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National Aeronautics and Space Administration
Headquarters
Washington, DC 20546-0001




December 3, 2013

Reply to Attn of:

Office of Communication
Headquarters FOIA Office

John Greenewald, Jr.


john@greenewald.com

FOIA: 14-HQ-F-00107

Dear Mr. Greenewald:

Thank you for your Freedom of Information Act (FOIA) request dated October 13, 2013, and received in our office 15 November 2013. Your request was for:

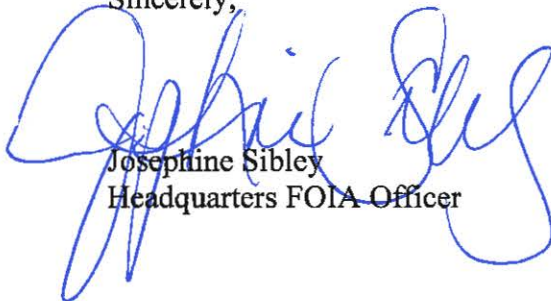
a copy of all documents relating to the Stardust Missions. Four out of five responsive documents were released under FOIA Case # FY2006-19. The case was filed on 05/18/2006 by Thomas Long. Please include these documents as responsive to this request.

The NASA Headquarters program office (s) has reviewed the 126 pages of Agency documents received from the Office of Science and Technology Policy (OSTP), and all are being released in full. Attached are the responsive documents for your request.

Fees for processing this request are less than \$15.00 and are not being charged in accordance with 14 CFR § 1206.700(i)(2).

Please contact me at hq-foia@nasa.gov or (202) 358-2462 for further assistance.

Sincerely,


Josephine Sibley
Headquarters FOIA Officer



Status of NASA Activities Regarding Near Earth Objects

**Pursuant to
Section 321(d)(1) of the NASA Authorization Act of 2005 (P.L. 109-155)**

May 2010

Status of NASA Activities Regarding Near Earth Objects

Section 321(d)(1) of the NASA Authorization Act of 2005 (P.L. 109-155) includes the following direction:

"The Administrator shall plan, develop, and implement a Near-Earth Object Survey program to detect, track, catalogue, and characterize the physical characteristics of near-Earth objects equal to or greater than 140 meters in diameter in order to assess the threat of such near-Earth objects to the Earth. It shall be the goal of the Survey program to achieve 90 percent completion of its near-Earth object catalogue (based on statistically predicted populations of near-Earth objects) within 15 years after the date of enactment of this Act."

The Conference Report (House Report 109-354) accompanying the Act includes the following direction:

"The Administrator shall transmit to the Congress, not later than February 28 of the fifth year after the date of enactment of this Act, a report that provides the following: (A) A summary of all activities taken pursuant to paragraph (1) since the date of enactment of this Act. (B) A summary of expenditures for all activities pursuant to paragraph (1) since the date of enactment of this Act."

Current Status:

NASA continues its work under the premise that the most effective tool for management of the NEO impact hazard is early detection and precision tracking of any potentially hazardous object. The longer the lead-time NASA can obtain before a potential impact, the more options may be available to the nation to deal with that threat. Therefore, NASA continues to sponsor the two most productive search teams looking for NEOs, as well as: the international Minor Planet Center (MPC) for collection and correlation of NEO orbit data; research at two radio telescope facilities capable of interplanetary radar for precision tracking and characterization of NEOs; and NASA's NEO Program Office for coordination of efforts, high precision orbit determination, and impact probability calculation. These efforts represent coordinated projects NASA sponsors with other US government agencies and departments such as the National Science Foundation (NSF) and the U.S. Air Force, and with non-government academic and space research organizations. NASA also continues to pursue improved capabilities for the detection and tracking of these potentially hazardous, but also potentially resource laden, planetary objects.

Over the last five years, NASA has continued a highly successful program to discover at least 90 percent of all NEOs with diameters larger than 1km, and NASA is now closing in on this objective. The Program can be tracked on-line at the NASA NEO Program website at <http://neo.jpl.nasa.gov>. As of January 1, 2010, search teams have discovered 887 NEOs, including 84 Near-Earth Comets (NECs), with sizes estimated to be 1 km or larger. NASA has also determined that only 146 of these are in orbits that could ever pose a collision hazard with the Earth. Based on our updated estimates of the total population of these objects, around 1050, NASA is close to achieving the initial goal and is confident that over 90 percent will have been found by the end of this year.

Figure 1. Cumulative history of large (>1 km) NEOs discoveries.

In the last five years, the NEO search effort has more than doubled the total number of known NEOs, from 3216 to 6730. Of the 3514 objects found in the last five years, 440 are in potentially hazardous orbits and 25 of these are larger than 1 km in size. Out of the total of 5843 objects smaller than 1 km in size found by the end of last year, 937 are in hazardous orbits. The population estimates for these smaller sizes indicate this represents less than 5 percent of all objects that might still pose a hazard for impacting our planet and causing significant damage. For this reason, NASA continues to pursue capabilities for a NEO Survey program to detect, track, catalogue and characterize NEOs down to 140 meters in size, with the objective of achieving 90 percent completion of this task by 2020. This threshold of 140 meters was chosen because achieving this goal is estimated to eliminate 99 percent of the risk of harm to humans from an unexpected impact on our planet.

Figure 2. NEA Discoveries and estimated completeness in five size bins.

To pursue the goal of 140m and larger NEO detection and characterization, NASA has continued work on several initiatives to partner and take advantage of potential dual-use facilities and spacecraft. First, NASA sponsorship of the international MPC, which operates under the auspices of the International Astronomical Union, has allowed it to upgrade its capability to process all observations received from world-wide observatories and disseminate the resulting orbit information freely via the Internet. The MPC is now ready to accommodate the anticipated significant increase in NEO observation data from world-wide “next generation” search efforts. NASA has also partnered with the U.S. Air Force Panoramic Survey Telescope and Rapid Response System (Pan-STARRS) to incorporate its use for detection of NEOs down to a few hundred meters in size. Although this system has experienced some delays in final development, it is expected to begin regular NEO survey operations shortly. NASA also continues to support interplanetary radar capabilities to precision track and characterize NEOs at its Goldstone facility, part of NASA’s Deep Space Network for communication with interplanetary spacecraft, and at the National Science Foundation’s Arecibo radio telescope in Puerto Rico. The successful launch of NASA’s Wide-field Infrared Survey Explorer (WISE) on December 14, 2009 added a significant new capability. In addition to its prime mission of mapping the infrared sky, WISE has also begun to return data on NEOs through an enhancement to its ground data processing (called NEO-WISE) that allows automated searches of collected images to detect and characterize NEOs. In only two weeks of operations, the NEO-WISE project discovered two NEOs less than 1 km in size.

