the ailing Solar Maximum Mission spacecraft.

The engineer in charge of that pioneering mission, Goddard's Frank Cepollina, went on to lead the first Hubble repair mission in 1993 as well as three subsequent service calls to the popular telescope. Perhaps more significantly, it was Mr. Cepollina and his team of engineers who just a few years ago expended considerable brainpower — not to mention funding — figuring out how to repair Hubble without astronauts follow-

ing NASA's decision to cancel a shuttle mission that had been planned for that purpose. The team took the proposed robotic servicing mission through preliminary design review before NASA reversed course and reinstated the shuttle mission.

Today Mr. Cepollina runs the Space Servicing Capabilities Office as a Goddard deputy center director, where he continues to champion on-orbit satellite repair and refueling.

"The time for study is over," Mr. Cepollina said at a NASA-sponsored satellite servicing workshop in Maryland in March. "We have now got to move forward."

Moving forward, at this point, depends on Mr. Cepollina and his government-industry team finding a suitable launch to the space station for the demo hardware, which is designed to be mounted to an Express logistics pallet on the station's exterior.

The ideal vehicle is the space shuttle. But with the experiment hardware not expected to be ready to leave Goddard until the end of the year, the only way Mr. Cepollina's team will be able to hitch a shuttle ride is if at least one of the three remaining orbiter flights slips into 2011, or if the White House or Congress directs NASA to fly more shuttle missions. Under either scenario, making room for Mr. Cepollina's payload should be treated as a high priority. After all, satellite servicing has at least as many near-term applications as the 135-kilogram humanlike helper robot that NASA is planning to launch to the space station this fall on the shuttle's last scheduled flight.

Besides shuttle, relatively near-term options for getting the demo gear to the space station are Japan's H-2 Transfer Vehicle and Space Exploration Technologies Corp.'s

Dragon capsule, both of which offer the unpressurized flight accommodations the hardware needs.

But an even more pressing issue is funding.

Congress established Mr. Cepollina's office with a \$20 million earmark for 2009 and \$50 million for 2010, money that has been used to build flight hardware and conduct ground-based tests.

NASA's 2011 budget proposal currently before Congress is awash with technology money. Some of it should be used to finish and fly the space station-based satellite refueling demo and to allow Mr. Cepollina's team to get started on the next step: showing that satellites operating 36,000 kilometers from Earth in geosynchronous orbit — the operating location of most communications spacecraft — also can be refueled and repaired.

By some estimates, operational satellites commonly forfeit two or three years of productive and potentially lucrative service life in order to preserve enough fuel to boost themselves into higher disposal orbits where they won't pose a threat to other satellites.

The follow-on demo the Goddard group has in mind entails building and launching a robotic spacecraft to boost one or two failing geosynchronous satellites into graveyard orbits to prove the servicing craft's rendezvous and grappling capability. Having demonstrated this, the craft could then be sent on to replenish the nearly empty tanks of an otherwise healthy spacecraft to extend its useful life.

Surely there's a commercial operator — and perhaps the U.S. Defense Department as well — that has a satellite or two that fits the bill.

LETTERS

Much to Learn in Mars Sample Return

The Mars sample return (MSR) mission being investigated by NASA's Jet Propulsion Laboratory is a fundable module that provides a golden opportunity to accomplish several crucial goals of the piloted mission to Mars within one compact mission.

The mission development time is consistent with readying the nuclear rocket for MSR propulsion. This would validate nuclear propulsion for the piloted mission to Mars and is a perfect opportunity to incorporate biological samples in the MSR mission, which would expose selected flora and fauna to the Mars journey environment and provide a base for the piloted mission requirements.

The overriding challenges of MSR are landing, scooping up the sample, transferring to the ascent vehicle, reaching Mars orbit and handing off the sample to the orbiting Earth return vehicle, then returning to Earth orbit and to Earth's surface. This architecture is fraught with risk, but some can be mitigated.

