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PROFILE/8A>

GEN. JAMES E. CARTWRIGHT

COMMANDER,
U.S. STRATEGIC COMMAND



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Kistler Teeters on the Brink After Main Investor Withdraws Support

BRIAN BERGER, WASHINGTON

Kistler Aerospace Corp. will lay off the majority of its 25 employees by the end of October after its main financial benefactor opted to pull the plug on the company, which has spent over a decade and some \$500 million trying to develop a reusable rocket.

Blaming NASA's sluggish follow-through on a pledge to buy space station resupply services from the private sector, Douglas Teitelbaum, director of corporate bailout specialist Bay Harbour Management LLC, said he was "radically reducing" his investment in the Kirtland, Wash.-based company.

Kistler emerged from Chapter 11 bankruptcy in March after New York-based Bay Harbour agreed to provide \$15 million in financing to get Kistler back into the business of building its reusable K-1 rocket.

The K-1 was conceived in the early 1990s as a low-cost alternative to expendable rockets for launching small low Earth-orbiting satellites. More recently, Kistler has shifted its focus to the government market, repackaging the K-1 as a reusable cargo carrier for the international space station.

Teitelbaum, Kistler's controlling creditor, told *Space News* Sept. 27 that he was done waiting for NASA to make good on its pledge to buy space station resupply services from the private sector. "I'm not in the business of throwing money down a rat hole while the government tries to organize itself to decide whether or not it can accomplish what [President George W. Bush] directed it to do," Teitelbaum said.

After a meeting of Kistler's board of directors Sept. 30, Randy Brinkley, the company's chief executive officer, said Teitelbaum's decision will force Kistler to lay off the majority of its staff in the weeks ahead. Brinkley said Kistler has been talking to other potential investors and would continue



KISTLER AEROSPACE ARTIST'S CONCEPTION

▲ Kistler Aerospace's main investor pulls the plug, citing NASA's failure to buy space station resupply services utilizing commercial vehicles such as the company's planned reusable K-1 rocket (above).

to do so. He said there were no immediate plans to dissolve up the company and sell off its assets.

"We are not taking any irreversible actions," Brinkley said. "We are maintaining at this point in time all our material with our subcontractors and our subsidiaries in Australia."

Most, if not all, of Kistler's K-1 hardware resides with its subcontractors. Kistler has two subsidiaries in Australia that were established to operate the K-1 out of the country's Woomera launch range.

Teitelbaum's money has been critical to keeping Kistler's doors open while it pursues NASA business.

"While I don't like laying people off and shutting down operations, I just can't keep tossing money at this thing with nothing

in sight," Teitelbaum said. "Candidly, I told NASA this. I said, 'if I don't get to a decision soon I am going to cut my bleed.'"

NASA has been looking for alternatives to the space shuttle for launching cargo to the space station since at least 2002, when it awarded four companies contracts worth a combined \$10 million to study the options.

Kistler was not among the companies selected for the so-called Alternate Access to Station contracts. But Kistler the year before made an unsolicited proposal to NASA offering to sell data from a series of K-1 demonstration flights. Such a contract would give Kistler credibility with the prospective financial backers while giving NASA an opportuni-

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October 3, 2005

NEWS BRIEFS

Goddard, Marshall to Lead Robotic Lunar Lander Work

NASA picked two of its field centers to lead the development of a \$500 million-\$750 million unmanned lunar lander that the agency hopes to launch as soon as 2010.

NASA's Marshall Space Flight Center in Huntsville, Ala., and Goddard Space Flight Center in Greenbelt, Md., will lead a team that includes the Johns Hopkins University's Applied Physics Laboratory in Baltimore. The robotic mission is intended to demonstrate precision landing and determine whether lunar resources can support a sustained human presence on the Moon.

Earlier this year, NASA chose Goddard to build the Lunar Reconnaissance Orbiter, which is slated to launch in 2008.

ESA Eyes Technologies For Asteroid Deflection

The European Space Agency (ESA) has settled on two potential target asteroids for a proposed mission to test technologies that would be needed to deflect near-Earth objects from a collision course with Earth.

ESA does not yet have the funding needed for the mission, which is called Don Quijote. The idea is to send two small satellites to the target asteroid — one to crash into it and the second to monitor the event. The two target asteroid finalists are designated 2002 AT4 and 1989 ML.

The preferred target will be selected in 2007. By that time ESA hopes to have received satellite design bids and cost estimates from European industry. The Don Quijote mission then will be submitted to ESA's customary technical and financial review boards before being given the go-ahead for funding.

Telenor Picks ILS Proton M To Launch Thor 2-R Satellite

Norway's Telenor Satellite Broadcasting has ended a highly competitive launch-services competition by selecting an International Launch Services Proton M rocket to orbit Telenor's Thor 2-R telecommunications satellite in late 2007 despite Proton's higher price compared to a European Ariane 5 ECA rocket, according to industry officials.

Thor 2-R, under construction at Orbital Sciences Corp. of Dulles, Va., will weigh just 2,450 kilograms at launch — much lighter than most satellites carried by the Proton M rocket.

Because Proton will be launching Thor 2-R as a solo passenger, Telenor will be paying for the entire Proton rocket. Among the competitors for the launch was the Arianespace consortium of Evry, France, which offered to launch Thor 2-R as one of two satellites aboard the Ariane 5 ECA.

Industry officials said Telenor is paying substantially more to launch on Proton than it would have paid aboard Ariane 5, but in return the Oslo-based company likely will be able to operate Thor 2-R longer than would have been the case aboard the Ariane 5 launch.

Ariane 5 places satellites in geostationary transfer orbit, from which point they

use their own fuel to climb into final geostationary position. By carrying such a small satellite and nothing else, Proton will be able to place Thor 2-R closer to its final destination, saving fuel that can be used to extend the satellite's service life.

Cato Halsaa, managing director of Telenor Satellite Broadcasting, said Sept. 30 that a Proton launch will give Telenor three additional years of Thor 2-R operations. Halsaa also said Telenor's schedule made it difficult to select Ariane 5 ECA because that vehicle, which recently was redesigned, has made only one flight.

Interim Radios May Ease Time Urgency for JTRS

Upgraded tactical radios purchased by the Pentagon to support current operations should take some pressure off the schedule for fielding the next-generation system, according to the Senate Appropriations Committee.

Initial versions of the Joint Tactical Radio System (JTRS) are scheduled for fielding in 2008, but the program has encountered significant technical problems that will make it difficult to meet that timetable, according to a Sept. 28 report accompanying the committee's version of the 2006 Defense Appropriations Act.

While the recently purchased radios are not quite as capable as the JTRS units, they are far better than the legacy equipment, the committee said. The panel directed the Pentagon to review the JTRS schedule in light of the program's challenges and the availability of the interim radios and come back to Congress by Dec. 30 with a revised program plan.

NASA Criticized by GAO For Misusing Airplanes

A Sept. 26 report by the non-partisan Government Accountability Office (GAO) criticizes NASA's use of space agency planes when former Administrator Sean O'Keefe was in charge, saying the agency spent five times more than it would have using commercial flights.

The report, made public Sept. 30, was requested by Sen. Susan Collins (R-Maine), chair of the Senate Homeland Security and Governmental Affairs Committee.

"Use of NASA passenger aircraft services can save time, provide more flexibility to meet senior executives' schedules, and provide other less tangible and quantifiable benefits," states the report, "NASA Travel: Passenger Aircraft Services Annually Cost Taxpayers Millions More Than Commercial Airlines." It goes on to say, "However, GAO's analysis of available reported data related to NASA passenger aircraft services during fiscal years 2003 and 2004 showed NASA reported costs were nearly \$25 million compared with estimat-

CORRECTION

Joanne Irene Gabrynowicz's commentary piece [Sept. 12, page 19] should have been titled "Katrina and the Disasters Charter: A Turning Point."

U.S. Senate Bill Requires NASA To Finish Station

The U.S. Senate passed legislation by unanimous consent Sept. 28 that would require NASA to complete the international space station.

The bill, the NASA Authorization Act of 2005 (S. 1281), also calls for designating the space station a national laboratory, a proposal put forward by Sen. Kay Bailey Hutchison (R-Texas). However, the bill approved by the Senate no longer includes Hutchison's language requiring NASA to keep flying the space shuttle until its successor, the Crew Exploration Vehicle, is in service.

That language had attracted White House opposition. Under NASA's plan the space shuttle would retire in 2010, about two years ahead of when the Crew Exploration Vehicle is slated to enter service.

The House of Representatives passed its NASA authorization bill, H.R. 3070, earlier this year. The House and Senate



Sen. Kay Bailey Hutchison

must reconcile all remaining differences between the two pieces of legislation before they can be sent to President George W. Bush to be signed into law.

ed commercial airline coach transportation costs of about \$5 million."

Most of the flights — 86 percent, or seven out of eight — "were taken to support routine business operations specifically prohibited by federal policy regarding aircraft ownership, including routine site visits, meetings, speeches and conferences."

The space agency issued a Sept. 30 statement under Administrator Mike Griffin's name: "We at NASA have accepted the Government Accountability Office's findings and have embraced new guidelines and procedures for the use of our airplanes that have been set by the Office of Management and Budget. Going forward, all airplane use will be within those guidelines."

Calif. Wildfires Destroy Some Boeing Facilities

Wildfires in California's San Fernando Valley had destroyed as many as three buildings at Boeing's Santa Susana field laboratory by the afternoon of Sept. 30 and damaged a number of other structures, according to preliminary damage reports, but a company official said it was too early to determine how the fires will affect current testing operations there.

Boeing spokesman Dan Beck did not have details as to which buildings were affected specifically, but said preliminary reports indicate some office space, storage locations and a machine shop might have been damaged or destroyed.

"We don't know what kind of an impact it will have on our operations at this point,"

Beck said in a Sept. 30 interview. "As of now, there are no more blazes going on that are threatening the property."

Boeing currently uses the 2,800-acre site to conduct testing on Rocketdyne's RS-27 engines for its Delta 2 rockets. This past August, Boeing completed selling Rocketdyne to United Technologies Corp.'s Pratt & Whitney of East Hartford, Conn., but kept the Santa Susana site in the deal.

Beck said the research and development facility has become much less active over the years, leaving many buildings either abandoned or inactive. Boeing has about 200 employees stationed there, he added.

Norspace Gets Deal with Space Systems/Loral

Norspace AS of Horten, Norway, will supply frequency converters and filters for three satellites under contracts with satellite prime contractor Space Systems/Loral of Palo Alto, Calif., Norspace announced.

Under the contracts, valued in total at about \$20 million, Norspace will supply several hundred surface acoustic wave (SAW) filters and multiplexer assemblies to Loral. The satellites to incorporate the gear were not identified, but the equipment is used for multi-beam spacecraft as well as for mobile communications. Norspace estimated that its SAW equipment currently operational in orbit represents an 80-percent market share among commercial telecommunications satellites.

SEE BRIEFS PAGE 8-9



This Week on Space.com

Mystery Monday – Delving into Dust Devils.

Tech Wednesday – NASA's Moon Vision: Some Assembly Required.

NightSky Friday – The southern sky is awash with sea creatures: a Sea-Goat, the Fishes, and a Whale.

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Early Decisions About Sensors Led to NPOESS Problems

JEREMY SINGER, WASHINGTON

The cost problems that are expected to force the restructuring of a program to develop a new constellation of U.S. government weather satellites can be largely traced back to assumptions made early on in the program that a key sensor would be relatively easy to develop, according to industry and Pentagon officials.

Those assumptions later proved to be false, and the size of the resulting cost overruns required the Pentagon to notify Congress Sept. 28 that the price of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) will be at least 15 percent higher than the Defense Department's current estimate of \$6.8 billion.

The Pentagon was forced to notify Congress about the cost growth on NPOESS due to legislation known as the Nunn-McCurdy provision.

The NPOESS program's cost growth is forcing the government to look at options for the program that include delaying the launch of the first satellite four years later than the current date of 2010; eliminating certain instruments from the first two satellites; and dropping plans to launch an experimental spacecraft that would test out key NPOESS instruments before the launch of the first operational satellite.

The NPOESS system, which is being integrated by prime contractor Northrop Grumman Corp., is intended to provide weather data to military and civil customers, and is jointly funded by the U.S. Air Force and the National Oceanic and Atmospheric Administration.

Lt. Col. Karen Finn, a spokeswoman for the Air Force, said in a written statement that the development of the sensors for the NPOESS satellites has proven to be more difficult than expected. While some of the key sensors —



NASA ARTIST'S CONCEPTION

NPOESS

most notably the Visible Infrared Imager Radiometer Suite (VIIRS) — are based on those that already are in use in space today, there have been issues with “scaling up the sensors” for NPOESS, she said.

“It is the combination of system engineering, design, management, fabrication, integration and test, quality processes and inadequate levels of employee experience that contributed to cost and schedule overruns with VIIRS, making the current program baseline unexecutable,” Finn said.

The VIIRS instrument, which is intended to provide imagery, sea-surface temperature readings and ocean color measurements, is built by Raytheon Co. of Santa Barbara, Calif.

The government program office and Raytheon initially believed that the VIIRS instrument would be a “close cousin” to the Moderate Resolution Imaging Spectroradiometer that Raytheon had built for NASA's Aqua and Terra Earth observation satellites, and that only minor technical changes would be necessary, industry sources said.

Northrop Grumman was not involved at that point, because the government awarded the instrument development contracts on the NPOESS program prior to the award of a contract to Northrop Grumman in 2002 to be the lead systems integrator for the program.

Based on this assumption, the program office allowed Raytheon to pass an early milestone, known as the critical design review, without building a prototype sensor, the sources said. Prototype hardware called an engineering development unit is normally used to evaluate hardware design at the critical design review phase, but in this case the development unit was not built until later, the sources said.

This built a shaky foundation for the sensor program, and program officials today are still dealing with the “lingering efforts of a poor design,” the sources said.

The Moderate Resolution Imaging Spectroradiometer design has since proven to be of little use on the VIIRS effort, the sources said.

John Leslie, a spokesman for the National Oceanic and Atmospheric Administration, said that a partial engineering and development unit was built prior to the critical design review. Program officials had felt that a full prototype of the VIIRS sensor would not be needed at that point based on the expected similarity to the Moderate Resolution Imaging Spectroradiometer, Leslie said.

The industry sources said that the VIIRS sensor required focal planes that were so different from those of earlier instrument that engineers had to start from scratch. As engineers worked on the VIIRS engineering development unit in mid-2003, they found information from sensor cells leaking into other cells, causing a problem called “cross-talk” that would damage the data provided from the instrument, the sources said.

Engineers were able to fix the interference problem, but by mid-2004, encountered further difficulty when parts started breaking during vibration testing of the engineering development unit, the sources said.

At that point, officials from Northrop Grumman and the government program office began reviewing VIIRS to determine whether the problems with the design were isolated or widespread.

When hardware intended to cool the instrument's focal plane failed during testing of the engineering development unit in November, program officials knew that the cost and time needed to redesign various VIIRS components would significantly disrupt the program's schedule.

Program officials found that one of the roots of the problems with VIIRS was the quality of personnel working on the effort, the sources said. Many of the people that had worked on the Moderate Resolution Imaging Spectroradiometer did not join the VI-

IRS program, and Northrop Grumman and Raytheon each brought in experts to help get the sensor work back on track, the sources said.

More than 80 percent of the cost growth on the program is due to instrument problems, with VIIRS as the most glaring example, but not the sole culprit, the industry sources said.

Sources interviewed for this article emphasized that the NPOESS problems have been with the individual instruments, rather than integrating too many sensors onto the spacecraft, requirements creep or the recent decision to add a wide-area imagery payload.

Sally Koris, a spokeswoman for Northrop Grumman Corp., said in a written statement that Northrop Grumman is taking the NPOESS issues “very seriously” and is working with the government to limit the rising cost.

“We have responded to problems with aggressive action to mitigate the impact of cost and schedule issues, including actions aimed at correcting systemic problems with selected subcontractors,” Koris said. “Northrop Grumman and its teammates are completely dedicated to achieving mission success on this critical program to ensure this much-needed capability is delivered to military and civilian users.”