NASA has also funded several NEO research grants over the last five years that use ground-based telescopes to learn more about the size, shape, dynamics and composition of these small bodies, commonly called “characterization” studies. This work ranges from simple time-series photometry collection on specific objects, which can reveal more about their size and spin dynamics, to higher resolution spectroscopy in order to learn something about their materials composition. Significant characterization data on several dozen objects has also been collected by planetary radar work funded by NASA at both the Arecibo and Goldstone facilities. If an object comes close enough to the Earth, high-power radar can provide more detailed information on an object’s size, shape, and spin dynamics, and can even provide rough imaging of its surface features. Radar can also detect if an NEO has its own small satellite objects, which in turn can provide data on the mass of an object.

Funding:

Project Element	FY2005	FY2006	FY2007	FY2008	FY2009
NEO Program Office	\$ 0.5	\$ 0.5	\$ 0.5	\$ 0.6	\$ 0.5
Minor Planet Center	\$ -	\$ -	\$ 0.4	\$ 0.3	\$ 0.6
Spacewatch	\$ 0.6	\$ 0.3	\$ 0.3	\$ 0.3	\$ -
NEAT	\$ 0.6	\$ 0.8	\$ -	\$ -	\$ -
LONEOS	\$ 0.3	\$ 0.3	\$ 0.3	\$ -	\$ -
LINEAR	\$ 1.0	\$ 1.0	\$ 1.0	\$ 1.2	\$ 1.1
Catalina Sky Survey	\$ 0.7	\$ 0.7	\$ 0.7	\$ 0.9	\$ 0.7
Pan-STARRS	\$ -	\$ -	\$ 0.5	\$ 0.5	\$ -
NEO-WISE	\$ -	\$ -	\$ -	\$ -	\$ 1.7
Other Follow-Up	\$ 0.1	\$ 0.2	\$ 0.1	\$ 0.7	\$ 0.5
Characterization	\$ 0.3	\$ 0.3	\$ 0.3	\$ 0.6	\$ 0.6
Totals	\$ 4.1	\$ 4.1	\$ 4.1	\$ 5.1	\$ 5.7

Table 1. NEO Observation Program expenditures (\$M) 2005–2009.

Table 1 above summarizes the expenditures for the NEO program over the last five years. Recent funding supports improved capabilities at the MPC and supports the search systems: LINEAR (Lincoln Near Earth Asteroid Research program), Catalina Sky Survey, Pan-STARRS, and NEO-WISE. The program has reduced and eliminated funding for three less capable search projects: Near-Earth Asteroid Tracking (NEAT) program, the Lowell Near Earth Object Survey (LONEOS), and Spacewatch.

Future Plans:

Looking to the future, the report requested by Congress in 2008 from the National Research Council study on NEO issues was released in January 2010. NASA partnered with the U.S. National Science Foundation to task the National Research Council to review all previous studies and NEO survey and characterization efforts, and make recommendations focusing on the optimal approach to the continued NEO survey program, as well as a NEO deflection capability, to include options that may blend the use of different facilities (whether ground or space-based) or involve international cooperation. The National Research Council report concluded that “the current near-Earth object surveys cannot meet the goals of the 2005 George E. Brown, Jr. Near-Earth Object Survey Act directing NASA to discover 90 percent of all near-Earth objects 140 meters in diameter or greater by 2020.” The National Research Council report has just recently been published and NASA is currently examining its recommendations to determine actions that could be taken in the near term, as well as factoring longer-term recommendations into our future planning.

The President’s FY2011 budget request for NASA includes an additional \$16M per year for Near-Earth Object detection and characterization activities (an increase of nearly 400% versus prior years). NASA plans to use these additional funds to:

1. extend the collection, archive, and analysis of small body data collected by NASA’s WISE mission;

2. enable additional collection of NEO detection and characterization data by the U.S. Air Force's Pan-STARRS project;
3. pursue additional partnership opportunities with the USAF for use of other space surveillance assets for NEO observations;
4. support the continued operation of planetary radar capabilities at the NSF's Arecibo and NASA's Goldstone facilities;
5. investigate use of both ground and space-based concepts for dedicated capacity to detect, track and characterize Potentially Hazardous Objects (PHOs) 140 meters and below; and,
6. improve our understanding of the characteristics of PHO's important for determination of possible mitigation actions against a detected impact threat.

Additionally, beyond the NEO program in the Planetary Sciences Division, NASA continues several successful science missions related to the characterization of comets and asteroids. The extended missions of two already highly successful spacecraft continue to be on track. The Deep Impact spacecraft, re-vectorred to encounter another comet, is on course for a fly-by of comet Hartley 2 on November 4, 2010, an encounter that will increase our knowledge of the diversity of near-Earth objects. The Stardust spacecraft will soon complete a trajectory correction maneuver to precisely adjust its time of arrival for its encounter with comet Tempel 1 on February 14, 2011. The goals of this encounter are to extend the mapping of Tempel 1's surface (which was started by Deep Impact in 2005), look for changes since the encounter of the Deep Impact spacecraft in 2005, and attempt to image the crater created by the impactor of that mission. NASA's Dawn spacecraft, on a mission to the largest asteroids, Vesta and Ceres, continues on course through the Main Asteroid Belt for its rendezvous with Vesta in May 2011. Dawn will orbit Vesta for almost a year and then continue on to a Ceres encounter in 2015, to learn more on the nature of asteroids and about this region of space that is the source of most NEOs.