Upon reaching Mars, an economical method to enter Mars orbit is via aerodynamic capture, whereby repeated "dipping" into the atmosphere produces drag to lower the apogee. Mars is known to be subject to global dust storms, and if the aero-capture process is then occurring, it is fairly simple to scoop up samples of the dust-laden upper atmosphere and return that to Earth, thereby avoiding the landing, sampling and return to Mars orbit (which still would need to be addressed in readiness for the piloted Mars mission).

All in all, MSR is presenting an outstanding opportunity to reduce risk to the piloted Mars mission.

*Ernest Y. Robinson,
Retired nuclear engineer, Aerospace Corp.
Altadena, Calif.*

SPACE SHOT

"So the point is what we're looking for is not just to continue on the same path — we want to leap into the future; we want major breakthroughs, a transformative agenda for NASA."

Barack Obama
U.S. President

in an April 15 speech at Kennedy Space Center, Fla.

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April 19, 2010

Human Spaceflight: Diversify the Portfolio

◀ S. ALAN STERN ▶

The American people expect big things from our nation's human spaceflight enterprise.

Tragically, however, for the past 20-plus years, our country's civil human spaceflight effort hasn't been able to deliver big things, such as achieving historic exploration milestones at far-away destinations or dramatically advancing the cause of easy human access to near-space locales.

Instead, human spaceflight in the United States has struggled just to keep its sole domestic transportation system — the space shuttle — flying a few times per year, and to complete the assembly of its sole destination — the international space station. And new programs, with names such as the Orient Express, the Space Exploration Initiative, the Orbital Space Plane and now Orion/Ares, in every case became politically or fiscally unsustainable, yielding only hallucinations for space exploration. This is something we must change if the

United States is to lead in space.

One longstanding characteristic of human spaceflight efforts in the United States is that they have consistently revolved around a monolithic architecture-destination combination that requires the efforts of tens of thousands of individuals and consumes virtually the entirety of NASA's human spaceflight development budget. But it's no secret that if you own only one stock, you probably deserve what you get when it's in trouble.

By contrast, in NASA's science program, which I formerly directed, dozens and dozens of concurrent spaceflight projects are always in development, from brief suborbital missions, to small Earth orbiters, to small-, medium- and large-scale planetary missions, to vast multibillion-dollar efforts such as Cassini, Hubble and the James Webb Space Telescope that require thousands of individuals to develop.

The diversity of NASA's science mission portfolio is one of

its great strengths — for no single mission, no individual development, no single charge number, and no single launch, risks the fate of the entire program.

This diversity of science mission efforts, just like the diversity in other forms of aerospace development — from airliners to missiles, to combat aircraft to transports — is a trait that civil human spaceflight could well benefit from.

Fortunately, in President Barack Obama's vision for NASA, we already see the seeds of a diversified portfolio for human spaceflight. In its 2011 NASA budget request, the Obama administration requests funds to use multiple human-carrying suborbital vehicle designs to conduct research and education missions, and to initiate two or more systems to transport crew to the international space station.

Such multipronged efforts promote competition, drive innovation and design diversity, and give the government valuable

cost-control options that monolithic (single-legged) transportation access does not. Multiple efforts also provide a kind of robustness in the event of accidents that domestic human spaceflight has never before enjoyed.

The administration should be commended for this fresh and promising approach, and Congress should endorse it in the authorization and appropriation processes.

But could that same approach be further extended to human exploration of the solar system?

There are no laws of man or physics that require human exploration systems to cost tens of billions of dollars and take multiple decades to field. Indeed, there is now ample empirical evidence that old-style, Apollo-like development practices today produce more commotion than forward motion, and have only stymied the pace and achievement of human space exploration.

What we need now is more

than just a flexible path. We need parallel paths.

To be more specific, we need to be funding a diverse suite of individually lean but exciting human space exploration efforts, perhaps fielded by different NASA centers as we do in robotic spaceflight. These efforts should be aimed to put in place simultaneous projects involving lunar and asteroid exploration, high Earth orbit and Lagrange point servicing, and perhaps the first forays to fly by the planets with humans.