Raytheon spokeswoman Sabrina Steele deferred to Northrop Grumman for comment.

In contrast to the story with VIIRS, some of the instrument work is going relatively well, the industry sources said. Officials working on the Cross Track Infrared Sounder, which is built by ITT Industries of Fort Wayne, Ind., have produced several engineering development units and have encountered only minimal problems due to their heavy attention early in the program, the sources said.

Comments: jsinger@space.com

KISTLER FROM PAGE 1

ty to leverage private-sector investment to resupply the space station.

NASA officially bought into the idea in early 2004, awarding Kistler a \$227.4 million contract for flight data from the still unfinished K-1. The award was a boon for Kistler, giving the company what many saw as the inside track in NASA's planned competition to buy space station resupply services from commercial providers.

But one of Kistler's fiercest competitors, Space Exploration Technologies (SpaceX), cried foul, protesting the award to the U.S. Government Accountability Office on the grounds that NASA should have given other companies a chance to bid to provide the flight data. NASA rescinded Kistler's award in June 2004 after being informed that the congressional watchdog agency intended to rule in SpaceX's favor.

Elon Musk, president of El Segundo, Calif.-based SpaceX, said Kistler's singular focus on winning NASA contracts is largely

responsible for the company's undoing.

“Kistler was too heavily dependent on a large development contract from a single entity, which has been the root cause of failure in many prior launch vehicle start-ups,” Musk said in an e-mail. “In contrast, the SpaceX Falcon has been a private development with no major external dependencies, and we are fortunate to have earned eight distinct customers prior to first launch.”

Musk, an entrepreneur who made a fortune before turning 30, is bankrolling the development of the Falcon 1. SpaceX is preparing to launch the Falcon 1 this autumn carrying a small experimental satellite built by students at the U.S. Air Force Academy.

Marc Schlather, president of ProSpace, a grass roots lobbying group, said Kistler's troubles are typical of what entrepreneurial companies face when trying to sell commercial services to NASA.

“This is a situation we've seen time and time again,” Schlather said. “If you talk to

the capital markets, if you talk to the people in the know about investment, they will tell you that no one is going to close a privately financed business plan based on the expectation of business from NASA, because they are not a dependable customer.”

NASA spokesman Michael Braukus said Sept. 29 that the agency is “working hard” to issue a bid solicitation this autumn for space station launch services.

Lori Garver, a Washington aerospace consultant and former senior NASA official, said blaming the agency for the struggles of space-launch start-ups is not entirely fair.

“The situation with entrepreneurial companies and NASA has evolved over time,” Garver said. “Yes, it has taken longer to get clarified than anybody would have hoped, but keep in mind that most of these companies were initially looking for commercial business.”

That certainly is true of Kistler. The company was founded in 1993 by physicist and serial entrepreneur Walter Kistler with \$1 million in seed money and a concept for a

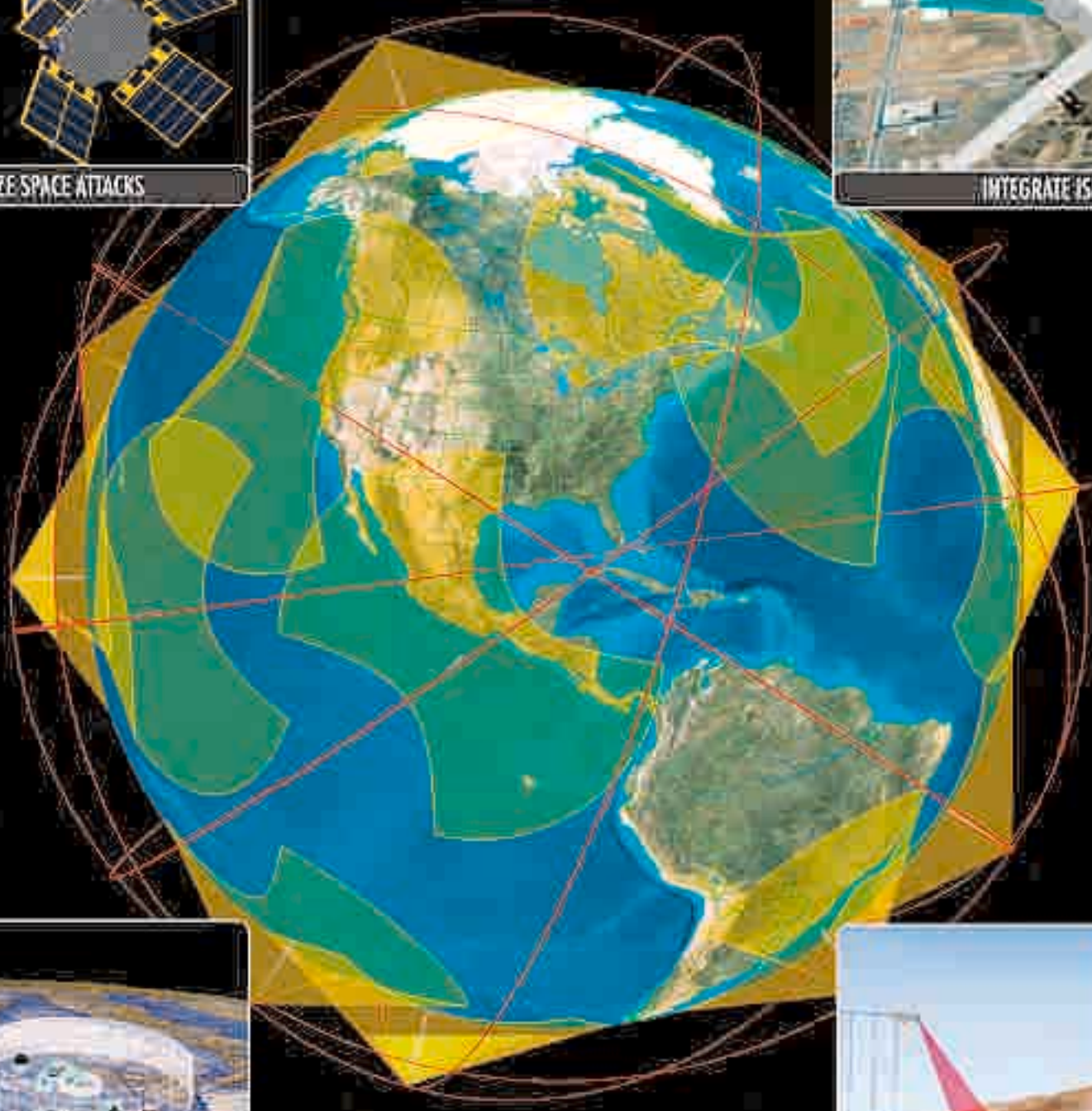
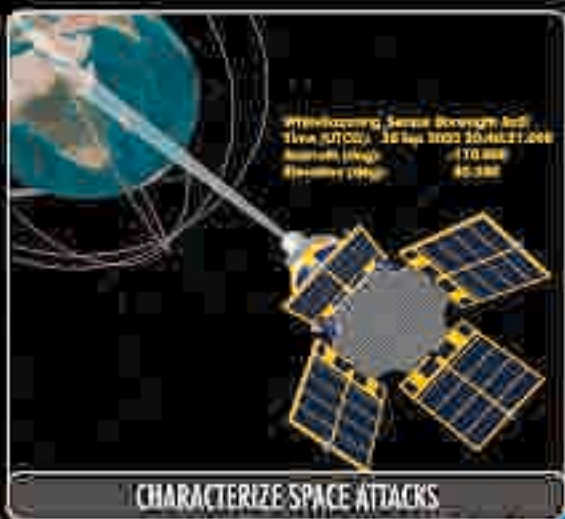
\$250 million reusable rocket that could be ready within five years to launch commercial satellites at far less cost than existing conventional rockets.

Kistler Aerospace raised hundreds of millions of dollars during the 1990s on the strength of its technical team and its prospects for capturing a healthy share of projected market for launching constellations of low Earth-orbiting communications satellites planned by Iridium, Globalstar, Teledesic and others.

Reality, however, never matched forecasts. By the time the so-called low Earth-orbit telecommunications market went bust with the collapse of Iridium and Globalstar around 2000, Kistler Aerospace was still at least several years and several hundred-million dollars away from achieving the first test flight of K-1.

It was around then that Kistler began to shift its attention to NASA and the international space station.

Comments: bberger@space.com



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Russia Looks To Position Glonass as a Competitive System

PETER B. de SELDING, PARIS

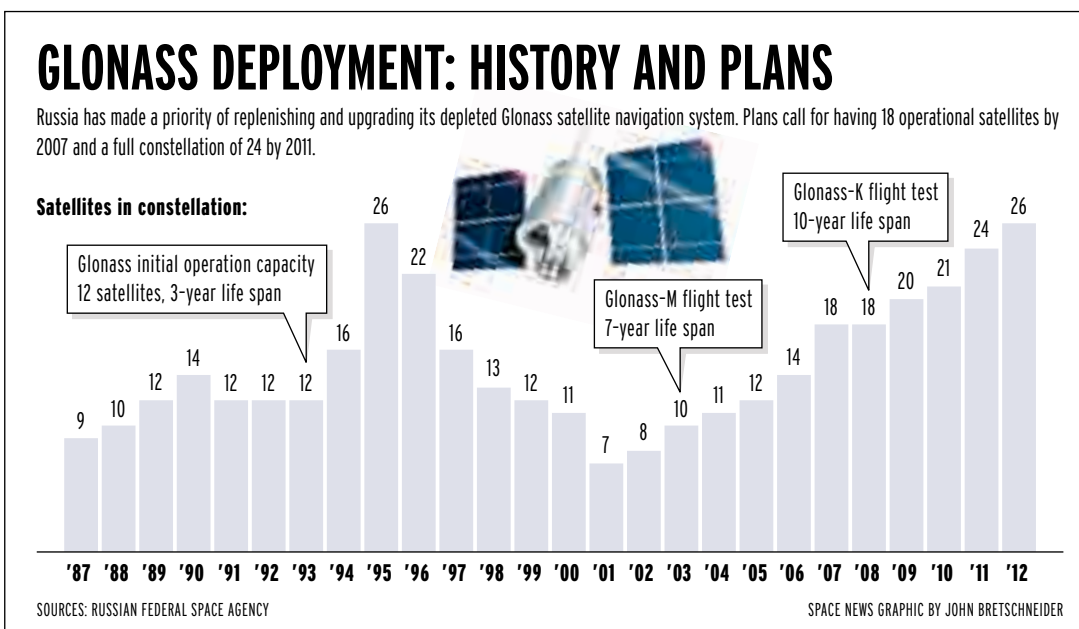
The Russian government, attempting to catch up to the U.S. GPS navigation system's commercial success and anticipate Europe's future Galileo effort, has enacted a law forcing Russian consumers to use only those terminals capable of receiving Russian Glonass satellite signals starting in 2006, according to the Russian space agency, Roskosmos.

The law, which permits dual-mode equipment as long as Glonass is one of the two compatible services, is designed to stimulate a consumer market for Glonass and prevent the Russian market from being taken over by equipment designed to work solely with the U.S. GPS satellite constellation, and later Galileo.

Glonass, which was built with Russian Defense Ministry funds in the 1980s and early 1990s into a potential GPS competitor, all but collapsed in the late 1990s as Russia's financial crisis and the limited lifetimes of the individual satellites combined to degrade system performance. The number of functioning spacecraft fell from 26 in 1995 to just seven in 2001.

Now designated a strategic priority for the Russian government, Glonass is on the mend. Thirteen Glonass satellites are operating, a figure that should rise to 18 satellites in 2007 and a full 24-satellite complement in 2011, according to Sergey Revnivykh of Roskosmos. He said the system will feature GPS-level performance by 2008.

Revnivykh presented a Glonass update at the 45th Civil GPS Service Interface Committee



meeting, held Sept. 13 in Long Beach, Calif.

Russia's decision to force new navigation equipment sold starting in 2006 to be Glonass compatible is the type of policy some European government officials have suggested to help Europe's Galileo satellite navigation system gain a market foothold when it is operational around 2011. European officials have said almost all navigation gear sold by 2015 will be dual-mode, capable of receiving GPS and Galileo signals.

Russia and Europe both have signed agreements with the United States promising that all three systems will be free of direct user fees for their open signals. Galileo features fee-paying signals as well as the free open service.

Galileo and GPS are global

satellite constellations that will be operated alongside regional systems planned in Japan, China and India. How and whether Glonass — also a global constellation — will fit into this picture has been unclear because of the system's instability over the last decade.

Revnivykh said Russia is committed to making Glonass fully functional. The next launch, in December, will be of two Glonass-M satellites and one older Glonass satellite, he said.

Gaps in service, he said, have been reduced from 14 hours to three hours now that 13 satellites are operational.

A second civil signal has been added to the Glonass-M satellites, introduced in 2003. Two of these are in orbit, and six more have been ordered from prime contrac-

tor NPO-PM of Krasnoyarsk. The Glonass-M spacecraft have seven-year service lives, compared to three years for their predecessors.

Revnivykh said a December agreement with India provides that India's GSLV rocket may be used to launch at least one Glonass-M satellite. The two governments also agreed to work together on ground infrastructure development for satellite navigation services.

The planned Glonass-K satellites, scheduled for launch starting in 2008, will have a third civilian signal and 10-year service lives. Up to 27 of these models will be ordered, also from NPO-PM.

Glonass-K satellites are expected to weigh 850 kilograms at launch, compared to 1,415 kilograms for Glonass-M. The lighter

weight will permit the new Glonass constellation to be launched, two satellites at a time, by the medium-lift Soyuz rocket. Up to now, Glonass satellites have been launched three at a time by the larger Proton rocket.

If Russian and European satellite-navigation plans hold to their current schedules, the U.S. GPS constellation has no more than six years to go before its status as a global monopoly ends.

By that time, the commercial satellite navigation market will exceed \$68 million in annual equipment sales, according to Lt. Col. Wayne Bell, chief of the GPS System Integration Branch at the U.S. Air Force Space and Missile Systems Center at Los Angeles Air Force Base.

Addressing the same meeting at which Roskosmos' Revnivykh spoke, Bell and Maj. Chuck Daniels, director of the Joint GPS Operations Center at Schriever Air Force Base, Colo., said the GPS constellation will be modernized with three new-generation spacecraft launched per year starting in 2006.

The latest GPS launch, on Sept. 26, put up the first GPS 2R-M satellite, built by Lockheed Martin, carrying a second civil signal. A third civil signal will be available starting in 2007, when the first GPS 2F satellite is launched.

Bell said six new GPS ground stations have been added — six more are scheduled for installation by November 2006 — to better track the GPS constellation and warn users, civil and military, of outages or faulty signals.

Comments: pdeselding@compuserve.com

ESA Misses Deadline for Galileo Funding Decision

PETER B. de SELDING, PARIS

The Galileo satellite-navigation system, whose projected in-service date already has slipped from 2008 to 2011 because of disputes among European governments over financing, risks falling further behind schedule because of a turf war that has all but stopped work on the project, government and industry officials said.

A Sept. 30 deadline for European Space Agency (ESA) governments to agree on their share of financing for Galileo's ground network and initial four satellites came and went without an agreement.

The specific issue to be settled is a commitment from ESA governments to cover their 50-percent share of the 400 million euros (\$482 million) in additional costs for Galileo's In-Orbit Validation phase.

This segment of the project is being built by an industry consortium called Galileo Industries S.A. of Brussels under a contract that has been fully negotiated with ESA and is ready to be signed. The total contract value, including the 400-million-euro cost overrun, is nearly 1.1 billion euros.

Half of this sum is being paid by the European Commission, the executive arm of

the 25-nation European Union; the other half is ESA's responsibility. The European Commission already has approved its share and has given ESA the responsibility of negotiating the contract.

Several of the European government officials who oversee ESA have refused to sign off on the ESA contract until they are guaranteed that certain Galileo operating facilities, such as the control centers, are located on their territories. Germany has been the most adamant about this, but it has not been the only country with such concerns.