NASA also continues investigating partnerships with other national space agencies that could enhance the NEO discovery and characterization efforts. NASA is sponsoring a science team to work with the Canadian Space Agency on collection and processing of data from their Near Earth Object Surveillance Satellite (NEOSSat), which continues development and is scheduled for launch in 2011. A potential partnership is also being discussed with Germany's planned Asteroid Finder mission. The NASA NEO Program is continually seeking other opportunities for partnerships with all nations that can contribute facilities and missions that will increase our knowledge of the population and characterization of NEOs. To this end, NASA is actively involved in the NEO Working Group of the Scientific and Technical Subcommittee of the United Nations Committee on Peaceful Uses of Outer Space (UN COPUOS), which is promoting more involvement by other nations in dealing with the threat of potentially hazardous NEOs.

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Sent: Wednesday, April 06, 2011 7:27 AM
To: Holdren, John P.; Wackler, Ted M.
Cc: Bolden, Charles (HQ-AA000); Garver, Lori B. (HQ-AB000); Keiser, Rebecca Spyke (HQ-AB000); Keegan, Richard J. (HQ-LA000); Scolese, Christopher J. (HQ-AI000); Radzanowski, David P. (HQ-AH000); Noble, David Lyman. (HQ-AH000); Simms, Natalie L. (HQ-AH000); HARRISON, HOLLY R. (HQ-AA000); Phadke, Shilpa; Palacios, Tina (HQ-AA000); McIntosh, Garvey (HQ-TG000)
Subject: NASA Update 4/6/2011

On behalf of Dave Radzanowski

Scientists Find New Type Of Mineral In Historic Meteorite

NASA and co-researchers from the United States, South Korea and Japan have found a new mineral named "Wassonite" in one of the most historically significant meteorites recovered in Antarctica in December 1969. The new mineral was discovered within the meteorite officially designated Yamato 691 enstatite chondrite. The meteorite was discovered the same year as other landmark meteorites Allende and Murchison and the return of the first Apollo lunar samples. The study of meteorites helps define our understanding of the formation and history of the solar system. The meteorite likely may have originated from an asteroid orbiting between Mars and Jupiter. Wassonite is among the tiniest, yet most important, minerals identified in the 4.5-billion-year-old sample. The research team, headed by NASA space scientist Keiko Nakamura-Messenger, added the mineral to the list of 4,500 officially approved by the International Mineralogical Association. Wassonite is a mineral formed from only two elements, sulfur and titanium, yet it possesses a unique crystal structure that has not been previously observed in nature. In 1969, members of the Japanese Antarctic Research Expedition discovered nine meteorites on the blue ice field of the Yamato Mountains in Antarctica. This was the first significant recovery of Antarctic meteorites and represented samples of several different types. As a result, the United States and Japan conducted systematic follow-up searches for meteorites in Antarctica that recovered more than 40,000 specimens, including extremely rare Martian and lunar meteorites. Researchers found Wassonite surrounded by additional unknown minerals that are being investigated. The mineral is less than one-hundredth the width of a human hair or 50x450 nanometers. It would have been impossible to discover without NASA's transmission electron microscope, which is capable of isolating the Wassonite grains and determining their chemical composition and atomic structure. The new mineral's name was approved by the International Mineralogical Association. It honors John T. Wasson, professor at the University of California, Los Angeles (UCLA). Wasson is known for his achievements across a broad swath of meteorite and impact research, including the use of neutron activation data to classify meteorites and to formulate models for the chemical makeup of bulk chondrites. Johnson's advanced work in nanotechnology is part of the center's Astromaterial Research and Exploration Science Directorate. It is currently the location for celestial materials that would be returned to Earth from spacecraft. The facility collaborates with industry, academic and international organizations. Collaborators in the discovery of the new mineral include Clemett, Keller and Zia Rahman in the Astromaterials Research and Exploration Science Directorate at Johnson; Alan Rubin from UCLA; Byeon-Gak Choi from Seoul National University, South Korea; Shouliang Zhang from the Lunar and Planetary Institute in Houston; and Katsunari Oikawa from Tohoku University, Japan.

Frozen Comet Had a Watery Past, UA Scientists Find

The discovery of minerals requiring liquid water for their formation challenges the paradigm of comets as "dirty snowballs" frozen in time. For the first time, scientists have found convincing evidence for the presence of liquid water in a comet, shattering the current paradigm that comets never get warm enough to melt the ice that makes up the bulk of their material. Current thinking suggests that it is impossible to form liquid water inside of a comet. UA graduate student Eve Berger, who led the study, and her colleagues from Johnson Space Center and the Naval Research Laboratory made the discovery analyzing dust grains brought back to Earth from comet Wild-2 as part of the Stardust mission. Launched in 1999, the Stardust spacecraft scooped up tiny particles released from the comet's surface in 2004 and brought them back to Earth in a capsule that landed in Utah two years later. In the samples, we found minerals that formed in the presence of liquid water. The discovery is to be published in an [upcoming online edition](#) of the journal *Geochimica et Cosmochimica Acta*. Comets are frequently called dirty snowballs because they consist of mostly water ice, peppered with rocky debris and frozen gases. Unlike asteroids, extraterrestrial chunks made up of rock and minerals, comets sport a tail – jets of gas and vapor that the high-energy particle stream coming from the sun flushes out of their frozen bodies. When the ice melted on Wild-2, the resulting warm water dissolved minerals that were present at the time and precipitated the iron and copper sulfide minerals observed in the study. The sulfide minerals formed between 50 and 200 degrees Celsius (122 and 392 degrees Fahrenheit), much warmer than the