Of key importance to successfully exploiting this approach is the recognition that these new systems — developed in most cases via nontraditional "New Space" economic practices — cost pennies to dimes on the dollar compared with the old-style, "so big they always fail" human spaceflight efforts. As just one example, Burt Rutan's Scaled Composites invented and fielded a

SEE STERN PAGE 21

The Tipping Point

◀ RIKI ELLISON ▶

U.S. President Barack Obama recently announced a strategic arms control agreement with Russia in which he refused to give in to demands of limitations on U.S. missile defense, thereby reaching the tipping point of a successful mutual conclusion with Russia on reducing strategic weapons and platforms. The defiance to include limitations on U.S. missile defense is similar to President Ronald Reagan's stance on missile defense with the former Soviet Union in 1985. This gives the United States a significant tool to defend national security and protect our troops and allies in the Middle East and Asia from current and future missile threats by North Korea and Iran. These efforts also can be applied to stabilize future international crises driven by proliferation.

A new concept called "shared deterrence" was put forth by Marine Corps Gen. James Cartwright, vice chairman of the Joint Chiefs of Staff, at the 8th annual U.S. Missile Defense Conference in Washington as a replacement for the current extended deterrence policy of the U.S. nuclear umbrella. This new concept has a proposed mixture of defense, with one of those defensive elements being missile defense assets from both the United States and allied nations. Non-nuclear offense is included in this mixture and combined with its defensive counterpart makes the case for deterrence much stronger and more credible to proliferating nations such as North Korea and Iran. Shared deterrence is especially important when dealing with Iran, a nation that may not be dissuaded or deterred by U.S. nuclear force or conventional military strength.

A version of shared deterrence is in play today in the case of nuclear-capable North Korea. It has been inherent in the prevention of Japan and South Korea from taking pre-emptive military action or becoming nuclear in order to respond to threats from North Korea. The ability of the United States to provide defenses through shared deterrence to its partners and friends in the Middle East, including the western Persian Gulf states, Saudi Arabia, Egypt and Israel, is critical for the deterrence of Iran, the security of the United States and regional stability in a future where a nuclear Iran is a foreseeable reality.

Placing no limits on U.S. growth of mis-

sile defense so as not to upset the "balance of nuclear terror" between the United States, Russia and possibly China, while continuing to live in a proliferating world?

U.S. taxpayers are spending around \$10 billion a year on missile defense, which is equal to less than 2 percent of the total defense budget. They also have paid close to \$6 billion over the past decade on developing the Airborne Laser, a directed energy defensive weapon that recently intercepted and destroyed two ballistic missiles. The cost of firing the current Airborne Laser, a single-beam system that has the capability to fire multiple shots, is ap-

proximately \$70,000. That is 28 times less than the cost of firing the least-expensive, currently deployed short-range missile defense interceptor, the PAC-3, and 700 times less than the currently deployed long-range ground-based interceptor.

Only 1 percent of the annual funding for missile defense now goes to the Directed Energy Research program, which the Airborne Laser and other laser systems fall under. Why would our nation not vigorously pursue, develop and eventually deploy this revolutionary cost-efficient technology, instead of cutting the program and

reducing it to a technology experiment? In the military world of offensive and defensive systems, defense always costs more than offense. When a technological change allows the defense to become cheaper and more numerous than the offense, the offensive system becomes ineffective. It would seem that the current amount of tax dollars invested in our nation's directed energy development programs does not reflect the future cost benefits, let alone revolutionary game-changing technology, that it could provide. At only 1 percent of the missile defense budget, directed energy is not adequately funded, and as such its development and deployment will be slowed considerably.

With a cost-efficient land-, sea-, air- or space-based chemical or solid-state laser technology developed and deployed, could we not make ballistic missiles obsolete? Could we not share that technology to ensure that no one lives under the terror of nuclear ballistic missiles that we continue to live with today and into tomorrow? When President Reagan first introduced the idea of missile defense, he stated, "We seek neither military superiority nor political advantage. Our only purpose — one all people share — is to search for ways to reduce the danger of nuclear war." Those comments are as true today as they were in 1983. A tipping point for our nation and the world is within President Obama's grasp.