ESA Director-General Jean-Jacques Dordain said Sept. 30 that ESA has no authority to select where Galileo facilities will be located, and that these issues should be settled later on as Galileo's privately owned operator takes over. Faced with the same stalemate in December 2004, Dordain agreed to permit Galileo Industries to start work on the ground segment with a 150-million-euro advance payment that was supposed to cover costs through June. Dordain said then that a final contract was only weeks away from being approved.

Nearly 10 months later, nothing has changed.

In an interview, Dordain said ESA has agreed with Galileo Industries that the ini-

tial contract, which had been extended to Sept. 30 without any new funding, has now been extended again, to Oct. 31 — with no new financing.

Dordain said European transport ministers, who are funding the European Commission's 50-percent Galileo stake, are scheduled to meet Oct. 6 and have been advised by European Transport Commissioner Jacques Barrot that Galileo now faces serious trouble if the In-Orbit Validation contract is not approved in October.

Dordain said he has written to European research ministers, who fund ESA's share of Galileo, to say the same thing in advance of a meeting of ESA governments Oct. 13.

"My pockets are empty if we have no agreement by the end of October," Dordain said. "I could sign a contract with [Galileo Industries] tomorrow — even tonight — if I had the authorization from my delegations. The contract with industry is fully negotiated and ready to go. But nothing has moved since December."

Galileo Industries Chief Executive Guenter Stamerjohanns said the company has slowed its activity in the last five months as its money has run down.

"We have become experts in stretching out our funding," Stamerjohanns said Sept.

30. "But now the rubber band has been extended its maximum length before it snaps. We have a company to run, we have 120 employees and more than 500 working at subcontractor level. I have been very frank in telling people that there is a problem."

Stamerjohanns declined to speculate on how much of a delay the current impasse already has caused Galileo. "I am focused on getting the work started, not on figuring out when the program will be completed," he said. "But certainly the difficulties we have faced have not helped on the schedule side."

Several industry officials said ESA should sign a contract for part of the In-Orbit Validation work with the money it has, while continuing to wait for a compromise that will free up the remaining monies.

Dordain said he refuses to do this. "I have an obligation to our delegations to spend public money prudently," Dordain said. "If I signed a deal for, say, a portion of the work, I would leave myself open to surprises later on — for example, a contractor saying: 'The price has just risen to 1.2 billion euros.' Before I sign the contract I need a clear view of things. I certainly don't have that now."

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NEWS BRIEFS

BRIEFS FROM PAGE 3

French Firm Evaluates Impact of Google Earth

Governments may have to camouflage sensitive installations or move them underground to keep them from appearing on Google Earth, a Web-based imagery library created by the Internet search-engine giant, according to a study by a French firm specializing in imagery analysis.

The assessment was prepared by EADS Fleximage of Paris, which analyzes satellite and aerial photographs for military and civil applications. It evaluated Google Earth's potential to expose government secrets as well as its utility to professional imagery analysts.

A test version of Google Earth has been available free to anyone with a late-model computer since June. The system features aerial and satellite imagery of just about the entire surface of the Earth, with a few exceptions. EADS Fleximage says in its analysis that images of several well-known sensitive military installations have been degraded, but many are clearly visible.

The South Korean government recently complained to the U.S. authorities about sensitive installations in that country appearing on Google Earth. The U.S. National Geospatial Intelligence Agency said it would take no action on the matter.

Google has struck agreements with several satellite- and aerial-photography companies to show pictures with ground resolutions ranging from 15 centimeters to 15 meters. Most of the high-resolution satellite imagery is archived data at least two years old, meaning it is of limited value for some commercial and spying applications. Similarly, the date the images were taken, the ground resolution and other technical details are often absent, limiting Google Earth as a tool for professionals.

On the other hand, Fleximage said, Google Earth's ease of use makes it a valuable addition to the professional imagery analyst's toolbox, even for defense and security applications.

Emmanuel Villers, commercial director of Fleximage, said concerns expressed by several governments about Google Earth have eased in recent weeks, mainly because capitals around the world are resigned to the inevitability of such a service.

"Ten years ago, images sharper than 1 meter in resolution were reserved for military users. Since then, commercial satellites offer images as sharp as 60 centimeters to anyone, without restriction," Fleximage says in its study. "Now with Google Earth, these same 60-centimeter images — but more than two years old — are offered free on the Internet."

Eutelsat's Post IPO Moves Could Affect Credit Rating

Standard & Poor's credit-rating service is ready to raise its rating on Eutelsat's debt if the Paris-based satellite operator's upcoming stock-market listing results in a debt-reduction commitment instead of, for example, a guarantee of high dividends to shareholders.

In a Sept. 26 note, Standard & Poor's said Eutelsat, whose initial public offering (IPO)

of stock on the Paris-based Euronext exchange is scheduled to occur before the end of the year, is bound by its debt covenants to reduce its debt load at least slightly. But beyond this minimum level, it remains unclear whether Eutelsat will decide — as have several of its competitors this year — to sweeten its stock listing with a promise of high dividend payments.

"The group's leverage post-IPO will have to be assessed in the light of any potential dividend payments made to shareholders and/or acquisitions, as well as future free cash flow generation," Standard & Poor's said.

Astronomers Struck by Galaxy's Apparent Age

NASA researchers using the Hubble and Spitzer space telescopes have discovered a distant galaxy that is unusually massive and mature for being so young, the space agency announced Sept. 27.

Astronomers believe early galaxies were once small clusters of stars that gradually merged to form larger galaxies such as the Milky Way. The HUDF-JD2 galaxy, however, appears to have grown quickly within the first few hundred-million years following the theorized big bang. The galaxy is in a location that depicts an era of the universe when it was only 800 million years old.

Scientists detected the galaxy while studying infrared images taken by Hubble. The infrared signal detected by Spitzer — which is more sensitive to redder and older stars — was even brighter, indicating a large galaxy.

"At a time when the universe was only 800 million years old, it's positively massive," said Mark Dickinson, a scientist at the National Optical Astronomy Observatory in Tucson, Ariz.

This discovery suggests at least a few galaxies formed quickly long ago, NASA said.

ESA's Smart-1 Lunar Probe Boosts Orbit One Last Time

Europe's Smart-1 lunar orbiter has used the last of its ion-electric power supply to reboost its orbit enough to permit continued mapping of the lunar surface until August 2006. After a three-month lull in observation to permit the orbit-raising, a fresh campaign to take color images of the lunar surface is scheduled to start in October, the European Space Agency (ESA) announced.

Since Smart-1 was launched in September 2003, its PPS 135 xenon-electric thruster has been fired more than 840 times and has operated for around 5,000 hours, according to its manufacturer, Snecma of Paris. The Snecma technology is based on designs from OKB Fakel of Russia, which has supplied electric thrusters on numerous Russian satellites. Electric propulsion systems weigh much less than conventional chemical thrusters and have been installed on heavy Western communications satellites in recent years.

The PPS 1350 thruster used 80 kilograms of xenon gas to propel Smart-1 from Earth orbit to lunar orbit, and keep it there for 18 months. The engine was shut down Sept. 17.

Smart 1, whose principal mission has been to test new technologies such as electric propulsion for future ESA satellites, is now in



LOCKHEED MARTIN PHOTO

SBIRS sensor

Lockheed Martin Ships Second SBIRS Sensor

Lockheed Martin Corp. has delivered the second payload for the Space Based Infrared System (SBIRS) High missile warning constellation to the U.S. Air Force, according to a company news release dated Sept. 28.

The infrared payload, like the first that was delivered in August 2004, will be hosted by a classified satellite operating in a highly elliptical orbit. The SBIRS program also includes four dedicated satellites to operate in geosynchronous orbit, one spare, and ground systems.

The first dedicated SBIRS satellite is scheduled to launch in 2008. The launch dates of the elliptical-orbit satellites hosting SBIRS payloads are classified, but the first of those sensors was delivered more than a year late due to electromagnetic interference issues.

Joanne Maguire, vice president of Lockheed Martin Space Systems of Sunnyvale, Calif., the prime contractor on the SBIRS program, said the company looks forward to building on the positive momentum from completing and delivering the second payload.

an orbit that is governed mainly by lunar gravity. It is expected to crash onto the lunar surface in August 2006, according to ESA.

Northrop Is Delivering Upgraded Intel Software

Northrop Grumman reported progress Sept. 26 in its effort to upgrade intelligence data handling and processing software used on a variety of U.S. military programs.

The Los Angeles-based company is installing Version 7.3 of its Multi-Intelligence Core common software baseline, which is used in the U.S. Army and Navy Distributed Common Systems, the Marine Corps' Tactical Exploration Group and the Air Force's Extended Tether program.

There are more than 20 upgrades in the new version of the software. The enhancements are designed to improve a variety of functions, including data and imagery processing, target extraction and situational awareness, according to the company's press release.

Upgrades have been installed in 18 of

the 50 systems scheduled to receive it, said Northrop Grumman spokesman Tom Delaney. The company will work for the next few months on upgrading additional systems, and then start focusing on the 8.0 version of the software, which is scheduled for early 2006. Delaney declined to comment on the cost of the upgrades.

Sega Picks Payton To Serve as His Deputy

U.S. Air Force Undersecretary Ron Sega announced Sept. 27 that he had selected Gary Payton to serve as his primary deputy for military space programs.

Payton must be approved by the secretary of the Air Force, but not by the U.S. Senate.

A retired Air Force colonel and NASA astronaut, Payton returns to the service after having worked as deputy for advanced systems at the Missile Defense Agency, senior vice president for engineering and operations at Orbimage, and deputy associate administrator for space transportation technology at NASA.

October 3, 2005

Orbital Sciences Delivers Cargo Containers for ISS

Orbital Sciences Corp. announced Sept. 21 it delivered five cargo transport containers to NASA for future space shuttle missions to resupply international space station (ISS).

The reconfigurable containers each can accommodate up to five ISS hardware components, known as Orbital Replacement Units, such as heat exchangers and electronics control equipment. The reusable containers, each of which can carry about 180 kilograms of ISS hardware, can be opened and their contents removed via robotic methods or by spacewalking astronauts.

Orbital, headquartered in Dulles, Va., designed, built and tested the containers at its Technical Services Division in Greenbelt, Md., under contract to NASA's ISS Program Office at the Johnson Space Center in Houston. Barron Beneski, an Orbital spokesman, would not disclose the value of that contract.

Kinesix Sells Upgrades to NASA Simulation Software

Kinesix Software of Houston has sold upgrades and additional licenses for its Sammi control-room software product to NASA's Integrated Training Facility in Houston, where the agency runs computer-driven training simulations for flight controllers and astronauts.

The training facility, which features replicas of the space shuttle and international space station, uses Sammi for sophisticated graphical displays and user interfaces. The software upgrades will be used in the agency's Integrated Planning System, which helps NASA prepare for space shuttle and international space station flights.

In a press release dated Sept. 20, Kinesix said NASA's Johnson Space Center in Houston has used Sammi software since 1992 to run 90 percent of the graphical displays in its Mission Control Center, which oversees space shuttle flights.

EMS Sensor Will Help Point Webb Telescope

EMS Technologies of Atlanta announced Sept. 26 it has won a contract from the Canadian Space Agency to design a fine guidance sensor and filter for NASA's planned James Webb Space Telescope, which is scheduled to launch in 2013 to replace the aging Hubble Space Telescope.

The fine guidance sensor will allow the Webb telescope to track the positions of distant stars with high accuracy so the telescope

is fine-pointed, which also will allow the spacecraft's other instruments to capture very high-quality images. The Webb telescope is expected to observe the formation of some of the earliest stars and galaxies in the universe with a main mirror that is seven times larger than that on Hubble and hundreds of times more sensitive to near-infrared light.

The Canadian Space Agency agreed to provide two major pieces of hardware for the international James Webb Telescope project: the fine guidance sensor and the near-infrared camera.

The telescope equipment will be manufactured at EMS's Space and Technology division in Ottawa. The contract value was not disclosed.

NASA Pluto Probe Enters Final Launch Preparations

NASA's New Horizons spacecraft arrived at Kennedy Space Center, Fla., Sept. 24 for final preparations and testing before it launches in January to explore Pluto and its moon Charon, the agency announced Sept. 26.

The 450-kilogram probe is equipped with seven instruments to study the geology and environment of Pluto and Charon. It is scheduled to lift off Jan. 11, 2006, aboard a Lockheed Martin Atlas 5 rocket and arrive at Pluto as early as summer 2015.

New Horizons is scheduled in October to undergo a series of functional tests and readiness checks. A final spin-balance test is slated for November.

The spacecraft recently completed space-environment tests at NASA's Goddard Space Flight Center in Greenbelt, Md., and Johns Hopkins University Applied Physics Laboratory in Laurel, Md., where it was designed and built.

This mission is the first in NASA's New Frontiers program of medium-class planetary missions.

QinetiQ Helps Tourist Prepare for Station Visit

QinetiQ, a British defense technology company, has been helping future space tourist Greg Olsen prepare for his scheduled October visit to the international space station, providing medical assessments and gravity-force training, the company announced Sept. 27.

Olsen, a multimillionaire U.S. businessman and scientist, is slated to blast off from the Baikonur Cosmodrome Oct. 1 aboard a Russian Soyuz rocket. Also aboard the Soyuz will be NASA astronaut Bill McArthur and Russian cosmonaut Valery Tokarev, who will

U.S. Air Force Launches Updated GPS 2R Satellite

The U.S. Air Force on Sept. 25 successfully launched the first of eight GPS 2R satellites upgraded by prime contractor Lockheed Martin to provide enhanced and more-reliable navigation services.

Lockheed Martin of Bethesda, Md., said the satellite will provide improved navigation performance for the U.S. military as well as civilian users.

The modernized satellites feature improved antenna panels to increase signal power to GPS receivers, making them less susceptible to interference or enemy jamming attempts. Other enhancements include two new military signals and a second civilian signal.

The modernized satellite launched from Cape Canaveral, Fla., aboard a Boeing Delta 2 rocket. The current GPS constellation consists of 28 satellites.



Delta 2

NASA, Industry Partners Test Prototype Solar Sails

NASA announced Sept. 27 that the agency and two industry partners have completed ground tests on a pair of prototype 400-square-meter solar sails that could be used to propel spacecraft using energy from the Sun.

Solar sails harness pressure created by light photons bouncing off their surfaces to propel a spacecraft through space and enable it to perform other critical maneuvers. A spacecraft using this technology would require no propellant, meaning more of its mass could be dedicated to payload.

The recently tested prototype sails, which are 40 to 100 times thinner than a piece of writing paper, were developed together by ATK Space Systems of Goleta, Calif., and L'Garde Inc. of Tustin, Calif. The work is led by the In-Space Propulsion Technology Office at NASA's Marshall Space Flight Center in Huntsville, Ala.

Both companies tested the solar sails at NASA's Plum Brook Station in Sandusky, Ohio. There, the technology was subjected to space-like temperatures, boom and deployment tests and other space-environment conditions.

NASA's Science Mission Directorate selected the technology for development in August 2002.

Comments: Warren Ferster, wferster@space.com

replace long-term space station occupants Sergei Krikalev of Russia and John Phillips of NASA.

QinetiQ subjected Olsen to acceleration training using the company's centrifuge in Farnborough, England, which simulates the gravitational forces experienced during liftoff and re-entry. Doctors also monitored his heart and general well being during the tests to make sure he was fit.

Space Adventures Ltd. of Arlington, Va., helped arrange Olsen's flight. He will become the third space tourist following American Dennis Tito and South African Mark Shuttleworth, both of whom paid the Russians less than \$20 million for their flights to the space station.

Olsen is expected to help with general cleaning and prepare meals while on board the station. After a week, he will return to Earth with Krikalev and Phillips.

XM Satellite Radio Tops 5 Million Subscriber Mark

XM Satellite Radio of Washington announced Sept. 27 that it has surpassed the 5 million subscriber mark, a significant milestone for the United States' leading satellite radio service.