sub-zero temperatures predicted for the interior of a comet. Discovered in 1978 by Swiss astronomer Paul Wild, Wild-2 (pronounced "Vilt") had traveled the outer reaches of the solar system for most of its 4.5 billion year history, until a close encounter with Jupiter's field of gravity sent the 3.4 mile-wide comet onto a new, highly elliptical orbit bringing it closer to the sun and the inner planets. Scientists believe that like many other comets, Wild-2 originated in the Kuiper belt, a region extending from beyond Neptune's orbit into deep space, containing icy debris left over from the formation of the solar system. Wild-2 is thought to have spent most of its time in the Kuiper belt, transiting on unstable orbits within the planetary system before Jupiter's gravity hurled it into the neighborhood of the sun. The discovery of the low-temperature sulfide minerals is important for our understanding of how comets formed – which in turn tells us about the origin of the solar system. In addition to providing evidence of liquid water, the discovered ingredients put an upper limit to the temperatures Wild-2 encountered during its origin and history. The mineral found – cubanite – is very rare in sample collections from space. It comes in two forms – the one we found only exists below 210 degrees Celsius (99 degrees Fahrenheit). This is exciting because it tells us those grains have not seen temperatures higher than that. Cubanite is a copper iron sulfide, which is also found in ore deposits on Earth exposed to heated groundwater and in a particular type of meteorite. According to Berger, two ways to generate heat sources on comets are minor collisions with other objects and radioactive decay of elements present in the comet's mixture. Heat generated at the site of minor impacts might generate pockets of water in which the sulfides could form very quickly, within about a year (as opposed to millions of years). This could happen at any point in the comet's history. Radioactive decay on the other hand, would point to a very early formation of the minerals since the radioactive nuclides would decay over time and cause the heat source to flicker out. The presence of the cubanite and the other sulfide minerals helps scientists better understand cometary heat sources. The interior of the comet must have been warm enough to melt ice yet cool enough – below 210 degrees Celsius – to form cubanite. Each sample analyzed consisted of a microscopic speck of cometary dust about the size of a bacterial cell. The group then studied the chemical composition by electron microscopy and X-ray analysis, during which the chemical elements revealed their presence by giving off a characteristic beam. Turning the sample in different orientations gave the scientists clues about its crystallographic structure. The findings show that comets experienced processes such as heating and chemical reactions in liquid water that changed the minerals they inherited from the time when the solar system was still a protoplanetary disk, a swirling mix of hot gases and dust, before it cooled down enough for planets to form. The results demonstrate the increasingly apparent connections between comets and asteroids. This study shows the high science value of sample return missions. These grains would never been detected by remote sensing or by flying a spacecraft past the comet to make observations without collecting a sample."

From: Sander, Kirk Michael. (HQ-AH000) <kirk.sander@nasa.gov>
Sent: Tuesday, August 09, 2011 6:32 AM
To: Holdren, John P.; Wackler, Ted M.
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Subject: NASA Update 8/9/2011

On behalf of Dave Radzanowski

NASA funds 30 new space research projects

The US space agency announced funding for 30 new space projects Monday, including ways to protect astronauts from deep-space radiation, eliminate space debris and improve spacesuit technology. Each of the proposals will get \$100,000 in funding for a one-year period as part of NASA's Innovative Advanced Concepts (NIAC), the agency said in a statement. These innovative concepts have the potential to mature into the transformative capabilities NASA needs to improve our current space mission operations, seeding the technology breakthroughs needed for the challenging space missions in NASA's future. Other projects on the list include using three-dimensional printing technology to create a planetary outpost, and various ways to fuel future exploration missions, including the use of solar and nuclear power. NIAC, originally known as the NASA Institute for Advanced Concepts, operated from 1998 to 2007 as an independent forum "to complement the advanced concepts activities conducted within NASA," the space agency said. It was halted for review in 2008 and re-established for fiscal year 2011 "to investigate visionary, far-reaching advanced concepts as part of the agency's mission."

NASA Researchers: DNA Building Blocks Can Be Made in Space

NASA-funded researchers have evidence that some building blocks of DNA, the molecule that carries the genetic instructions for life, found in meteorites were likely created in space. The research gives support to the theory that a "kit" of ready-made parts created in space and delivered to Earth by meteorite and comet impacts assisted the origin of life. People have been discovering components of DNA in meteorites since the 1960's, but researchers were unsure whether they were really created in space or if instead they came from contamination by terrestrial life. For the first time, researchers have three lines of evidence that together give us confidence these DNA building blocks actually were created in space." Callahan is lead author of a paper on the discovery appearing in Proceedings of the National Academy of Sciences of the United States of America. The discovery adds to a growing body of evidence that the chemistry inside asteroids and comets is capable of making building blocks of essential biological molecules. For example, previously, these scientists at the Goddard Astrobiology Analytical Laboratory have found amino acids in samples of comet Wild 2 from NASA's Stardust mission, and in various carbon-rich meteorites. Amino acids are used to make proteins, the workhorse molecules of life, used in everything from structures like hair to enzymes, the catalysts that speed up or regulate chemical reactions. In the new work, the Goddard team ground up samples of twelve carbon-rich meteorites, nine of which were recovered from Antarctica. They extracted each sample with a solution of formic acid and ran them through a liquid chromatograph, an instrument that separates a mixture of compounds. They further analyzed the samples with a mass spectrometer, which helps determine the chemical structure of compounds. The team found adenine and guanine, which are components of DNA called nucleobases, as well as hypoxanthine and xanthine. DNA resembles a spiral ladder; adenine and guanine connect with two other nucleobases to form the rungs of the ladder. They are part of the code that tells the cellular machinery which proteins to make. Hypoxanthine and xanthine are not found in DNA, but are used in other biological processes. Also, in two of the meteorites, the team discovered for the first time trace amounts of three molecules related to nucleobases: purine, 2,6-diaminopurine, and 6,8-diaminopurine; the latter two almost never used in biology. These compounds have the same core molecule as nucleobases but with a structure added or removed. It's these nucleobase-related molecules, called nucleobase analogs, which provide the first piece of evidence that the compounds in the meteorites came from space and not terrestrial contamination. "You would not expect to see these nucleobase analogs if contamination from terrestrial life was the source, because they're not used in biology, aside from one report of 2,6-diaminopurine occurring in a virus (cyanophage S-2L). However, if asteroids are behaving like chemical 'factories' cranking out prebiotic material, you would expect them to produce many variants of nucleobases, not just the biological ones, due to the wide variety of ingredients and conditions in each asteroid. The second piece of evidence involved research to further rule out the possibility of terrestrial contamination as a source of these molecules. The team also analyzed an eight-kilogram (21.4-pound) sample of ice from Antarctica, where most of the meteorites in the study were found, with the same methods used on the meteorites. The amounts of the two nucleobases, plus hypoxanthine and

xanthine, found in the ice were much lower -- parts per trillion -- than in the meteorites, where they were generally present at several parts per billion. More significantly, none of the nucleobase analogs were detected in the ice sample. One of the meteorites with nucleobase analog molecules fell in Australia, and the team also analyzed a soil sample collected near the fall site. As with the ice sample, the soil sample had none of the nucleobase analog molecules present in the meteorite. Thirdly, the team found these nucleobases -- both the biological and non-biological ones -- were produced in a completely non-biological reaction. "In the lab, an identical suite of nucleobases and nucleobase analogs were generated in non-biological chemical reactions containing hydrogen cyanide, ammonia, and water. This provides a plausible mechanism for their synthesis in the asteroid parent bodies, and supports the notion that they are extraterrestrial," says Callahan.