With a cost-efficient land-, sea-, air- or space-based chemical or solid-state laser technology developed and deployed, could we not make ballistic missiles obsolete?

Placing no limits on U.S. growth of missile defense in follow-on Strategic Arms Reduction Treaty (START) talks provides a significant opportunity that opens the core debate about the revolutionary technology being developed to destroy ballistic missiles in flight. Does the United States continue to press forward technologically to eventually eliminate the threat of ballistic missiles, as was put forward by President Reagan 27 years ago, to provide a parallel path or hedge for President Obama and the global arms control community to achieve and sustain global zero? Or does the United States hold to a self-imposed

Riki Ellison is chairman and founder of the Missile Defense Advocacy Alliance (www.MissileDefenseAdvocacy.org).

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ON THE MOVE



Northrop Grumman Corp., Woodland Hills, Calif., appoints **PAUL K. RUSSELL** (above) vice president of the newly created space business area within the company's navigation systems division.

In his new roll, Russell is responsible for overall leadership of the division's inertial measurement unit programs and products for space applications.

Russell joined Northrop Grumman in 2005 as director of the company's Azusa, Calif., site, where he was responsible for oversight of all functional activities and facilities.

JEAN-MAX PRATX is appointed chief executive officer of Thales Alenia Space ETCA, a Charleroi, Belgium, subsidiary

of Thales Alenia Space.

Since 1987, Pratz has held various positions within Thales Alenia Space, including vice president of on-board electronics from 2004 to 2010. He previously worked at Thales Alenia Space ETCA from 2003 to 2004 as industrial director.

EDDIE KATO is appointed senior vice president of sales and marketing for Thales Alenia Space's telecommunications activities based in Cannes, France. Kato succeeds **OLIVIER BADARD**.

Prior to his appointment Kato was vice president and general manager for the Asia Pacific Region, where he headed the marketing and sales activities.

Norsat International Inc., Vancouver, British Columbia, appoints **TREVOR GREENE** chief financial officer. Greene succeeds **EUGENE SYHO**, who will remain on board during a transition period and then will be leaving to pursue other opportunities.

Greene, a chartered accountant, has worked for Ernst & Young Chartered Accountants since 2005, and has obtained substantial experience in financial reporting of both Canadian and U.S. publicly listed companies.

Comments: Tom Wiseman, twiseman@spaceneews.com

STERN FROM PAGE 19

fledgling human spaceflight capability for many times less than NASA expended on space shuttle brakes alone. Achieving such lower costs is fundamental, for it is only the combination of a multiplicity of efforts and breakthrough price points that makes a diversified human spaceflight portfolio viable.

So let's give industry incentive to produce safe systems for human exploration inexpensive enough for NASA to afford multiple parallel efforts. And let's ask how, more than 40 years after Apollo — as far in Apollo's future as Charles Lindbergh was in its past — American ingenuity can produce a lunar return by Americans for a \$3 billion to \$5 billion development, a high-orbit satellite servicing capability for a still lower development cost, and a first mission to a near-Earth asteroid that costs no more than 10 times what a decade-long robotic mission to Pluto does — say, for \$7 billion to \$8 billion.

Yes, the developments that result may be limited in their capability compared with what \$40 billion and \$100 billion development efforts might promise, but

for decades, expensive, monolithic development efforts have been singularly unproductive in delivering actual exploration.

Of course, because human spaceflight is harder and more expensive than robotic spaceflight, there will likely never be nearly as many projects in NASA's human spaceflight program as in NASA's Science Mission Directorate. But perhaps we can imagine the day when at least a few separate human spaceflight exploration missions are simultaneously being fielded, rather than one.

It is time to reinvent human space exploration, to make it simultaneously affordable, sustainable, exciting and robust. It may be hard, but it is time to find a new way forward that can serve the future rather than the past.

So let's diversify our human spaceflight portfolio in the United States, let's reinvent how we do things, let's turn some heads, and let's make history and lead again — and again — and again.