"We are on track to have more than 6 million subscribers by the end of this year," Hugh Panero, XM president and chief executive officer, said in a prepared statement, referring to expected sales during the upcoming holiday season.

Solar-Powered Aircraft Completes Tests

The Pathfinder-Plus, an experimental solar-powered aircraft, has completed a series of research flights to investigate the effects of turbulence on its lightweight, flexible-wing structure, NASA announced Sept. 21. The tests took place at the agency's Dryden Flight Research Center in Edwards, Calif.

The 23-year-old Pathfinder, which is due for retirement soon, performed two low-altitude flights, gathering data on turbulence and aircraft dynamics that will be used in designing future solar-powered aircraft.

For these latest flights, the aircraft was equipped with an atmospheric turbulence measurement system mounted on booms across the leading edge of its wing. The flights took place over the northern portion of a dry lake in an area designated for unmanned aerial vehicle testing. The Pathfinder-Plus tests were to take place in September 2004, but got delayed due to rainfall that flooded the lake bed.

AeroVironment of Monrovia, Calif., which built and owns the Pathfinder, conducted the tests. The company's vice president, Bob Curtin, said data from these trials will be used in designing the next stratospheric unmanned aircraft, the Global Observer.



Pathfinder-Plus

October 3, 2005

Satcom Firms Tout Their Value to Disaster Response

MISSY FREDERICK, WASHINGTON

Arguing that satellite technology proved invaluable for first responders during Hurricane Katrina, members of the industry urged Congress and the Federal Communications Commission Sept. 29 to remember that satellite providers must be protected and prioritized when spectrum allocation decisions are made.

Hearings before the Senate Commerce, Science and Transportation Committee and the House Energy and Commerce telecommunications and the Internet subcommittee both examined communications interoperability issues during Hurricane Katrina at Sept. 29 hearings. A similar hearing was held by the same Senate committee Sept. 22.

Industry leaders used the House hearing to tout once again the success satellite technology had during Katrina, though the technology received mixed reviews from government officials attending the Senate hearing this time around.

Satellite Industry Association Chairman Tony Trujillo Jr., a senior vice president at Intelsat of Washington, promoted satellite technology before the House, saying that satellites were used to reunite families, reconnect communities and connect emergency personnel.

"Although the performance of satellite systems was impressive, their use was often limited by a lack of preparation," Trujillo said. "Had satellite systems been

more effectively integrated into our emergency communications network, many of the communications problems that occurred ... would have been substantially mitigated."

Trujillo recommended satellites be regarded as an essential component in all future telecommunications planning, that systems be pre-deployed to professionals, and that satellite spectrum be preserved and protected.

Another industry player, Inmarsat Global Ltd. of London, filed a petition with the FCC Sept. 26, seeking permission to operate a spacecraft in the 2 GHz band, or S-band, part of the spectrum.

The FCC authorized eight companies to use the band for Mobile Satellite Services in 2001, but six of those companies have forfeited their authorizations, according to a Sept. 27 Inmarsat press release. The two companies remaining with authorization are ICO Satellite Management LLC of Kirkland, Wash., and TMI Communications, Inc. of Canada, according to Greg Kalish, senior vice president of Cubitt Jacobs & Prosek Communications, which represents Inmarsat.

Inmarsat representatives said the company is pursuing the 2 GHz spectrum in an effort to offer services to first responders.

"The devastating effects of the recent Gulf Coast hurricanes have demonstrated the need for interoperable communications service for emergency responders and political officials," Inmarsat Chief Executive Officer Andy Sukawaty

said in the release. "The 2 GHz band will allow Inmarsat to continue its long legacy of supporting the communications needs of the U.S. military, civil defense and all agencies associated with homeland security."

If Inmarsat's application is granted, it would provide Mobile Satellite Services by 2010 including voice, data and multimedia offerings for emergency responders, political officials and the military.

During the Senate hearing, Sen. Frank Lautenberg (D-N.J.) emphasized the need to incorporate satellite phones into any future solution for first responders.

"With satellite communication systems through cell phones, you won't have to worry about towers. We're very hopeful that can be part of the solution to the problem," Lautenberg said.

But David Boyd, director of the Office for Interoperability and Compatibility for the Department of Homeland Security, said that a combination of technology will be needed in a disaster, singling out satellite phones as just another technology that can be both helpful and unreliable.

"Many solutions have been offered and many claims have been made for each solution, but none is a silver bullet," said Boyd, who went on to outline some of the drawbacks of satellite technology.

"Satellite phones are extremely useful for command elements, but often hopelessly impractical for individual first responders," Boyd said. He said one draw-

back is that users must be trained to use the technology, and that vegetation, buildings or the elements can all cause interference to the signals.

"They also use batteries which need recharging, and a first responder in the middle of a rescue, up to his armpits in water will find the antenna hard or impossible to aim," Boyd said.

Iridium spokesperson Liz DeCastro said in an interview that these limitations are exaggerated.

"There wouldn't be literally tens of thousands of first responders using them today if they weren't a good tool for communications in emergency situations," DeCastro said.

Iridium's phones can be charged with a solar charger or cigarette lighter charger if electricity isn't available, DeCastro said, and have an extended battery, which allows up to six hours of talk time and 65 hours of standby time. She also said various companies are coming up with customized solutions so that a direct line of sight isn't needed between the antennae and satellite.

And while buildings and vegetation can block the phone's light of sight, DeCastro said weather is not an issue for satellite phones.

Iridium was among those scheduled to testify in a second panel featuring industry players before the Senate Sept. 29, but the panel was postponed to an undetermined future date.

Comments: mfrederick@space.com

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NASA Propulsion Strategy Reaches Back While Looking Ahead

BRIAN BERGER, WASHINGTON

The initial propulsion work in support of NASA's bid to return to the Moon and go on to Mars will focus primarily on adapting space shuttle systems and developing methane-fueled engines, a technology with which the United States has little experience.

The space shuttle main engine and solid rocket boosters are the basis for two new launchers NASA intends to develop, one for lofting an astronaut-carrying capsule known as the Crew Exploration Vehicle (CEV), and a heavy lifter for Moon-bound cargo loads. As currently envisioned, the CEV and other elements of the Moon and Mars exploration architecture would rely on engines fueled by a mixture of liquid oxygen and methane, NASA officials said.

Relying on a mix of old and new technology will help NASA limit risks in its propulsion development work, said Steve Cook, deputy director for space transportation at NASA's Marshall Space Flight Center in Huntsville, Ala. Marshall is in charge of developing the rockets NASA will need to return to the Moon by 2018 and go on to Mars.

"Historically when we've gone into a program like this, we've had engine developments that start right off the bat," Cook said. "Instead we're saying, 'let's focus our new propulsion development on much smaller-scale efforts. Let's also have back up plans in case it doesn't work out.' It's a balanced risk versus reward that we've laid out here."

NASA's propulsion plan also addresses the need to keep the shuttle

a concept that helps preserve the skills by taking advantage of what's available in the shuttle program and adapting it to the new program so you give the existing [work force] a future and utilize their years of experience to make the future a success."

NASA hopes to field the 25-metric-ton CEV and its launcher, known as the Crew Launch Vehicle, by 2012 to support the international space station program. The rocket is based on the space shuttle solid rocket booster built by ATK Thiokol of Brigham City, Utah, and uses a variant of the space shuttle main engine as an upper stage.

That launcher also would be used starting in 2018 for Moon missions, lofting the CEV into low Earth orbit to rendezvous with an Earth Departure Stage and Lunar Lander, both of which would be launched on a heavy-lift cargo vehicle. The heavy-lift rocket, which NASA intends to start developing around 2011, is expected to be powered by two space shuttle solid rocket boosters and a cluster of five space shuttle main engines.

Advancing Methane Propulsion

The new methane-fueled engines would be used to power the CEV and the ascent stage of the Lunar Lander. NASA envisions using methane-fueled technology for both the main maneuvering engines and attitude- and reaction-control thrusters on the CEV.

Cook said NASA intends to initiate before year's end an advanced development effort for methane propulsion. The effort, he said, would be run by NASA's Glenn Research Center in Cleveland. Indus-

Cook said, but has studied methane propellants closely enough over the years to know that it can be done. Some of this work was done by the major U.S. propulsion houses.

'Achievable' Engine

Both Pratt & Whitney Rocketdyne and its main rival, GenCorp Aerojet of Sacramento, Calif., are interested in developing methane engines.

Jim Long, Aerojet's director of business development, said the tricky part of methane engines primarily has to do with the storage and handling of the fuel.

"We believe that from an engineering standpoint that a [liquid oxygen]-methane engine is achievable with most of the risk being cost and schedule," Long said. "The greater part of the technical risk is in the tank and feed system."

Wood said more guidance is needed from NASA on the methane-fueled propulsion system, but that industry is up to the task. "We have been working with methane and talking about methane for 40 years," Wood said. "There has never been an engine produced that runs on methane."

Pratt & Whitney Rocketdyne and Aerojet are likely to face competition from at least two small upstarts that have been working on methane engine technology: XCOR Aerospace of Mojave, Calif., and Orion Propulsion of Madison, Ala.

"We have been looking pretty seriously at it both for auxiliary propulsion and for main propulsion for about two years now," XCOR President Jeff Greason said. "We got interested in it when we were doing a design study for [the U.S. Defense Advanced Research Projects Agency] on a low-cost upper stage."

Greason said XCOR decided late last year to build and test a small methane-fueled thruster "on our own dime to get some experience with the propellant." XCOR expects to be ready to start test firing the small thruster in early 2006, he said.

XCOR also submitted a proposal to NASA last year to develop, build and test a 10,000-pound to 15,000-pound variable thrust liquid oxygen-methane engine. NASA awarded XCOR a contract for a separate proposal to build and test a composite tank for cryogenic fuels, but passed on its methane engine proposal.

Orion Propulsion, meanwhile, has been doing component-level work on small methane thrusters under a Marshall contract, according to a company press release.

Recognizing that the methane engine is fraught with the usual technical and schedule risks, NASA has decided to devote some effort to a hypergolic system as a backup. Hypergolic fuels, such as hydrazine, were used during the Apollo program and are still used by the space shuttle for in-space maneuvering. But hypergolic propellants are not the most efficient propellants and



Shuttle Main Engine

are extremely toxic, requiring cumbersome and costly handling procedures.

Upper Stage Work

Next up on NASA's list of near-term propulsion needs, Cook said, is an upper stage engine for the Crew Launch Vehicle. Rather than design a new engine, NASA's plan calls for using the space shuttle main engine modified to start while aloft rather than on the ground.

Here again, NASA's choice was made with an eye on the future. NASA intends to use a cluster of five space shuttle main engines to power the main stage of its heavy-lift rocket. "Since that won't start until 2011," Cook said, using the shuttle engines for the Crew Launch Vehicle "keeps the [space shuttle main engine] line going" until then.

Cook said he expects the space shuttle main engine air-start program to be in component level testing by the end of the year, with larger-scale testing getting under way at Stennis Space Center in Mississippi "about a year from now."

"The whole program is about a three-year effort," he said.

Wood said adapting the space shuttle main engine to serve as the Crew Launch Vehicle's upper stage is "a very doable thing." He said the company took a close look in early 1990s at what it would take to start the engine in flight.

"The tests we did back then indicated that it would not be a big hurdle for the [space shuttle main engine] to achieve," Wood said. "But it's a matter of getting started and having time to run the verification test program to satisfy everybody that it can meet the mission requirements."

Wood said the space shuttle main engines that NASA flies today could be used for the Crew Launch Vehicle once the shuttle program wraps up.

"When the shuttle is retired I can immediately take the engine assets out of the shuttle program and fly them on these vehicles," Wood said.

NASA has 12 complete engines at Kennedy Space Center in Florida, Wood said. In addition, the agency has several test articles and older variants of the engines, and those plus hardware available at Pratt & Whitney Rocketdyne may bring up to 30 the number of engines that could be assembled relatively quickly in support of the exploration effort, he said.

NASA also needs to make some modifications to the four-segment solid rocket booster that forms the main stage of the Crew Launch Vehicle. ATK Thiokol says the changes needed are minor.

Michael Kahn, ATK Thiokol vice president of space launch systems, said the only foreseen changes have to do with the difference between the way the boosters separate from the shuttle orbiter — they fall off to the side — and the way they will separate from the Crew Launch Vehicle's upper stage. He said there will need to be some changes to the booster's aft skirt.

He also said Thiokol would have to take a careful look at the booster's existing parachute system since the boosters would be falling farther and faster when used for the Crew Launch Vehicle than when used for the shuttle.

The heavy-lift cargo vehicle NASA wants calls for two five-segment solid rocket boosters that will require a significant development effort. Kahn said the sooner NASA gets started on the five-segment booster, the better.

Looking further out into next decade, NASA needs an engine for the Earth Departure Stage it intends to use to send the Crew Exploration Vehicle and Lunar Lander on their way to the Moon. NASA intends to use the J2-S or an equivalent engine. Built by Pratt & Whitney Rocketdyne, the J2-S is a never-flown variant of the engine that powered the second- and third-stages of the Saturn 5 rocket.

"The whole initiative [NASA Administrator Mike Griffin] has introduced since he took over breathes new life into the propulsion industry. Before we were kind of in a going-out-of-business mode."

Byron Wood

propulsion work force intact until the last shuttle orbiter has flown.

Breathing New Life

NASA's strategy drew praise from the company that stands to benefit the most from NASA's planned propulsion work.

"The whole initiative [NASA Administrator Mike Griffin] has introduced since he took over breathes new life into the propulsion industry," said Byron Wood, president of Pratt & Whitney Rocketdyne of Chatsworth, Calif., the dominant U.S. maker of liquid-fuel rocket engines. "Before we were kind of in a going-out-of-business mode."

Wood added that NASA's emphasis on heritage systems will help Pratt & Whitney Rocketdyne, among others, ensure a safe fly-out of the space shuttle manifest.

"I think [Griffin] came up with

try sources said Glenn is expected to issue a draft request for proposals for methane research in the coming weeks.

Cook, who was in charge of the launch vehicle portion of NASA's recently unveiled exploration plan, said NASA's decision to develop a pressure-fed methane engine was driven by a look ahead at what would be needed for manned missions to Mars. While methane is a less efficient propellant than liquid hydrogen, it is easier to store for long stretches and is readily available on Mars, making it possible for NASA to meet future propellant needs by taking advantage of Martian resources.

Further, NASA sees the Moon as a proving ground for systems needed to explore Mars.