Tohoku Tsunami Created Icebergs In Antarctica

A NASA scientist and her colleagues were able to observe for the first time the power of an earthquake and tsunami to break off large icebergs a hemisphere away. Kelly Brunt, a cryosphere specialist at Goddard Space Flight Center, Greenbelt, Md., and colleagues were able to link the calving of icebergs from the Sulzberger Ice Shelf in Antarctica following the Tohoku Tsunami, which originated with an earthquake off the coast of Japan in March 2011. The finding, detailed in a paper published online today in the *Journal of Glaciology*, marks the first direct observation of such a connection between tsunamis and icebergs. The birth of an iceberg can come about in any number of ways. Often, scientists will see the towering, frozen monoliths break into the polar seas and work backwards to figure out the cause. So when the Tohoku Tsunami was triggered in the Pacific Ocean on March 11 this spring, Brunt and colleagues immediately looked south. All the way south. Using multiple satellite images, Brunt, Emile Okal at Northwestern University and Douglas MacAyeal at University of Chicago were able to observe new icebergs floating off to sea shortly after the sea swell of the tsunami reached Antarctica. To put the dynamics of this event in perspective: An earthquake off the coast of Japan caused massive waves to explode out from its epicenter. Swells of water swarmed toward an ice shelf in Antarctica, 8,000 miles (13,600 km) away, and about 18 hours after the earthquake occurred, those waves broke off several chunks of ice that together equaled about two times the surface area of Manhattan. According to historical records, this particular piece of ice hadn't budged in at least 46 years before the tsunami came along. And as all that was happening, scientists were able to watch the Antarctic ice shelves in as close to real-time as satellite imagery allows, and catch a glimpse of a new iceberg floating off into the Ross Sea. Scientists first speculated in the 1970s that repeated flexing of an ice shelf -- a floating extension of a glacier or ice sheet that sits on land -- by waves could cause icebergs to break off. Scientific papers in more recent years have used models and tide gauge measurements in an attempt to quantify the impact of sea swell on ice shelf fronts. The swell was likely only about a foot high (30 cm) when it reached the Sulzberger shelf. But the consistency of the waves created enough stress to cause the calving. This particular stretch of floating ice shelf is about 260 feet (80 meters) thick, from its exposed surface to its submerged base. When the earthquake happened, Okal immediately honed in on the vulnerable faces of the Antarctic continent. Using knowledge of iceberg calving and what a NOAA model showed of the tsunami's projected path across the unobstructed Pacific and Southern oceans, Okal, Brunt and MacAyeal began looking at what is called the Sulzberger Ice Shelf. The Sulzberger shelf faces Sulzberger Bay and New Zealand. Through a fortuitous break in heavy cloud cover, Brunt spotted what appeared to be a new iceberg in MODerate Imaging Spectroradiometer (MODIS) data. A closer look with synthetic aperture radar data from the European Space Agency satellite, Envisat, which can penetrate clouds, found images of two moderate-sized icebergs -- with more, smaller bergs in their wake. The largest iceberg was about four by six miles in surface area -- itself about equal to the surface area of one Manhattan. All the ice surface together about equaled two Manhattans. After looking at historical satellite imagery, the group determined the small outcropping of ice had been there since at least 1965, when it was captured by USGS aerial photography. The proof that seismic activity can cause Antarctic iceberg calving might shed some light on our knowledge of past events. This is an example not only of the way in which events are connected across great ranges of oceanic distance, but also how events in one kind of Earth system, i.e., the plate tectonic system, can connect with another kind of seemingly unrelated event: the calving of icebergs from Antarctica's ice sheet. In what could be one of the more lasting observations from this whole event, the bay in front of the Sulzberger shelf was largely lacking sea ice at the time of the tsunami. Sea ice is thought to help dampen swells that might cause this kind of calving. At the time of the Sumatra tsunami in 2004, the potentially vulnerable Antarctic fronts were buffered by a lot of sea ice, Brunt said, and scientists observed no calving events that they could tie to that tsunami.



NASA News Summary

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OFFICE OF PUBLIC AFFAIRS

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TO: THE ADMINISTRATOR AND SENIOR OFFICIALS

DATE: MONDAY, JULY 30, 2012 7:30 AM EDT | CS#12-2451

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LEADING THE NEWS

A Lot Hangs In The Balance With Tricky Mars Landing (FLTODAY)

Curiosity arrival on Aug. 6 sets up years of science

By Todd Halvorson

Florida Today, July 30, 2012

The pressure is on, the historical probability of failure is 67 percent, and for the U.S. space program, the stakes could not be higher.

Two years late and almost \$900 million over budget, NASA's Mars Science Laboratory and its Curiosity rover are cruising toward a day of reckoning on Aug. 6.

Equipped with the most sophisticated scientific instruments ever sent to another world, the spacecraft promises to prove whether Mars ever did, or does, have all the ingredients required for the evolution of primitive life.

But first Curiosity must survive a high-risk dive to the planet's surface, a perilous plummet engineers call "seven minutes of terror."

If the \$2.5 billion mission fails, America's cash-strapped Mars exploration program might not field another major lander or rover until sometime in the 2020s. A critically skilled work force of U.S. Mars landing experts might be lost.

"Right now, planetary science is in a crisis," said Scott Hubbard, former director of NASA's Mars exploration program and now a Stanford University professor.