S. Alan Stern is an aerospace consultant and NASA's former associate administrator in charge of science. He is chairman of the Commercial Spaceflight Federation's Suborbital Applications Researchers Group.

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PROFILE

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DEPUTY UNDERSECRETARY OF THE AIR FORCE FOR SPACE PROGRAMS

Managing Change

The U.S. Air Force has a busy year ahead of it in space, as it aims to launch the first satellites of several critical constellations, formulate plans to buy new weather and space surveillance satellites, and understand the ramifications of a handful of policy reviews and changes in NASA's human spaceflight program.

Space acquisition troubles have dogged the Air Force for much of the past decade as it has plodded through efforts to replace its Cold War-era constellations. The service has made some headway in recent years with the successful launches of its first three Wideband Global Satcom communications satellites.

This year the service hopes to continue that progress by launching the first of its new generation of highly protected communications satellites, the first of a new block of GPS satellites, and the first Space Based Space Surveillance (SBSS) satellite. Early next year is now the target for launching the long-awaited first Space Based Infrared System (SBIRS) missile warning satellite.

The White House sent its 2011 budget request to Con-

gress Feb. 1, and with it came several directives that will affect the Air Force in the years ahead. The administration proposed canceling NASA's Moon-bound Constellation program, a decision that will affect the cost and availability of the solid-rocket motors used for space launch and strategic missiles. The White House also terminated a troubled military-civilian weather satellite program, and the Air Force is now planning a replacement program.

The White House is also expected to soon complete a Space Policy Review addressing topics including space protection, cooperation, acquisition reform and export controls. The Pentagon will follow that with its own Space Posture Review, an interim version of which was delivered to Congress in March. And the forthcoming Nuclear Posture Review could inform decisions about the nation's strategic arsenal that may affect how rocket motors are bought and used.

Gary Payton is responsible for overseeing the military's space acquisition plans and research and development. Payton, a former astronaut, spoke recently with *Space News* staff writers Turner Brinton and Amy Klamper.

What does the cancellation of Constellation mean for the Air Force?

If there are increases to the Evolved Expendable Launch Vehicle (EELV) annual launch rate, that's a good sign. Right now we have a plan for United Launch Alliance to do eight launches a year, notionally five for the Air Force, two for the National Reconnaissance Office and one for NASA. So if we can increase that one for NASA up to two or three per year, that would be great for everybody, because we would be buying more rocket engines per year and flying more rockets per year, and that helps with the proficiency of the launch crews.

If some commercial company or companies want to use the EELV for human access to the space station, we'd have to look very closely at changes to the rockets' design in order to accommodate people. And any of those changes we'd have to manage very closely so that they don't ripple in to the Air Force design, which has been very successful with 31 successes out of 31 attempts. My view is, if it works, don't fix it.

One way to safely use these rockets is to build "white tail" EELVs that are the same for everybody. After you assemble them, then you add different things to allow crew inside the launch vehicle. We'd be building more rockets per year, and the critical parts are the same for all users. What I don't want to see is two separate assembly lines, one that is unique to NASA and another unique for the Air Force and intelligence community. That doesn't help anybody because their RS-68 engine is different from our RS-68 engine, and their RL-10 engine is different from our RL-10 engine.

Are you concerned about the Constellation decision's impact on the solid-rocket motor industrial base?

We've come to find out that it has a trivial impact on space launch because we don't use the big three-and-a-half meter segmented solids on our EELVs; we use solids that are about one-and-a-half meters in diameter. There is a small ripple effect into space launch, but the dominant industrial base concern according to the Office of the Secretary of Defense for Industrial Policy is on the ballistic missile side for the Navy and Air Force. We build 30 to 40 stages for the Trident D5 submarine-launched missile every year, and there are about a dozen motors built each year to sustain the Minuteman 3 industrial base. We already know these sustainment costs will go up, but we don't yet know by how much.