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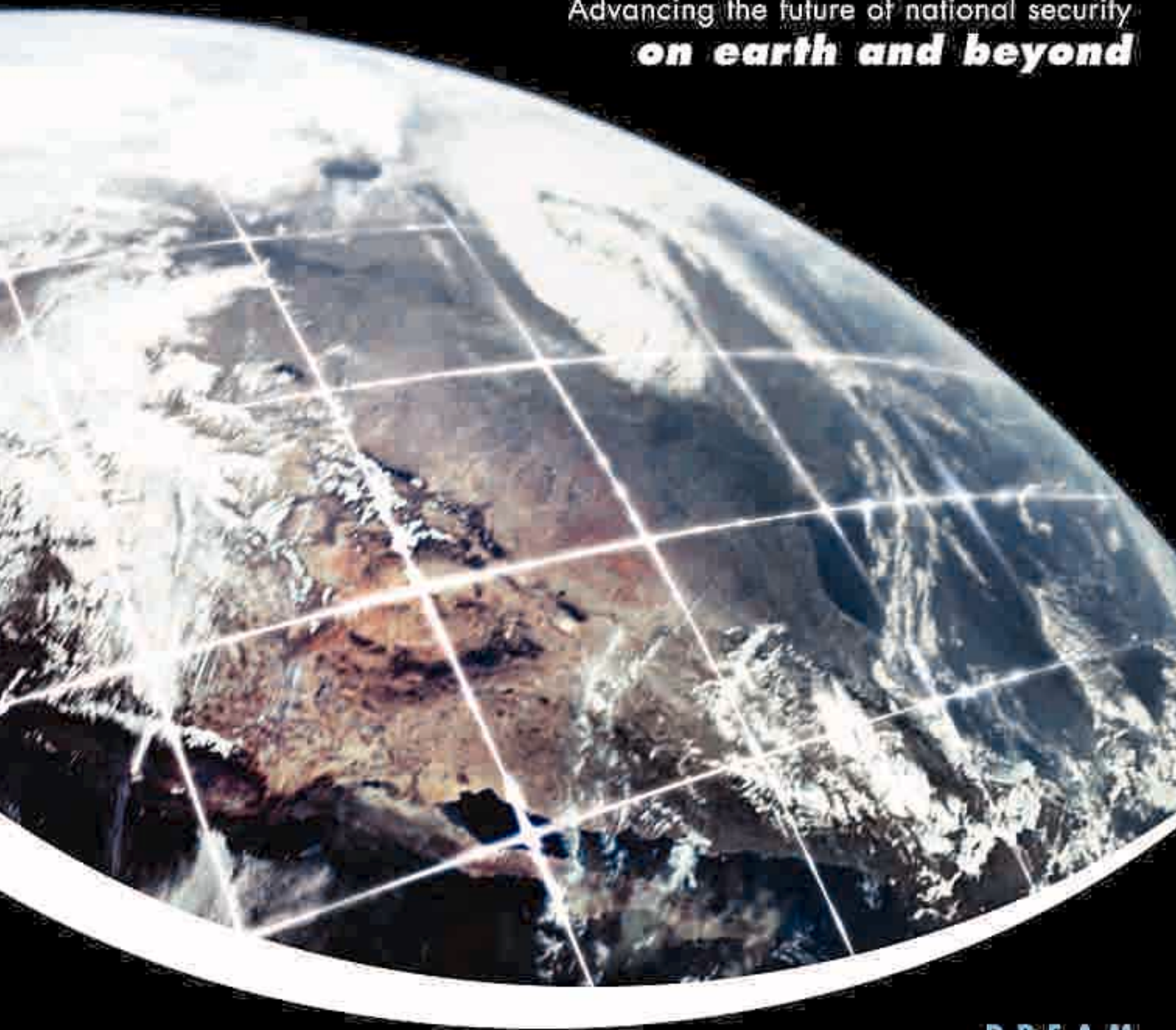
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October 3, 2005

STRATEGIC SPACE SUPPLEMENT

Senate Panel Affirms House Cuts to T-Sat, Space Radar

COLIN CLARK, WASHINGTON

JEREMY SINGER, WASHINGTON

A 2006 defense spending bill passed Sept. 28 by the U.S. Senate Appropriations Committee virtually assures that the U.S. Air Force will once again have to rewrite its deployment timetable for two major satellite systems, one for communications and the other for ground surveillance.

The bill's funding figures for the Transformational Satellite (T-Sat) communications system and Space Radar surveillance system track closely with proposed reductions in companion legislation approved by the House of Representatives in June. That leaves little to negotiate concerning those programs when the House and Senate lawmakers meet this autumn to hammer out a final version of the 2006 Defense Appropriations Bill.

And in a reflection of Congress' mounting frustration with cost growth on U.S. military space programs in general, the report accompanying the Senate bill directs the Air Force to come up with a plan in four months "to improve space acquisition and re-establish the proud legacy of successful satellite development." The panel "strongly encourages" the Air Force "to continue the implementation of needed changes in space acquisition," the report said.

The panel recommends cutting \$250 million from the Air Force's \$836 million request for the T-Sat effort. On top of that, the committee proposed fencing off \$150 million of the remaining money for the possible acquisition of a fourth Advanced Extremely High Frequency (EHF) satellite, the report said.

The Air Force has indicated that it wants to deploy just three Advanced EHF communications satellites before moving on to the more-capable T-Sat system, but the committee directs the service to take another look at the issue. Should the military decide to build the



The Air Force wants to deploy just three Advanced EHF communications satellites (one shown above) before moving on to the more-capable T-Sat system, but the U.S. Senate Appropriations Committee directs the service to take another look at the issue and consider incorporating advanced capabilities on a fourth Advanced EHF satellite.

fourth Advanced EHF satellite, the \$150 million would go toward that effort.

As part of its study, the Air Force should consider "advanced capabilities" that could be incorporated on a fourth Advanced EHF satellite, the report said.

The Senate report said "the current [cost] projections based on a large constellation are very high and bring into question the program's affordability."

Air Force and industry officials have raised the possibility of introducing T-Sat capabilities incrementally through the predecessor program.

The "committee encourages the Defense Department to pursue this policy ... if the study findings support this approach," the report said. The service also should evaluate whether it might need additional Advanced EHF satel-

lites beyond the fourth, the report said.

The House version of the defense spending bill would trim \$400 million from the Air Force's request for T-Sat next year. In a report accompanying its version of the bill, the House recom-

are in jeopardy.

The White House Office of Management and Budget has yet to publish an official response to the Senate bill. However, following passage of the House version, the budget office said the proposed reductions to T-Sat and Space Radar, along with those on several other programs, would cause significant delays or cancellations.

Pentagon officials have discussed the possibility of keeping the T-Sat and Space Radar programs on track next year with money diverted from other programs, but that possibility is considered a long shot, sources said.

The Senate bill also trimmed \$100 million from the Air Force's \$757 million request for the Space Based Infrared System (SBIRS) missile warning system. Citing the program's significant cost growth in the last year, the panel directed the Air Force to provide a new cost estimate and "implement any needed management changes...."

Air Force officials already are reviewing alternatives to the missile warning system as required by law in cases where Pentagon programs exceed the 25-percent cost growth threshold.

The House did not reduce the SBIRS funding request for 2006. If the Senate reduction stands, it would cause significant disruption to the program and drive the cost up even higher, according to a Pentagon source.

The Senate report also expressed concern about the lack of competition for Pentagon launch vehicle contracts.

The Air Force plans to split roughly evenly its next round of satellite launch contracts between Lockheed Martin Corp. and Boeing Co. in order to keep both companies in the launch business. In addition, the companies are seeking U.S. government permission to combine their rocket manufacturing operations.

"Thus, the Committee directs that launch services contracts provide an annual opportunity for companies to present their qualifications and compete for launch services," the Senate report said.

INSIDE



Sen. Wayne Allard

Sen. Wayne Allard (above), chairman of the Congressional Space Power Caucus, said our nation's dominance is being challenged not so much from outside this country as from within. In many respects, the senator said, we have become our own worst enemy. See *Commentary*, page 4A

Gen. James E. Cartwright (below), commander of the U.S. Strategic Command, said there needs to be more integration between space, air, land and sea. When you have surveillance needs, the general said, you may be able to bolster your coverage through air, terrestrial or maritime assets. See *Profile*, page 8A



Gen. James E. Cartwright

mended that the Air Force consider alternatives to the current schedule for fielding T-Sat that included slowing the pace of development while launching upgraded versions of the Advanced EHF and Wideband Gapfiller satellites.

One source close to the T-Sat program said the first launch of those satellites, currently scheduled for 2013, likely will slip about eight months into 2014 as a result of the congressional actions. That assumes the program will receive full funding in future years, a prospect that seems unlikely given the skepticism among lawmakers about the readiness of the technology. T-Sat would be delayed further if Congress ultimately compels the Air Force to buy the fourth Advanced EHF satellite in the final version of the appropriations bill, the source said.

Meanwhile, the Senate panel echoed the House bill by cutting \$126 million from the Pentagon's \$226 million request for the Space Radar. The Senate report said "the current [cost] projections based on a large constellation are very high and bring into question the program's affordability."

The Pentagon wants the Space Radar satellites to provide high-resolution imagery and surveillance of moving ground targets regardless of time of day or weather. The Air Force had hoped to begin launching those satellites around 2015, and conduct a small-scale space demonstration in 2008, but those plans

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STRATEGIC SPACE SUPPLEMENT

The Greatest Threat to U.S. Space Dominance

◀ U.S. SEN. WAYNE ALLARD (R-COLO.) ▶

After the end of the Cold War, the range of threats facing our nation seemed limited and discernible. We could plan, prepare and, if necessary, preempt a potential threat. But the terrorist attacks on Sept. 11, 2001, and more recently hurricanes Katrina and Rita, have demonstrated that our knowledge is limited and that our nation remains vulnerable to man-made and natural disasters.

The value of space was again demonstrated during the Katrina relief effort. Without space, it might have taken weeks to fully respond to the crisis.

For example, the Air Force's Defense Meteorological Satellite Program spacecraft revealed to emergency management agencies those communities that lacked electrical power. Commercial remote sensing companies provided high-resolution satellite imagery to relief organizations, which helped determine the extent of the damage in specific areas. And, our Global Positioning System (GPS) helped our response units navigate areas devoid of landmarks or signs of previous existence.

Disasters like Katrina and Rita have helped us to appreciate space as a critical enabler. However, I still do not believe we have fully recognized just how important space is to our country.

Space Dependence

Four years ago, the U.S. Commission on National Security Space found that the United States was more dependent upon space than any other nation, although we often take space for granted. But if you look closely, you will see that most of our commercial sector now depends upon space assets. And our military looks to space so

Our nation's dominance in space is being challenged not so much from outside this country as from within. In many respects, we have become our own worst enemy.

much that it would be difficult for our forces to operate without the unique capabilities — such as communications and navigation — space provides.

The Space Commission identified several scenarios in which our dominance in space could be significantly diminished. A potential terrorist attack, another war in the Middle East, or tensions over Taiwan headed the commission's list of worries.

While I share many of the concerns expressed by the Space Commission, I believe that a new, more ominous threat has arisen.

Our nation's dominance in space is being challenged not so much from outside this country as from within. In many respects, we have become our own worst enemy.

Over the last decade, we have done everything possible to sabotage our own space supremacy. And we have done this in every area of government, at every possible turn. Our warfighters, program managers, contractors, and yes, even Congress, are responsible, and all are guilty of ignoring the

warning signs.

Our nation has no rival when it comes to building world-class satellite systems. We have an extremely talented industrial base, outstanding research laboratories and brilliant engineers. Most of our satellite systems operate years beyond their life expectancy and out-perform even our own high expectations.

Greatest Challenge

The problem is not the operation of our satellites. Once they get into space, our satellites rarely disappoint. Rather, our greatest challenge lies in the development and building of those satellites.

Many national security acquisition programs continue to experience significant technical problems, schedule delays and cost growth. The Defense Science Board (DSB) concluded that cost has replaced mission success; unrealistic estimates have led to unrealistic budgets; and inadequate definition of requirements has resulted in the introduction of new requirements late in the development cycle.

The problems identified by the DSB only scratched the surface. Witnesses from the Government Accountability Office (GAO) have testified that most original baselines for many space programs — perhaps the most important point in the acquisition process — are flawed from the very beginning. Cost, schedule and performance estimates used for the baseline, in almost every space program, have been prepared with highly inaccurate, or at best, incomplete, information.

Some would suggest that the best way to fix this problem is to hire better program managers and system engineers. I certainly

agree that the absence of trained and experienced space professionals has hindered the government's ability to manage these programs.

Acquisition Breakdown

However, as the DSB and GAO have discovered, the deck already is stacked against a program manager before he or she starts working on a program. While the lack of talent is hurting our space programs, it is the space acquisition process itself that is bringing our space programs to a grinding halt.

This is occurring for multiple reasons.

First, the Department of Defense is launching acquisition programs before fully knowing whether the planned technologies can achieve the system requirements. All too often the necessary investments in technology development and systems engineering have not been made, nor has the technical risk for a program been fully examined.

According to GAO, the primary reason why this happens is because it is easier for a



Sen. Wayne Allard

program manager to secure money within the department by including the technology development and system engineering within an acquisition program. This problem is so serious that, according to the GAO, 80 percent of research and development funding is being allocated to acquisition programs, not science and technology budget activities. What is so harmful about including research and development activities within an acquisition program? The answer is that it introduces an unacceptable degree of uncertainty into the acquisition program.

In most cases, the schedule for a space acquisition program is entirely dependent upon how fast the technology can be developed. As the element of uncertainty rises, both cost and schedule are put at greater risk. Too many times, baselines for satellite programs are blown because the maturity of a particular technology has not progressed to the level needed.

Another way the process is hindering our space acquisition programs is the manner in which contractors are winning bids to develop and build these satellites.

Space program contractors are submitting bids at the lowest possible credible price. In the highly competitive space business, where there are few contracts and 10- to 15-year acquisition timetables, contractors are fighting tooth and nail over every contract. As a result, according to DSB, most contractors submit bids that have a 20 percent chance of meeting the original baseline for the program.

So what does this mean to a \$5 billion space acquisition program? According to A. Thomas Young, the former chairman of DSB, the contractor bids are so far off that when a government program manager walks in the door on the first day to work on his or her \$5 billion program, he or she is

already guaranteed a \$2.5 billion cost overrun. Further complicating the situation is the fact that the program manager won't discover the inadequacy of the program's baseline until the program is halfway complete — when the integration testing starts.

Requirements Creep

A third reason are the numerous demands being placed on our space programs by the warfighter. Some of these requirements are legitimate needs. Others are desires that provide only marginal or niche capability.

There has been a profound absence of discipline when it comes to requirements definition and requirements implementation. The warfighters do not seem to understand the impact that adding new requirements has on cost and schedule: Adding new requirements after a certain point is a sure-fire way to ensure a program's cost and schedule will grow beyond its original baseline.

It is important to acknowledge that the Air Force is trying to fix these problems. I applaud Gen. Lance Lord, the commander of Air Force Space Command, for taking the lead in crafting the Air Force's space cadre development strategy. I believe this effort is critical and will pay significant dividends in the future. I also support the excellent work done by former Under Secretary of the Air Force Peter B. Teets in developing the Air Force's new space acquisition guidelines.

Yet, while these efforts are notable, they don't go far enough.

The Air Force continues to resort to re-baselining many of its space acquisition programs in order to complete them. Some space programs now are projected to cost



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STRATEGIC SPACE SUPPLEMENT

Europe Readies Test of Laser Communication System Hardware Might Be Used on U.S. Missile Defense Satellite NFIRE

PETER B. de SELDING, PARIS

The German and European space agencies are scheduled to begin testing Oct. 3 on laser-optical communications links between terminals located on mountaintops 142 kilometers apart. The testing is in preparation for the 2006 launch of the hardware aboard U.S. Missile Defense Agency and German government satellites.

The two-week trial of laser communications hardware developed by Tesat-Spacecom GmbH, of Backnang, Germany, will be conducted from the Optical Ground Station, located at an elevation of 2,000 meters on Spain's Tenerife Island and operated by the European Space Agency (ESA).

The laser communications terminal will transmit and receive signals from an identical unit installed at a similar elevation on La Palma Island.

The purpose of the tests is to assess the degradation of a laser signal sent at a speed of 5.5 gigabits per second as it traverses the atmosphere.

The hardware is identical to gear being integrated as a secondary payload on the German government's TerraSAR-X radar Earth observation satellite and the U.S. Missile Defense Agency's Near Field Infrared Experiment (NFIRE), both set for launch in 2006.

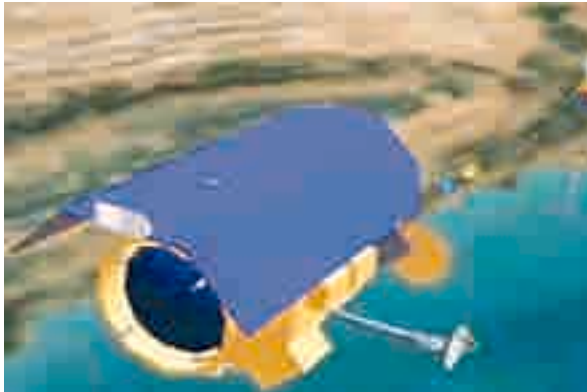
The laser communications packages are not related to either satellite's prime mission. TerraSAR-X is designed as an operational Earth observation system for use by German government and commercial industry. NFIRE is intended to develop the means to distinguish the body of missiles in their boost phase from their exhaust plume.

Once in orbit, the two laser terminals will attempt to communicate with each other in the more laser-friendly environment of low Earth orbit.