The crisis comes at a time when scientists are tantalizingly close to determining whether Mars could harbor microbial life.

"We are that close – I mean, I'm holding my fingers a half an inch apart – to really understanding the habitability of Mars," Hubbard said.

Here's the situation:

The Obama Administration in February unveiled a proposed NASA budget for 2013 that cuts planetary science by 20 percent and Mars exploration by 40 percent.

NASA's overall budget would be \$17.7 billion under the president's proposal – just \$59 million less than 2012. But it cuts money from the Mars exploration program in part to pay for its highest priority science project, the James Webb Space Telescope, which is several years behind schedule and several billion dollars over budget. The scientific successor to the Hubble Space Telescope initially was expected to cost \$5 billion and launch in 2014. Now Congress is capping the cost at \$8 billion and launch is slipping to 2018.

The president's budget for the telescope in 2013 is \$628 million, up from \$518 million in 2012. Over five years, NASA would funnel \$3.1 billion into the telescope project compared to \$1.5 billion for Mars exploration.

The budget outlook forced NASA to abandon joint U.S.-European Mars missions planned for the years 2016 and 2018.

In 2009, NASA had agreed to ante up \$1.4 billion for those international missions. The European Space Agency's contribution was set at \$1.2 billion. In February, the U.S. reneged. Since then, the Europeans partnered with the Russian Federal Space Agency on the projects. The Russians agreed to provide Proton rockets to launch the missions.

"There's no doubt that tough choices had to be made," NASA Administrator Charles Bolden said when the U.S. space budget plan was rolled out earlier this year.

Getting to Mars is hard. Current chemical rocketry limits opportunities to three-week windows every 26 months, when Earth and Mars align in a way that makes voyages possible. Adding to the difficulty, two-thirds of all Mars missions have failed.

Hubbard noted that the former Soviet Union's record is dismal. "They are 0 for 21. "I mean, they have tried 21 times to have a fully successful mission at Mars, and they have never, ever succeeded," he said. The U.S. is the only country that has successfully delivered spacecraft to the surface of Mars. A Soviet lander touched down in 1971, but it failed 20 seconds later.

Launched Nov. 26 aboard an Atlas V rocket at Cape Canaveral Air Force Station, the Mars Science Laboratory and its one-ton Curiosity rover — which is about the size of a Mini Cooper automobile — are just days away from their destination. A safe landing would extend a string of successes that include NASA's Spirit and Opportunity rovers and its Phoenix polar lander.

A Mars Science Lab failure would be devastating.

The U.S. currently has no other major Mars mission in the works. NASA aims to launch a lower-cost robotic scout in late 2013 on a mission to study the Martian atmosphere. It is scheduled to arrive in Martian orbit in September 2014.

Beyond that, the future of America's Mars exploration program is unclear. NASA is in the midst of an effort to conceive Mars missions that could be executed within a severely depleted budget.

No U.S. Mars mission is on the books for the orbital-alignment launch opportunity in 2016. However, a low-cost stationary lander is one of three finalists for the 12th mission in NASA's Discovery program, which caps costs at \$425 million.

A NASA planning group will recommend options in mid-August.

"We're very hopeful we'll be able to recapture the Mars program starting in 2018, and with many exciting missions in the future," said John Grunsfeld, chief of NASA's Science Mission Directorate.

But it's highly unlikely the U.S. will be able to afford big, multibillion dollar Mars landing missions until sometime in the next decade.

The situation is sparking heated debate in Congress.

Some legislators say the proposed cuts are disproportionate — that they endanger U.S. leadership in Mars exploration, and that U.S. landing experts could lose their jobs.

"These proposed cuts not only threaten the most successful exploration program in NASA history, they also imperil what is certainly the world's most specialized work force," said U.S. Rep. Adam Schiff, D-Calif., whose district includes NASA's Jet Propulsion Laboratory. U.S. Mars missions are managed there.

The House of Representatives already has moved to restore Mars exploration funding. The Senate is poised to follow suit, and has directed NASA "to retain U.S. core competencies in areas such as (Mars) entry, descent and landing."

Hubbard sees a problem.

"If we defer another landing on Mars to the next decade, then those people have to earn a living, and they'll go somewhere else and do other things."

There's a sense of déjà vu about that possibility. The 20-year gap between two flagship Viking missions in the mid-1970s to the 1997 arrival of the relatively tiny Mars Pathfinder rover severely eroded American core competencies.

"We had to go back to the basics...we had to go to a very small, robust and simple system. Now we've built our way back to this very sophisticated capability with Curiosity," Hubbard said. "And if we don't exercise it, we'll lose it."

NASA Rover Closing In On Mars To Hunt For Life Clues (REU)

By Irene Klotz

Reuters, July 30, 2012

Full-text stories from Reuters currently cannot be included in this document. You may, however, click the link above to access the story.

Mars Science Lab | Mars Science Lab Fine-tunes Path For Rover Landing (SFN)

By Justin Ray

Spaceflight Now, July 30, 2012

Firing its thrusters for a mere six seconds early Sunday, NASA's Mars-bound Curiosity rover added more precision to its flight path for a high-stakes entry, descent and landing next Monday morning.

It was one of six mid-course correction opportunities for the Mars Science Laboratory spacecraft since launching atop an Atlas 5 rocket on Nov. 26. Two more chances are available Saturday and Sunday, the last coming just 9 hours before landing.

Curiosity is headed a landing zone inside Gale Crater near the base of Mount Sharp where the rover will explore for two years (a full Martian year) to determine if the site was once habitable for life.

Touchdown is scheduled for 1:31 a.m. EDT (0531 GMT) next Monday, Earth-receive time.

Sunday's maneuver featured two brief firings at about 1 a.m. EDT to tweak the craft's planned atmospheric entry point by about 13 miles. Navigation tracking had indicated that without the burn MSL would have hit the top of the Martian atmosphere about 13 miles east of the target spot.

"The first look at telemetry and tracking data afterwards indicates the maneuver succeeded as planned," said Tomas Martin-Mur of NASA's Jet Propulsion Laboratory, chief of the mission's navigation team.