When we understand the ramifications, we'll have to adjust to it. It may mean buying fewer stages per year. It might mean using these stages for other applications. Right now we pull solid-rocket segments out of storage for use in Minotaur launch vehicles, and that's been a very successful pro-

gram for years. We may have to change that.

What is in the interim version of the Space Posture Review, and what was left out?

Well it's not a finished product. It went around for interagency coordination before it went to Congress, and it had to be signed by the director of national intelligence and the secretary of defense. What it really does is set the environment. It's a congested and contested environment, and some people add that it's a competitive environment. We've migrated from the Cold War era where there were two dominant space players, and we had a tacit agreement that if you don't play with our satellites, we won't play with yours. There are more players nowadays. The interim report says there are 60 nations that have assets in orbit. So the tacit agreement that we shared with the Soviet Union doesn't apply anymore.

There's plenty of evidence that shows there are lots of folks who can do signal jamming, lasers and kinetic anti-satellite attacks. And satellite technology is shrinking, so they're getting harder to keep track of. The interim review sort of lays out that environmental picture, and the final results will come after the White House completes its Space Policy Review. It will not be done in time to inform the 2012 budget request.

Will you include funding to purchase commercial communications capacity in the 2012 budget and beyond?

If you look at the demand curves for communications, no matter where we are the demand curve is going up. We cannot satisfy that demand just with government satellites. So we will be in the business of using commercial capacity for the foreseeable future. Are there better ways to buy and lease it? Sure. The Defense Information Systems Agency and the Office of the Secretary of Defense for Networks and Information Integration are doing a study to quantify everything that has to go over communications links of all types, whether they are terrestrial, airborne or satellite. To satisfy those demands, we could work on better compression algorithms to have to transmit less data. Or you can pipe data from the aircraft to a gateway on the ground and use fiber to get it where it needs to go. Or you pipe it over the horizon through a government or commercial satellite. That's all a part of our mil-satcom way ahead. I would predict the amount of commercial capacity we buy will continue to increase.

You mentioned airborne communications nodes as a possible solution for the bandwidth crunch. Why do you think this has never really been implemented?

We've done some demonstrations of it, and it works as you would expect. But the operations and maintenance

costs for keeping something even as inexpensive as an unmanned aerial vehicle continuously on orbit are high. For each orbit I have, I have to have one aircraft in the sky, another flying to the orbit, then another on the ground getting ready to go. So to maintain one orbit, I really have to have two-and-a-half to three-and-a-half aircraft. If you need 24/7 coverage for months or years, costwise, that is best served by a satellite. But if it's a surge and I just need it for a few hours, airplanes are probably a great idea.

You plan to hold an open competition to build the next SBSS satellite. Why would you not sole-source this contract to Boeing and Ball Aerospace, who built the first system?

The next satellite will not be a carbon copy. If you look back, the first satellite was designed as a pathfinder, meant to get something on orbit before the Midcourse Space Experiment stopped functioning. But the program was delayed. It is now sitting in a clean room awaiting launch.

We are developing new requirements for the follow-on satellite. We want to see if perhaps it could have some sort of relationship with the Missile Defense Agency's planned missile tracking constellation. In essence, there are several different designs we have to look at for the long-term suite of mission requirements. It's really not about the performance of any particular contractor on the first satellite.

The first SBSS satellite was ready last fall, but difficulties with its Minotaur 4 launcher have kept it on the ground. Have those issues been fully resolved?

I think so. In April we're going to launch the Hypersonic Test Vehicle-2, which is a cooperative program between the Air Force and Defense Advanced Research Projects Agency. Then we should be able to launch the SBSS satellite in June.

What will it take to assure you that a new rocket like SpaceX's Falcon 9 is ready to launch operational military payloads?

We have a set of criteria called the New Entrant Evaluation Plan. One of those requirements is a design review to show margins and the design of the launch vehicle. Both Orbital Sciences and SpaceX will satisfy the new entrant criteria as they progress through NASA's Commercial Orbital Transportation Services program. I don't have any problem seeing a future where, for the right size satellites, SpaceX should be a competitor.

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THERE IS ONE IMPORTANT WORD: HOW.**

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