Room for the laser payload on the NFIRE satellite opened up after the Missile Defense Agency removed a kill vehicle carrying an additional sensor that was designed to fly close to the target missile during testing.

However, the U.S. Senate Appropriations Committee recommended that the Pentagon restore the kill vehicle to NFIRE in its version of the 2006 defense budget legislation, and if the House of Representatives agrees to do so when members meet to sort out differences between their bills, the laser payload may need to find a new host.

The use of laser optics for communications has yet to fulfill its backers' long-held hopes for military or commercial



NFIRE

space applications. But several European governments, notably Germany and France, continue to invest in it, mainly for its potential to speed communications between low-orbiting satellites and their ground controllers, even when they are on opposite sides of the Earth; between satellites located in low-Earth and the higher geostationary orbit; and between unmanned vehicles or aircraft and geostationary-orbiting satellites.

Tesat-Spacecom has been developing its laser terminals for more than a decade. Since 2002, it has received about \$40 million in funding from the German Aerospace Center, DLR, which is the principal owner of TerraSAR-X.

German government officials have said the laser technology is a candidate for use on the second generation of the German Defense Ministry's five-satellite SAR-Lupe radar reconnaissance system. The first-generation satellites, which are designed to use low-speed radio-frequency intersatellite links, are scheduled for launch starting in 2006.

Tesat-Spacecom had been selected to provide laser intersatellite links for the now-abandoned U.S.-based global satellite broadband constellations.

Berry Smutny, Tesat executive vice president, said the company has abandoned, for now, its attempt to introduce the technology into the commercial telecommunications market. But the military and civil government markets, he said, continue to show promise.

"What we hope to develop here is a trans-Atlantic link in both senses of the word," Smutny said Sept. 28.

ESA and the French space agency, CNES, were the first in Europe to use lasers in space. The Silex laser terminal built by EADS Astrium of France was launched on CNES' Spot 4 Earth observation satellite in 1998 and has since successfully communicated with the European Space Agency's Artemis telecommunications satellite in geostationary orbit.

Under a 1994 agreement, ESA and the Japanese space agency, JAXA, plan to use a Japanese-built version of the Silex terminal launched Aug. 23 aboard Japan's Kirari low-orbiting satellite to communicate with Artemis.

A.G. Bird, an Artemis program manager at ESA, said the Kirari-Artemis communications experiment is scheduled to start in November. A test model of the Japanese-built terminal was used in 2003 from the Tenerife Optical Ground Station to communicate with Artemis.

The Silex terminal on Artemis and Spot 4 weighs about 190 kilograms, operates on 200 watts of power and provides 50 megabits per second of data throughput. The Tesat-Spacecom terminal weighs less than 25 kilograms, operates on 125 watts of power and is designed to provide 5.5 gigabits of throughput.

"The EADS Astrium and Tesat-Spacecom units are different technologies that are difficult to compare," said Zoran Sodnik, manager of the Tenerife station. "The Tesat product is a second-generation system and is certainly more advanced in terms of its capability to provide high-speed intersatellite links. How well it will operate through the atmosphere is what we will find out in the tests we are about to conduct."

The French arms procurement agency, DGA, expects to begin tests of its Lola technology demonstrator in 2006 with a new-generation Silex terminal from EADS Astrium installed on a jet aircraft to communicate with Artemis. DGA officials say ultimately the technology could be used to beam communications between unmanned aerial vehicles and ground controllers via a geostationary satellite.

The Lola experiment and the work at ESA's Optical Ground Station ultimately should provide clues as to whether laser communications' advantages in encryption and data throughput can overcome the signal dispersion that occurs as the signal courses through the atmosphere, especially for ground-to-space links.

Comments: pdeselding@compuserve.com

ALLARD FROM PAGE 4A

more than twice their original baseline. According to the Congressional Budget Office, the Air Force budget for space programs is projected to grow by 40 percent next year and double by 2011. This is not because of new programs, but to pay for those already in the pipeline that have been delayed or experienced significant cost increases.

We in Congress are tired of the frequent cost increases and schedule delays.

No More Excuses

We have heard all the excuses and they are no longer good enough. In many respects, the Air Force and its contractors have lost all credibility with Congress when it comes to space acquisition programs. My colleagues and I are no longer surprised by additional cost increases or notices of further schedule delays. Nor do some in Congress give much credence to the Air Force's proposals to fix these programs.

The Congress's lack of confidence in Air Force space acquisition management has resulted in enormous reductions in funding for space programs. For example, the House of Representatives cut \$400 million

from the Transformational Satellite program and another \$125 million for the Space Radar program.

That is a net loss of more than \$500 million from the Air Force's space budget next year. Unfortunately, similar cuts can be expected in the Senate as well.

The key question that we should be asking is: Can the Air Force get its space programs back on the right path?

First, we must slow down our newer space acquisition programs until we get a better trained, more experienced space cadre in place. We need people who understand the complexities of our space programs and who can make decisions that are in the best interests of our national security. We also need to invest the time to conduct realistic, independent cost estimates and perform multiple examinations of the technology being used in the program. We need to slow down, learn from our mistakes, and make sure to get it right the first time.

Second, the Air Force must limit the amount of research and development that is conducted in its space acquisition programs. More money needs to be spent on basic science and technology so that the technical barriers for incorporating advanced technolo-

gies in acquisition programs are reduced.

Acquisition programs should not be incubators for unproven technology. We need to better differentiate between the building of a satellite and the development of the technology necessary for that satellite.

Third, the Air Force must prove that it can effectively manage a space acquisition program from start to finish under the program's original baseline. The Air Force needs a space acquisition program that it can point to as a successful example.

The Air Force also needs to prove that its space program budget requests are justified, and that the service will not be asking for more money to pay for unexpected costs increases, except in the most unusual and infrequent circumstances.

Restoring Credibility

Until its credibility is restored in Congress, you can expect the Air Force to face a struggle in its effort to get its programs off the ground and into orbit.

Fourth, only when we have rebuilt the confidence that has been lost between the Air Force and Congress — and only then — do I believe we should start considering a mechanism for providing a reserve fund.

Since unexpected costs and schedule delays do occur, it is only prudent to provide program managers with a reserve fund they can use to deal with an emergency problem. This should not be a slush fund. Nor should it be a special account to add more capability. If the fund is created, there must be close management and even closer oversight.

I strongly believe the continued mismanagement of our space acquisition programs is a far greater threat to our space dominance than any external danger. Our space assets have provided a critical transformational capability for warfighters, and they remain a key component of our national intelligence network. We cannot afford to remain on the current path. Too much is at stake.

The good news though is that the Air Force can fix this. Our problems are not insurmountable. Indeed, with Under Secretary Ron Segal's leadership, I am confident this situation can be turned around and that significant progress can be made toward this goal.

These are tough issues facing our nation. We need to overcome these challenges, and together, I know we can.

U.S. Sen. Wayne Allard (R) is Colorado's senior senator, and is chairman of the Congressional Space Power Caucus.



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STRATEGIC SPACE SUPPLEMENT

PROFILE

Marine Corps Gen. James E. Cartwright

**COMMANDER,
U.S. STRATEGIC COMMAND**

Not Sticking with the Status Quo at Strategic Command

James Cartwright entered uncharted waters in the summer of 2004 when he took command of U.S. Strategic Command, or Stratcom. That organization, historically focused on the ICBM mission, had seen its portfolio expand significantly in the preceding years to include space support, missile defense and cyber warfare.

Cartwright's first order of business was to review Stratcom's organization. That exercise led to changes that included shifting some of the operational functions traditionally associated with U.S. Space Command — which had been folded into Stratcom — to other facilities such as Vandenberg Air Force Base, Calif.

But Stratcom retained broad oversight and long-term planning responsibilities for space at its headquarters near Omaha, Neb. And when it comes to that planning, whether for satellite architectures or computer software, Cartwright makes clear he will not be bound by the practices of the past.

A former Marine aviator with flight experience in F-4 and F/A-18 combat aircraft, Cartwright spoke recently with *Space News* editor Lon Rains and staff writer Jeremy Singer.



SPACE NEWS PHOTO BY NICKY KOZAK

What are your main concerns today with military space programs?

Our analysis indicates that the problems lie not with the technical sophistication of the programs, but with the level of effort that goes on.

Space programs take five or more years in systems engineering whether they are a new start with high technical risk or a recapitalization of an old capability.

If that's true, or if it is true even on the margins, it tells you that you've got to figure out how to go in and re-engineer the process in a way that goes back to the core values — what is it that we want to accomplish, and is space the right domain?

There needs to be more integration between space, air, land and sea. For instance, you might want to do global surveillance from space, so you examine issues like how many orbits you need per day, etc.

And when you have surge needs, you may be able to bolster your coverage through air, terrestrial or maritime assets.

How do you get to more integrated architectures?

Right now, we have space architects, we have air architects, we have intelligence architects. How you start to cross pollinate really is at the heart of the need for the new Strategic Command. It's to put these missions in a place where — and I don't want say this pejoratively — you're not necessarily carrying the baggage of how the domain grew up. And so you can look at it in a way that says, "I could get great leverage if I could just connect these two dots."

Do you embrace the idea of getting away from

multimission platforms and returning to single-sensor satellites?

What you'd like to have is the flexibility for the mission to grow with the changes in the world. We have talked for a long time, let's just take air as an example, about multimission platforms.

Well, if I'm going to do that in space then the sophistication goes up. I need to make that platform last longer. I need to have more people associated with the platform to make the systems work, and you start to build yourself to a spiral where you no longer can afford the platforms.

If you were to lose one, the loss — the significance, the regret factor, however you want to term it — becomes very difficult. And because of the capital investment it has to almost be perfect. You can't assume any risk in the normal operations. In space you can't assume risk in the launch that you would not get to orbit for some reason.

And so, have we gone too far in multimission? I think so. Do we want to go to single mission? Case is still out. I think you can get down to where a couple of missions give you the breadth and flexibility, and are compatible.

Usually in space what you worry about is sensors that have some vibration or movement in pointing that disrupts other sensors on the spacecraft. So you find those synergies and try to get there, rather than trying to build an overly complicated spacecraft.

Does the separation of the Air Force undersecretary and National Reconnaissance Office (NRO) director positions concern you?

There has to be some sort of relationship between the departments and the NRO be-

cause we have missions that are integrated. Almost all of our missions today are integrated.

You'd have to flesh out the relationship between the secretary of defense and the NRO director. There has to be a way for military and intelligence issues to be brought to the table.

The chairman of the joint chiefs has a legal requirement to be able to advise the secretary and the president, and that includes matters associated with space. So he has to have some relationship with the NRO.

The next level would be Stratcom. And because of the operational missions that we've been given and the integration, there has to be an articulation of that relationship, particularly on the operational side where our responsibilities and those of the NRO's may need to be de-conflicted on issues ranging from communications to space situational awareness.

Are you nervous about how this relationship is going to work out?

No. These are reasonable people. They're all Type A, but they're reasonable people. At the end of the day, they want this nation to succeed.

Where are you in the process of getting the national missile defense system declared operational?

If you need the system, it's ready. It's not heavily redundant, but we're working to add redundancy and improve our command and control work.

We're going through several software upgrades that are a result of Pfc. Cartwright sitting at a console for multiple hours and then coming back and saying "you know if that

were red instead of blue I might see this or I might catch this."

The major issue right now is to integrate that redundancy, get a confidence in the operators that that redundancy in fact is there and will serve us well.

The flight test program also has to prove out, as all test programs must. But I would say of all of the programs, that's the one I'll watch most carefully.

What are some of the changes that you would like to make in the way Stratcom buys software?

Today, as is the case with satellites, we try to buy one software package that serves all functions. And so it takes us forever to build it; when it gets fielded it can be labeled legacy; it costs us a fortune; and for an individual, again Pfc. Cartwright sitting at a desk, probably only uses 30, 40 or 50 percent of the functionality.

The question is can we — particularly in the command-and-control and the user-defined functions — can we do that in a simple architecture? There are several commercial alternatives out there that are very simple, and we can teach Lance Cpl. Cartwright to actually do this in school and write applications, so that I can find a need, put you at a desk and say "this is going to be your function," and give you an update every week until you have about the 90-percent solution or 80-percent solution of your function.

It's tailored to you. When I'm done with it, I can toss it for no little or no loss and I can change my applications as fast as the threat changes. And that's where I want to be. I don't want to be building too many overly complex software packages that, because of the investment, I've got to keep whether it fits the problem or not.

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SPACE NEWS
INTERNATIONAL



October 3, 2005

Taiwan's Argo Could Be Added to RapidEye

PETER B. de SELDING, PARIS

Taiwan's national space agency has hired Italian and German companies to assist in the design of a multimission Earth observation satellite platform, whose first application may be as part of the RapidEye commercial constellation scheduled for launch in 2007.

Carlo Gavazzi Space of Milan, Italy, and SpaceTech of Immenstaad, Germany, have formed a joint venture to assist Taiwan's National Space Organization (NSO) in developing the Argo satellite, which Taiwanese authorities plan to launch in 2008.

Under current plans, Argo would be inserted as a sixth satellite in the RapidEye Earth observation constellation managed by RapidEye AG of Brandenburg, Germany. The five primary RapidEye satellites are under construction by Surrey Satellite Technolo-

gy Ltd. of England and are to be placed into orbit aboard the Ukrainian Dnepr silo-launched vehicle.

"The signing of the contract with us is the first concrete step moving Argo forward," Roberto Aceti, Carlo Gavazzi Space's general manager, said in a Sept. 28 interview. "The satellite bus would be developed in Taiwan, whereas we have responsibility for system consulting and some of the on-board avionics."

C.Z. Frank Chen, chief scientist at Taiwan's NSO — formerly known as the National Space Program Office — described Argo as the first in a series of planned Earth observation missions using small satellites developed domestically. In a Sept. 14 internal presentation on Argo that was subsequently published by the NSO, Chen said joining the RapidEye system will permit Taiwan to take part in a commercial venture.

RapidEye Director Wolfgang Biedermann said RapidEye has had discussions with NSO authorities but cautioned that no formal agreement on Argo's insertion into the RapidEye system has been signed. "We would expect this to be a great enhancement to our system, but details need to be worked out," Biedermann said Sept. 28. "We have certain requirements and we must be certain that a new addition does not disrupt our system."

NSO's Chen said that Argo, launched a year after the five RapidEye satellites, would require that four of the five RapidEye spacecraft be repositioned in orbit so that the resulting six-satellite formation is evenly distributed 60 degrees apart in the planned 620-kilometer orbit. Each satellite is expected to have a swath width of 77 kilometers and a ground resolution of 6.5 meters.

NSO already operates the For-



RapidEye Constellation

mosat-2 satellite, which was built by EADS Astrium of France and launched in mid-2004. Formosat-2 has a 2-meter ground resolution

— 8 meters for color imagery — and a 24-kilometer swath width.

Comments: pdeselding@compuserve.com

Israeli Firms Join Forces on Microsatellites Business Venture Fueled by Ministry of Defense Space Plans

BARBARA OPALL ROME, TEL AVIV, Israel

Israel's top government-owned aerospace firms are putting aside their historic rivalry for future space work and forming a new commercial joint venture aimed at the prospective market for microsatellites.

Executives at Israel Aircraft Industries (IAI) Ltd. and Rafael Armament Development Authority Ltd. expect to sign an agreement formalizing the new entity by mid-October. Tentatively called MicroSat, Ltd., the new company should end a protracted turf battle between the two firms over Defense Ministry (MoD) budgetary allocations and the marketing rights associated with the development and production of relatively low cost, multi-mission satellites weighing no more than 120 kilograms.

For years, IAI — the nation's sole satellite-producing firm — has aggressively opposed attempts by Rafael to encroach on what it views as its exclusive domain. IAI executives argued that it would be a waste of taxpayer funds for the cash-strapped nation to invest in the duplicative infrastructure demanded by space-related development activities.

The matter was ostensibly put to rest in mid-2003, when Amos Yaron, then director-general of Israel's MoD, strong-armed the two firms into agreeing to coordinate rather than compete for funding and infrastructure development associated with microsatellite initiatives. Jacob Toren, a former Rafael chairman, succeeded Yaron as MoD director-general in mid-September.