The accuracy is remarkable considering Curiosity will have traveled about 352 million miles on its 8-month interplanetary trek from Earth to Mars.

The thruster firings changed the 8,463-pound spacecraft's velocity by about one-fortieth of one mile per hour (one centimeter per second).

"I will not be surprised if this was our last trajectory correction maneuver," Martin Mur said of Sunday's burns. "We will be monitoring the trajectory using the antennas of the Deep Space Network to be sure Curiosity is staying on the right path for a successful entry, descent and landing."

Curiosity, packed within its protective descent pod, will enter Mars' atmosphere at a speed of about 13,200 mph (5,900 meters per second) and touch down on the red planet's surface at just 1.7 mph only seven minutes later. The heat

shield, parachute and novel rocket-powered "sky crane" will work in sequence to slow the car-sized rover enough to set its wheels directly onto the ground at landing.

The mission's first two flight path corrections occurred on Jan. 11 and March 26 to put the spacecraft on a course to intercept Mars. They erased the deliberate, launch-induced miss of the planet by 25,000 miles so that the spent Centaur rocket body following Curiosity won't hit Mars.

The initial operation used 59 minutes of thruster firings, changing the craft's speed by 12.3 mph. The follow-up maneuver lasted 9 minutes and altered the velocity by 2 mph.

Another burn June 26 lasted 40 seconds to tweak the spacecraft's entry point by 125 miles and advanced that descent timing by 70 seconds, putting the vehicle on a course to hit the planet at the right place, angle and time.

In recent days, the flight batteries were topped to 100 percent via the cruise stage's solar arrays and engineers performed a final check of the descent sensor for tracking velocity and altitude during landing.

At the time of touchdown, Mars will be 154 million miles from Earth and the one-way communications time will be 13.8 minutes.

NASA Rehearses For '7 Minutes Of Terror' (AuBC)

Australian Broadcasting Corporation, July 30, 2012

NASA scientists are using simulators to rehearse a Mars landing which they have described as "seven minutes of terror".

Next week the US space agency will use a rocket-powered crane to lower its \$2.5 billion rover onto the Red Planet.

NASA hopes the laboratory rover, called Curiosity, will be able to search for signs that the planet once supported life.

NASA scientist Matt Wallace says they are not sure how the unfamiliar conditions on Mars will affect the landing.

"You can't ever know with certainty that you're going to get it 100 per cent right," he said.

"You're never going to get to a point where you know everything about Mars unless you go there.

"It's a little bit of a Catch-22, and so you go there having to do the best you can and learn when you land."

Wind Tunnel Testing At Cleveland's NASA Glenn Research Center Boosts Confidence In Curiosity Rover's Mars Parachute (video) (PLAINDLR)

By John Mangels

Cleveland Plain Dealer, July 28, 2012

"We have an almost unprecedented level of confidence that this [landing] is going to work," said JPL aerospace engineer Devin Kipp, who's in charge of the parachute portion of Curiosity's descent. "But at the same time, this is the most complex thing we've ever attempted" on Mars, "and it has the most number of wild-card, random variables that could go wrong."

So NASA engineers pored over every aspect of what's called EDL, or entry, descent and landing.

The space agency's three previous Mars rovers – Sojourner, in 1997, and the twins Spirit and Opportunity, in 2004 – used a sequence of heat shield, parachute, retro rockets and a protective cocoon of airbags to slow their plummet through the planet's thin atmosphere and cushion their bouncing arrival.

But at nearly a ton, the Mini Cooper-sized Curiosity is five times heavier than either Spirit or Opportunity, and a whopping 86 times the mass of tiny Sojourner, which was no bigger than an adult beagle. The tried-and-true airbags –

bounce-tested years ago on simulated Martian rocks inside the giant vacuum chamber at NASA's Plum Brook Station near Sandusky – couldn't handle Curiosity's bulk.

So NASA ditched the airbags in favor of the "sky crane." It's a sort of jet pack on steroids that will hover while gently lowering Curiosity to the ground on a tether, then fly a safe distance away and crash. The sky crane not only can handle heavy-lifting, but it provides a far more precise landing spot than the careening air bags. "It looks crazy, but it's well-reasoned," Kipp said.

For the maneuver to work, though, Curiosity's initial descent still has to be slowed by a heat shield, and the supersonic parachute.

Fortunately, a lot of what NASA needed to know about parachute behavior in the wispy Martian atmosphere had already been worked out in preparation for the Viking Mars lander missions in 1976. There were well-documented chute inflation tests in Earth's thin stratosphere, and drop tests with dummy loads. Having those results saved the Curiosity team months of work and millions of dollars in costs.

But there were still differences, and some unknowns, that could affect performance and had to be checked out.

Curiosity's chute would have to be bigger than Viking's – 70 feet across, compared to 53 – to handle the rover's additional weight and its bullet-fast, supersonic 900 mph speed when the canopy unfurls. Its fabric is nylon, not Viking's disco-era polyester, and its suspension cords substitute Kevlar for Viking's more stretchy Dacron.

The engineers needed to know that Curiosity's canopy material wouldn't suffer damaging friction burns when it burst from its packing bag during deployment. (It didn't.)

And they needed to get to the bottom of some odd flight data readings that had showed up just seconds after NASA's Phoenix Mars lander opened its Viking-style parachute, en route to a successful 2008 landing near Mars' north polar ice cap.

The readings seemed to indicate the Phoenix chute was undergoing the jellyfish-like undulations of area oscillation, partially deflating and refilling, over and over. "There was a lot of concern that this is a phenomenon we [didn't] have a good physical understanding of," said Kipp.

Since Curiosity's chute would be 33 percent larger than the Viking and Phoenix canopies, "we had to convince ourselves that, by making it bigger, we weren't introducing any new physics that Viking [and Phoenix] didn't have to deal with," Kipp said.

To tackle the problem, JPL and Stanford University engineers used data from the 1970s Viking parachute tests to program a computer model that could predict how Curiosity's canopy would behave. The JPL Curiosity team also commissioned the chute tests at Glenn's supersonic wind tunnel, which could mimic the punishing conditions of the rover's Mars descent.