In interviews here, government and industry sources said the new firm would combine IAI's satellite design, manufacturing, integration and launch expertise with capabilities developed at Rafael in the fields of micropropulsion, inertial sensors and inter-satellite, laser-linked communications.

"The new firm will focus on joint development and sales of micro-satellites that could weigh as little as 10 kilograms and no more than 120 kilograms," said Nehemia

Miller, director of Rafael's Space Systems Directorate. "It will be the first commercial space venture jointly managed and owned by IAI and Rafael, with the managing director coming from Rafael and the chairman from IAI."

And while MicroSat, Ltd. is initially aimed at commercial and scientific projects, sources here readily acknowledge it would serve to further national military space initiatives that have been hard hit by budget cuts in recent years. MicroSat, Ltd.'s focus on the microsatellite and so-called nanosatellite niche markets conveniently overlaps with MoD's ambitions to launch on demand, from fighter aircraft, very small satellites capable of operating as a unit for a variety of intelligence gathering, targeting and command and control missions.

As envisioned by the MoD military space roadmap — details of which remain classified — the generic, low-cost satellite bus would house a variety of so-called plug-and-play payloads, with mission functions divided among two or three platforms so that the sum of the formation far exceeds the contribution of each individual spacecraft.

Tal Inbar, senior research fellow at Israel's Fisher Institute for Air & Space Strategic Studies, refused to elaborate on MoD military space plans. He noted, however, that in a small country like Israel, where less than a handful of firms are responsible for developing space systems, "any gains achieved through commercial space programs naturally serve to promote national security goals and our defense industrial base."

In a Sept. 28 interview, Inbar said he was optimistic about the eventual prospects for the micro-satellite market. "Very small satellites with a short lifetime that can be launched on demand to the most efficient low Earth orbits could be an excellent tool for disaster monitoring and mitigation. Such platforms are not yet available, and recent Katrina and Rita hurricanes made clear that even a space superpower like the United

States lacked sufficient satellite coverage for these missions," he said.

He added that such satellites could potentially be launched from airliners. "In this exclusive and potentially lucrative niche market, the Israeli industry has much to offer," Inbar said.

However, Israeli executives directly involved in the establishment of the MicroSat venture were much more hesitant in their expectations for the emerging market.

"In the long term, our vision is to provide a constellation of micro-satellites whose contribution is far greater than any one of them," said Yossi Weiss, manager of the Space Division at IAI's MBT Group. He quickly added, "But this is still in the research and development phase and could take 10 to 20 years to realize. We're going to need to do a lot of research in order to validate if there is truly a commercial market out there for this niche."

Likewise, Rafael's Miller conceded there is no immediate business justification for the new firm. Nevertheless, he said the MicroSat venture represents a long-term investment that could yield future profits while promoting nearer-term Israeli development goals. "Right now, there is no killer application and no real business benefit in support of these extremely small satellites. But we're looking to the future. Not too long ago, nobody expected laptop or hand-held computers to become the necessity they are today. We expect the same trend to materialize in the micro- and nano-satellite niche."

Ironically, the first tangible program to be managed and implemented by the new firm does not fit into the category of microsatellites. Nevertheless, government and industry sources intend to leverage work performed for Project Venus, a French-Israeli cooperative program aimed at precision agricultural imaging and environmental monitoring, into future microsatellite initiatives.

Planned for launch in 2008, the Vegetation and Environment Monitoring New Mi-

cro-Satellite (Venus) mission is based on the same satellite bus developed by IAI for MoD's TechSAR synthetic aperture radar satellite, which has an estimated weight of 210-260 kilograms. It also will incorporate a low-thrust electric propulsion system developed by Rafael in cooperation with Israel's Technion University and the country's Nahel Sorek nuclear research institute.

Israeli industry executives said the new IAI-Rafael venture would sign a contract soon with the French space agency, CNES, which partners with the Israel Space Agency on the Venus program. Weiss said use of the TechSAR satellite bus for the Venus project would allow the new firm to demonstrate its ability to provide small, low-weight generic platforms for multiple missions. Similarly, Miller said demonstration of the Israeli-developed electric propulsion system for Venus would serve to benefit other micro-satellite initiatives, including those required by MoD.

"Validation of our concept through Project Venus will benefit other small satellite programs. We expect to achieve significant savings in fuel consumption and the ability to change orbital paths in flight, which will allow us to improve satellite revisit time," Miller said. He was referring to the ability of the satellite to linger longer or position itself more accurately over high-value target areas.

Seed money for the new IAI-Rafael firm is expected to come from the CNES contract associated with Project Venus, the Israel Space Agency, Israel's Ministry of Industry and Trade and from the two Israeli government-owned firms.

Government and industry sources here declined to provide a specific breakdown of funds destined for the new MicroSat venture. However, they roughly estimate the CNES contract at about 12 million Euro, and the collective Israeli government share at about \$14 million. An additional, as yet undetermined investment amount will be shared evenly by IAI and Rafael, sources here said.

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October 3, 2005

NASA Gulf Coast Facilities Seek To Regain Their Footing

MISSY FREDERICK, WASHINGTON

NASA and Lockheed Martin officials remain optimistic that the disruption in space shuttle external tank work caused by hurricanes Katrina and Rita will not result in significant delays in getting the orbiter fleet flying again.

Work at NASA's Michoud Assembly Facility in New Orleans,

where the tanks are built, is resuming in spite of the damage it sustained in Katrina, poor conditions in the surrounding area, and the fact that a large portion of the work force remains without housing.

Only a fraction of the roughly 2,000 people who work at Michoud have returned to their jobs, said Marion LaNasa, a spokesman for external tank

manufacturer Lockheed Martin Space Systems.

NASA spokesman Martin Jensen said it will launch the shuttle no earlier than March, but agency officials have said the launch likely will not take place before May 2006. Internal NASA memos have suggested the flight could be delayed beyond autumn of 2006.

NASA shipped external tank

119, which it plans to use for the next shuttle mission, from Kennedy Space Center in Florida to Michoud Sept. 27. The hardware was expected to arrive Oct. 2, Jensen said.

That tank was being prepared for flight at Kennedy when NASA officials elected to modify it following the foam-shedding incident during the Space Shuttle Discovery mis-

sion over the summer. The effects of the storms led NASA to consider doing the modification work at Kennedy, but agency officials ultimately decided to stick with the original plan despite the conditions at Michoud.

Temporary repairs have been made to the facility's roof, but conditions are still primitive, according to LaNasa. The facility regained power the week of Sept. 19, Jensen said.

LaNasa said water has to be brought in, and there are some questions about the conditions of the sewer lines. "We're not in a position to support the entire 2,000-person work force previously on the site," he said.

As of Sept. 28, 240 employees had returned to the site, and Lockheed Martin was contacting specific individuals with the skills necessary to resume production on the tanks. The company hopes to double the amount of workers on site by the end of October, LaNasa said.

"The intention is to not have it delay external tank work," LaNasa said. "The people we're bringing in are the priority folks working on external tank production. We're putting the focus on what we believe is the priority, the work on the next flight tank, while at the same time working as hard as we can to get all of our employees back in place as soon as possible."

Employees whose work is less critical to external tank assembly are being relocated to other areas, LaNasa said.

Lockheed Martin is exploring temporary housing options for its employees, nearly half of whom were left homeless by the disaster, and also is reviewing public transportation options, LaNasa said.

One possibility discussed by NASA and the Federal Emergency Management Agency is stationing a barge near Michoud to temporarily house some 400 people, but it remains unclear whether that will happen.

NASA officials originally estimated the damage at Michoud and Stennis Space Center, Miss., at about \$1 billion, and Jensen declined to update estimates of the damage.

Employees began returning Sept. 19 to Stennis, which sustained roof damage from Hurricane Katrina, but no damage from Hurricane Rita.

Johnson Space Center in Houston, meanwhile, reopened Sept. 27, after Hurricane Rita's approach prompted NASA to close the center Sept. 21. While Johnson was closed, all control functions for the international space station were handled by Russia.



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Comments: mfrederick@space.com

October 3, 2005

ON THE MOVE



■ **JASON LAND** (above) joins Vista Satellite Communications, Hollywood, Fla., as vice president of global services.

Land has more than 10 years' experience in global satellite communications, technical coordination and broadcast television production.

He comes to Vista from Strategic Television Inc. in Thousand Oaks, Calif., where he served as vice president of operations.

■ **PHILIPPE WILLEKENS** is selected to become the new executive director of the International Astronautical Federation, a Paris-based non-governmental organization devoted to the promotion of space activities.

Willekens has served at the European Space Agency (ESA) since 1987, most recently as manager of the Hands-on Education Projects for Students program. He was previously responsible for the Ariane assets management in ESA's Directorate of Launchers.

■ **DENNY BEAUGUREAU** has been appointed the special assistant to the director of the Defense Information Systems Agency, Arlington, Va.

Beaugureau previously served as the deputy to the commander of the Joint Interoperability Test Command, Fort Huachuca, Ariz.

The Defense Information Systems Agency — a Department of Defense combat support agency — provides real-time information technology and communications support to the president, vice president, secretary of defense, the military services and the combatant commands.



■ Analytical Graphics Inc. (AGI), Exton, Pa., names **MARC SIMMONS** (above) manager of its business partner program. In this

position, Simmons identifies and cultivates business partner opportunities with software-development and engineering organizations and markets business partner products and services that complement AGI's software suite.

Simmons comes to AGI with 14 years of experience in the aerospace and information technology software industries. He spent more than seven years working in the enterprise software arena for VERITAS Software and the Hewlett-Packard Co. in California.

■ The Laser Institute of America (LIA) announces the formation of a Northeast Chapter. The goal is to provide laser community networking avenues and education for LIA members and to serve as a recruitment tool for potential new members. Bi-monthly meetings will be held throughout the Northeast with a guest speaker or factory tour as part of each meeting.

Five voluntary committee chairmen — from five different Northeast regions — will plan a meeting in their respective area over the next year. These individuals are: **BILL SHINER**, IPG Photonics; **BO GU**, GSI Group, Inc.; **RON SCHAEFFER**, Photo Machining; **ROBERT BROWN**, CCAT; and **GEORGE ANDREWS**, New Haven, Conn.

■ NASA selects two teams to receive the agency's Software of the Year Award.

A team from NASA's Goddard Space Flight Center, Greenbelt, Md., was recognized for their Land Information System Software, and a team from NASA's Jet Propulsion Laboratory, Pasadena, Calif., for the Autonomous Sciencecraft Experiment software.

The two winners were chosen from nominations from NASA centers. The competition, begun in 1994, was designed to reward outstanding software at the agency.

■ **KEVIN CREASON**, lead systems administrator for the International Space Station Information Technology (ISSIT) Production Facility, Houston, is awarded NASA's Silver Snoopy Award in recognition of his "outstanding performance, contributing to flight safety and mission success."

In his tenure with Johnson Space Center in Houston, Creason successfully integrated and deployed numerous components of the ISSIT infrastructure that resulted in quick system recovery and availability, directly supporting the successful completion of the space station mission.

Comments: Tom Wiseman, twiseman@space.com

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December 6 - 8, 2005

NASA - Risk Management Conference
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NASA will conduct its premiere risk management training conference (<http://rmc.nasa.gov>) from December 6 through 8, 2005, in Orlando, Florida. For the past 5 years, this conference has provided an unprecedented opportunity for discussing risk management principles and advances in techniques for managing uncertainty and communicating risk on NASA programs and projects. The theme for this year's event is "Risk Management: Enabling the New Age of Exploration."

Past participants have included the NASA Administrator, Associate Administrators, astronauts, key management personnel responsible for major NASA programs and projects, project personnel responsible for day-to-day activities, industry, and the international space community. Complex challenges, risk balancing, and lessons learned in implementation of risk management are discussed, including tools to aid and improve the risk management process. This year's program will include approximately 40 speakers, 5 tutorials, 7 breakouts, an expert panel, and 7 demonstrations.

COMMENTARY

< EDITORIAL >

Crossroads for Space

On Sept. 21, as military space professionals from throughout the United States headed to Washington for the National Defense Industrial Association's National Security Space Policy & Architecture Symposium, a senior Pentagon official gave a speech that could have profound implications for their industry.

The setting was a luncheon sponsored, coincidentally, by the same trade group, and the speaker was Kenneth Krieg, the new U.S. under-secretary of defense for acquisition, logistics and technology. In a nutshell, Mr. Krieg told the industry to brace itself for defense cuts made necessary by relentlessly growing demands on the Pentagon's increasingly strained resources.

The message was not addressed to a particular sector, but anyone who makes satellites, rockets, and related hardware and software should take special notice because military space programs may be in for a disproportionate share of the cuts that Mr. Krieg suggested are in the offing.

Why space? Part of the reason is a growing perception throughout the national security community that the Pentagon has lost its way in space and things have gotten out of control.

This perception is not without justification: Virtually every major program in the Defense Department's nonclassified space portfolio is behind schedule and over budget, many of them severely so. The classified side of the business is harder to gauge, but indications are that the well-known problems with the Future Imagery Architecture spy satellite program are just the tip of the iceberg.

On Capitol Hill, long-simmering frustration has boiled over. Reliable supporters of military space have become outspoken critics: "We have heard all the excuses and they are no longer good enough," Sen. Wayne Allard (R-Colo.) said in a speech at the space policy symposium.

Every month or so brings new revelations about a program in trouble — the National Polar-orbiting Operational Environmental Satellite System being the latest example — while repeat offenders like the Space Based Infrared System (SBIRS) seem perpetually trapped in a bad-to-worse vortex.

If there is any good news, it is that the leaders of the space community, both in industry and government, have stopped trying to whitewash the problem. Gone is the defensive bravado that in April led Gen. Lance Lord, the usually cerebral and reflective commander of U.S. Air Force Space Command, to advise critics of the space acquisition system that the system was fixed and to "get over it." The more recent version of that speech, delivered in early September by Gen. Lord's vice commander, Lt. Gen. Daniel P. Leaf, is that it is time to just get

down to the serious business of fixing the problem.

And fixing it will require a comprehensive effort on several fronts by industry and the military.

It is well established that the Air Force needs to do more up-front systems engineering work on space development programs and beef up its cadre of skilled space professionals. The latter task is absolutely critical: In addition to performing the systems engineering work that has been lacking in recent years, the space cadre is needed to help weed out the lowball bids that are pervasive in government contracting.

Industry executives, meanwhile, have a strong interest in curbing the win-at-all-costs mentality on the part of their bid teams. The more problems space programs have with the byproducts of lowball bids — cost growth and delays — the less likely Congress will be to fund any new large programs.

Congress and senior Pentagon leaders also have important roles to play, starting with resisting the temptation to single out space simply because of bad publicity. If cost and schedule performance are among the survival criteria during lean years ahead, there needs to be an evaluation of whether space programs truly have performed worse in those areas than complex aircraft and ship procurements. That study should take into account the fact that satellite programs typically do not have the luxury of amortizing research and development costs over large production runs.

Any slowdown in space development activity should be an organized retreat rather than a demoralizing rout. The riskiest acquisition programs should be scaled back to research and development, to be resurrected when the technology is more mature and the budgetary climate more favorable. The last thing anybody needs is a repeat of the SBIRS fiasco.

And while it might make sense in certain limited circumstances to make sole-source awards to incumbent contractors, competition is the best way to insure innovation, and there should especially be competition in the development of new spacecraft technologies that are first proven on experimental spacecraft for eventual use on operational systems.

Congress should insist that the military and intelligence communities beef up their research and development efforts and provide them the funding to do that. Proving new technologies on smaller and less expensive experimental missions in the long run will save taxpayers billions of dollars in cost overruns and painful delays in the deployment of systems critical to U.S. national security.

LETTERS

A New Agency?

There is little cause for cheer over NASA's plan to build the launch vehicles of the future out of cobbled up space shuttle parts and retrofitting to capsules for personnel transfer. It is hard to reconcile the yawning gap between the NASA that so brilliantly executes the design, construction and operation of exploratory spacecraft with the plodding mentality at Houston's Johnson Space Center and Marshall Space Flight Center in Huntsville, Ala., that never seems to get it right with launch vehicles. Maybe it is time to start all over with a new agency, sparked with the talent to tackle the problem of economical space transportation with imagination. Like the space shuttle, the NASA plans that were recently presented to the White House will remain a very costly system.

Edward Hujsak
La Jolla, Calif.

■ Readers are encouraged to express their views in letters to the editor. Letters may be edited. Please include name, address and telephone number. Unsigned letters will not be published, but names will be withheld upon request. Send letters to 6883 Commercial Dr., Springfield, VA 22159, or to cfraze@space.com. Letters to the editor, opinion and editorial columns may be published or distributed in print, electronic or other forms.

SPACE SHOT

"Incorporating satellite components into any terrestrial network before a disaster strikes provides critical redundancy and access to immediate communications that can be easily and quickly deployed to increase the effectiveness of disaster recovery and relief efforts."

Tony Trujillo

Intelsat's Senior Vice President
of Corporate Services and
Government Relations

testifying Sept. 29 before the House Energy and Commerce
telecommunications and the Internet subcommittee.

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October 3, 2005

Ex Luna, Scientia

◀ S. ALAN STERN ▶

NASA's planned return to the Moon is the most exciting proposed development in human spaceflight in a generation, and it promises to be a 21st century bonanza for the space sciences.

As designed by NASA Administrator Mike Griffin and his team, America's return to the Moon offers to be both affordable and technologically low risk. With their recently released plan, Griffin & Co. have simultaneously provided both a breath of fresh air for the future of human spaceflight, and the opening salvo of what will hopefully lead humankind to epic, in-person explorations of the canyons of Mars, the ore deposits of near-Earth asteroids and hopefully someday to the ice-fields of the outer solar system. Indeed, with luck, pluck and perseverance, the return to the Moon will serve as a much-needed precursor to enable more distant journeys where no one has gone before.

Several good motivations for returning to the Moon have been cogently made by politicians and space pundits alike. These include a more worthy basis for risking the lives of astronauts than the shuttle ever provided: gaining the operational experience needed to push on to far-away destinations like Mars and the continued demonstration of American leadership in an increasingly competitive human spaceflight arena.

However, the scientific value of the

impeding return of humans to the Moon too often has been overlooked. A powerful empirical demonstration of the value of the Moon for science is in the great scientific paradigm shifts that Apollo provided. Despite being limited to six simple forays, Apollo sampling expeditions were responsible for spawning both the giant impact formation paradigm of the Earth-Moon pair, and the broadly accepted insight that a wave of cataclysmic planetary bombardment very likely sparked by far-away events in the outer solar system (the so-called Late Heavy Bombardment) pummeled the Moon and the inner planets some 700 million years after Earth formed.

Griffin's planned return to the Moon offers far more sophisticated and far more in-depth lunar exploration than Apollo could ever have delivered. Imagine what we will know when not six, but 16 and then 60 lunar sites have been sampled. Imagine the value of core samples drilled not three meters deep as in Apollo, but 30, 300 and then 3,000 meters deep.

Likewise, taking advantage of the half century of advances between Apollo and its 21st century successor, one can only imagine the power that modern seismic profiling and tomography, super-sensitive interior out-gassing products analysis, subsurface radar imaging and so many other techniques can bring to the table of lunar research.

Between the in situ studies to be performed on the Moon and the treasure trove of returned samples one can anticipate, it is easy to envision benefits for planetary research that likely will include:

- "Poor man's" cometary sampling made possible by studies of returned polar volatiles emplaced by ancient cometary impacts;

- The return of a treasure trove of ancient terrestrial meteorites yielding otherwise unobtainable samples of the early Earth that long ago were cast up to the safe haven of the lunar surface;

- A far better understanding of the time variation of impact hazards to Earth, thanks to the age dating of numerous cometary and asteroidal bombardment craters; and,

- A deep understanding of the evolution of the Moon's geological, thermal and chemical evolution, which will illuminate results that robotic missions will return at bodies as diverse as Mercury, Ceres, Vesta and Venus.

This list is certainly only a primitive foreshadowing of the planetary science that can be achieved by an extensive series of landings across the Moon, the emplacement of an Antarctic-style outpost and a diverse array of research stations there like the Apollo Lunar Surface Experiments Packages.

But the scientific yield of the planned return to the Moon will not be limited to

planetary science alone. Astronomical research should benefit if the lunar return can be leveraged into the erection of facilities like a far side radio telescope. Space biology, too, will benefit through studies of both radiation effects and the first long-term studies of low-gravity effects on organisms. And both Earth science and Sun-Earth connection studies should benefit extensively from the return of samples yielding a detailed history of solar and galactic cosmic ray fluxes, nearby supernovae, and Earth's passages through the dust lanes and dark molecular clouds of the Milky Way.

And lest we forget, like the entirely unexpected Apollo-era discoveries of late heavy bombardment and that a giant impact on Earth was responsible for the formation of the Moon, the greatest discoveries of renewed lunar expeditionary missions may be ones we cannot even anticipate today.

Griffin & Co.'s return to the Moon holds deep promise for science, just as it does for national pride, international prestige and preparing the way for historic explorations farther afield.

Let us carry this story forward boldly as yet another banner of motivation to enable America's too-long delayed return to the Moon.

S. Alan Stern is a planetary scientist and executive director of the Space Science and Engineering Division of the Southwest Research Institute.

Does Space Control Equal Space Weapons?

◀ THERESA HITCHENS ▶

What do U.S. Air Force plans to establish space control really mean? Will the implementation of space control through counterspace operations include the use of weapons to attack satellites, or weapons based in orbit? The answers to those questions seem to be ever hazier as the debate about space weapons has emerged more fully into the public and political domains.

One vision of space control seems to be clearly established by the body of official military documentation defining that mission, and detailing how it is to be undertaken by the U.S. Air Force.

For example, the August 2004 "U.S. Air Force Counterspace Operations Doctrine" states: "Air Force counterspace operations are the ways and means by which the Air Force achieves and maintains space superiority. Space superiority provides freedom to attack as well as freedom from attack."

It further explains that counterspace includes "offensive counterspace" operations that "target an adversary's space capability (space systems, terres-

trial systems, links, or third-party space capability), using a variety of permanent and/or reversible means. The 'Five D's' — deception, disruption, denial, degradation and destruction — describe the range of designed effects when targeting an adversary's space systems."

In addition, the October 2003 "Air Force Strategic Master Plan FY '06 and Beyond" lays out detailed plans for so-called offensive counterspace systems: "[Air Force Space Command] will continue to pursue lethal or non-lethal effects that in the future would include "full spectrum, space-based ... systems that bring the capability of negating adversarial space capabilities."

It would seem to be obvious that using permanent means to attack and destroy an adversary's space systems, specifically satellites, would both require weapons and represent the weaponization of space. And it would be difficult to interpret the master plan's statement about space-based negation as meaning anything other than that weapons based on orbit are being developed.

Recent statements by senior Air Force leaders, however, seem to tell a different space control story.

For example, Gen. Lance Lord, commander of Air Force Space Command, was quoted in a Sept. 22 article by *The Washington Times*: "We're not talking about weaponizing space."

Similarly, his vice commander, Lt. Gen. Daniel Leaf, said in an August interview with *Foreign Policy*, a political magazine, that "[offensive counterspace operations] deny adversaries access to space capabilities. That doesn't necessarily mean combat in space or direct attack on satellites."

Both Lord and Leaf also have asserted in their recent public forays that the service's current emphasis is on the use of temporary and reversible means of implementing space control, rather than destructive weapons that would create dangerous space debris.

Yet, the master plan mentions "lethal" means, and the Counterspace Operations Doctrine lists hit-to-kill anti-satellite (ASATs) weapons as potential "resources and systems" for at-

tacking satellites. And there is not a single public Pentagon document that rules out destructive or debris-creating weapons.

Further, Lord, in his *Washington Times* interview, stressed that current offensive counterspace weapons are limited to so-called counter-communications systems designed to interrupt satellite signals; in other words, jammers.

At the same time, the Air Force's budget request for fiscal year 2006 includes a number of technology research efforts applicable to both kinetic energy and laser space weapons capabilities. These include some R&D programs that specifically mention ASAT applications, such as the Starfire Optical Range laser work at Kirtland Air Force Base in Albuquerque, N.M. The budget documents show those technology-development programs costing only some \$300 million in 2006, but doubling by 2009.

As the space weapons debate is engaged by the U.S. Congress later this year, it will behoove lawmakers to ask hard questions in order to resolve the apparent

disconnects between documents that, at least in theory, represent official thinking, and the public statements of Air Force leaders. Furthermore, Congress must be sure to clarify not only what space control involves today, but also how the Air Force intends to implement its space strategy in future years.

Either the United States intends to fight in, from and through space, or it does not. Either the United States intends to deploy anti-satellite weapons and/or on-orbit weapons to implement that strategy, or it does not. Either destructive weapons that will add to the already serious problem of space debris are being pursued, or they are not.

Concrete answers to these critical questions are required. The choices to be made about how best to ensure the future security in space are difficult enough even when those choices are clear.

Theresa Hitchens is director of the World Security Institute's Center for Defense Information, and the author of "Future Security in Space: Charting a Cooperative Course."

October 3, 2005

REMOTE SENSING

Unmanned Hurricane Tracker Gets Real-World Test

MISSY FREDERICK, WASHINGTON

An unmanned aircraft provided climate scientists an unprecedented look at the innermost workings of a tropical storm Sept. 16, gathering low-altitude wind speed data and other types of information that could one day be used to predict the severity of approaching hurricanes.

The Aerosonde aircraft, equipped with meteorological sensors, GPS receivers and satellite communications gear, flew directly into the lower regions of Tropical Storm Ophelia as it churned off the Atlantic coast of the United States. Ophelia had been downgraded from a hurricane just hours before the unmanned drone ventured into an area that is often too dangerous for the piloted aircraft typically dispatched to observe severe storms up close.

"The biggest thing was just to see if we could do it," said Joe Cione, a research meteorologist with the U.S. National Oceanic and Atmospheric Administration (NOAA). "The second thing was to provide the real-time data to the hurricane center."

The Aerosonde project is a joint effort of NOAA and NASA. The aircraft was supplied by Aerosonde, an Australian aeronautical technology company that has a cooperative agreement with NASA.

NOAA tried to launch the aircraft twice last year but was forced to cancel due to weather conditions and range constraints at NASA's Wallops Flight Facility, Va., the Aerosonde's take-off and landing site. Six attempts were made this year before scientists finally were able to get off the ground in time for Ophelia.

The Aerosonde was outfitted with a mounted version of the GPS dropwindsonde, which typically parachutes into storms after being dropped by an aircraft and measures wind speed, temperature and barometric pressure, Cione said. The drone also was equipped with an infrared sensor to measure the sea-surface temperature beneath the storm, he said.

Some of the data collected by the Aerosonde was relayed immediately via the Iridium satellite communications system to NOAA's National Hurricane Center and Atlantic Oceanographic and Meteorological Laboratory, both in Miami. Cione said he expects to receive additional data that was not relayed during the Aerosonde's 10-hour flight Sept. 30 for detailed analysis.

The Aerosonde can fly a total of approximately 2,400 kilometers per flight, so storms must be located close enough to the shore for a mission to be feasible, Cione said. NOAA had hoped to fly the aircraft into Ophelia while it was still a full-blown hurricane, but the storm



▲ An Aerosonde aircraft (like the one being launched above), equipped with meteorological sensors, GPS receivers and satellite communications gear, flew directly into the lower regions of Tropical Storm Ophelia as it churned off the Atlantic coast of the United States.

weakened before the drone's arrival.

"In retrospect, it was not a bad thing; it gave us a good test mission to see if it could survive

it," Cione said. Once inside the storm, the Aerosonde flew as low as approximately 366 meters, an altitude too dangerous for piloted aircraft, he said.

"Since manned aircraft can't go down there, the result is we don't know what's going on down there," Cione said. "With a GPS dropwindsonde, you get a snapshot, but we wanted to sample the whole region to get a good understanding of what's happening. That region is very important because it's where the ocean meets the atmosphere, where energy is transferred from the ocean to the atmosphere."

The Aerosonde project is funded for 60 more hours of flight time this year. Cione is attempting to switch the launch location to Florida for the 2006 hurricane season, and to secure the funding for several more missions next year.

"We hope to get a hurricane next time," Cione said.

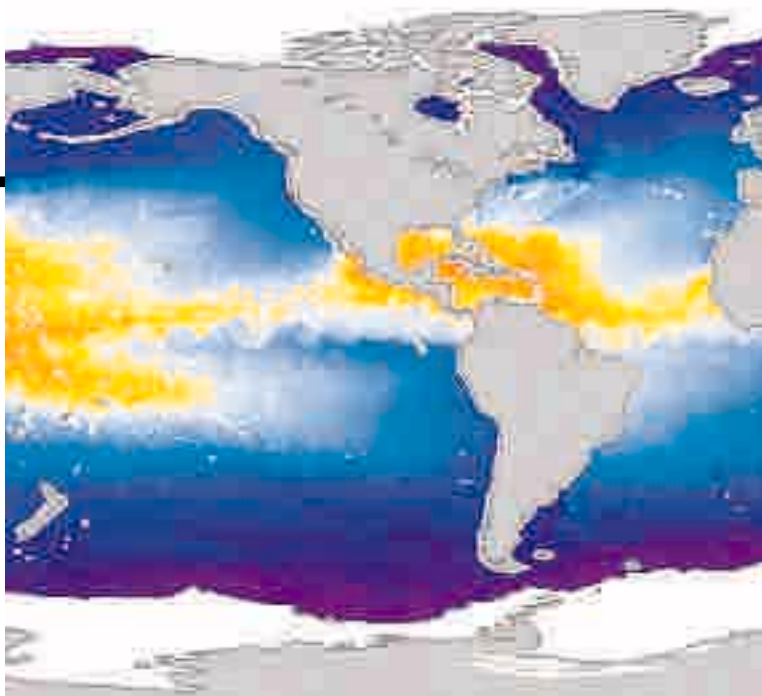
The Aerosonde will next be used by the U.S. Air Force in mid-October for a mission in Guam, said Peter Bale, manager of Aerosonde North America, which is based at Wallops.

"We're actually going to be chasing super typhoons," Bale said, adding that the remote Pacific island lacks an accurate early warning system for severe weather.

Cione expressed hope that Aerosonde-collected data eventually will be incorporated into the operational weather forecast models at NOAA's Environmental Modeling Center in Camp Springs, Md.

Comments: mfrederick@space.com

GLOBAL SNAPSHOT



Location: Northern Hemisphere

Data gathered by: NASA's Aqua satellite

Instrument used: Japan's Advanced Microwave Scanning Radiometer-EOS (AMSRE)

Uses of information: While Northern Hemisphere temperatures cool in September and October, warm ocean temperatures may continue brewing hurricanes until November.

In this Sept. 18, 2005, image, blue indicates cool ocean temperatures while orange indicates warmer waters capable of fueling hurricanes.

Warm ocean water forms the engine that drives a hurricane, and for North America the engine may get its start as far away as Africa. Originating as a "seed storm," an atmospheric disturbance called an easterly wave travels from the west coast of Africa over the warm tropical waters of the Atlantic, picking up steam as it moves. Tropical storms pull cool water up from the ocean depths to replace the warm water evaporating into the storm. As long as storms keep moving, they continue to derive energy from the warm waters. Hurricanes that follow in their wake, however, don't enjoy the same energy supply because earlier storms have brought cool Atlantic waters to the surface.

When a storm tracks into the Gulf of Mexico, however, the situation is different. Although the Atlantic has cool water beneath the surface waters, the shallower Gulf does not. Its entire water column is warm. The image shows widespread orange colors across the Gulf indicating the temperature had reached 28 degrees Celsius — meaning the Gulf was once again capable of sustaining a strong tropical storm.



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