At 10 feet tall, 10 feet wide and 48 feet long, the Glenn facility is the largest supersonic wind tunnel in the country. Built in the early 1950s, and still operating with its original compressors and drive motors, the "10 by 10" can whip up a gale that dwarfs the worst hurricane on record.

CLEVELAND, Ohio — Its Mach 3.5 top speed (3.5 times the speed of sound, or 2,664 mph) is so powerful that grains of dirt become damaging projectiles, requiring that the tunnel be kept scrupulously clean. Over the years, the 10 by 10 has tested scaled-down models or components of everything from the SR-71 Blackbird spy plane and the space shuttle to the Saturn moon rocket.

The Curiosity chute tests at Glenn were only meant to study chute motion, not durability, and their Mach 2-2.5 wind speeds were considerably higher than what the rover's canopy will experience at Mars. So the scaled-down 2-foot-wide mini-chutes lasted only a couple of seconds in the howling tunnel before ripping apart.

But in that blink of an eye, ultra-fast specialized cameras helped the engineers see what was going on. Optical tricks allowed them to visualize two supersonic shock waves, one created by air striking the chute, and the other building up around Curiosity's protective capsule.

In video footage from one of the tests, the chute's shock wave looks like a writhing alien blob, spilling out from under the canopy and snaking along its cords as if alive. "It was kind of crawling up those suspension lines," said Glenn mechanical engineer Jim Roeder, who led the wind tunnel tests.

In certain supersonic conditions, those two separate "bow shocks" can mingle in the space between capsule and chute, causing turbulence that makes the canopy repeatedly sag, then recover.

Creating more distance between canopy and capsule by lengthening the chute's cords could alter the shock wave patterns and ease the area oscillations. "Right now, the suspension lines are 50 meters long," Kipp said. "If we made them 80 or 100 meters, this problem would start to go away."

But longer cords would be heavier and bulkier, eating up precious room and fuel on the spacecraft delivering Curiosity to Mars. The Glenn wind tunnel tests helped convince the JPL team that the oscillations wouldn't fully collapse Curiosity's chute. And hundreds of thousands of computer simulations showed that the chute's billowing during descent barely affected the rover's carefully planned trajectory down to the surface.

"We felt like we had tested and analyzed ourselves out of being concerned about this problem," Kipp said.

The NASA engineers won't know whether that confidence is justified until early on the morning of August 6, when they'll listen and hope for Curiosity's report that it has safely touched down. The parachute is just one of many components that must work for the rover to survive. "Entry, descent and landing is like a game of dominoes," NASA's Mars Exploration Program director Doug McCuistion said in a recent news briefing. "If one of them is out of place, it's very likely that the last domino won't fall."

The "seven minutes of terror" landing sequence is automated, so all everyone can do at that point is wait. The JPL team has rehearsed, Kipp said, and "seven minutes feels like a long time, even when you know it's a test."

The nearly 14 minutes it takes a radio message to cross the 154 million miles from Mars to Earth will heighten the suspense. "By the time we're getting the signal that [Curiosity] is entering the atmosphere, we will already have been on the ground for seven minutes," Kipp said. "One way or the other."

What he means is the rover will either be down in one piece, or in a million pieces.

NASA's track record for landing spacecraft on Mars is an admirable seven of eight, so the odds favor Curiosity. "If it doesn't work, you're always going to wonder what else I could have done with the last 10 years of my life," Kipp said. "But I think everybody feels they've done everything they can. The team as a whole doesn't have any lingering concerns."

At Glenn, the engineers who tested Curiosity's parachute design have moved on to other work, but they'll closely follow its final approach to Mars. Roeder plans to stay up late, watching the landing coverage on TV.

"I think everybody here feels a little part of the effort," he said. "If it doesn't land correctly, I think we're all going to feel it."

Upcoming Martian Landing Will Be Successful: NASA Engineer (XIN)

Xinhua, July 30, 2012

NASA's Jet Propulsion Laboratory has high expectations for the upcoming landing of the Curiosity rover on Mars and is certain of great science results, a lab engineer says.

Torsten Zorn, a robotics engineer with JPL and a four-year veteran on the Curiosity project team, told Xinhua in an interview that the most interesting part of the venture could be learning more about the geological history of Mars.

Zorn said scientists want to find out how Mars' once wet surface dried up, how long the process took and what caused the changes. The findings will be important for scientists to determine whether Mars is habitable for humans.

To find life, in any form, Zorn said, is a goal of Curiosity. The rover is equipped with a drill to gather samples underground and send them to a self-contained lab to determine Mars' geological conditions and changes, and if there are any microorganisms present on the planet. The small lab will also test the soil samples to see if there are signs of life in the history of Mars.

Curiosity will test the Mars soil only with its own equipment after it lands on the planet on Aug. 5 but future missions will bring samples back to Earth for more study, Zorn said.

Zorn said many Americans have volunteered for the first one-way trip to Mars, but he said that if scientists can send human to Mars, they can also guarantee a return trip.

Curiosity will help pave the way for future manned Mars missions, Zorn said.

"It will definitely do its part to further help man's ability to land on another planet," he said. "We have a couple of different instruments onboard that will increase our knowledge of the environment, the radiation environment, the chemistry of the surface. There are many different ways that are helping should we decide to pursue a human space program to Mars. This is one of the stepping stones towards that goal."

Curiosity will concentrate on a small area of Mars to conduct detailed research, Zorn said, but following traces of water should be the general rule.

Curiosity also will take video images for the first time and send them back to Earth, Zorn said.

The rover also will be the first to use nuclear power thanks to a radioisotope thermoelectric generator that will utilize the heat of plutonium-238's radioactive decay.

The long-lived power supply will enable Curiosity to operate for at least a full Mars year (687 Earth days, or 1.9 Earth years).

Zorn said nuclear power is not new to spacecraft and was available in the 1960s. The technology is much more advanced now and suitable for use in a long-range rover such the Curiosity.

"I am very close to 100 percent sure" of success, he said, adding that the lab has tested Curiosity under almost all scenarios and has prepared several years for the mission.

Curiosity represents an international effort, Zorn said, because it contains parts from Russia, Spain and Canada.

With a length of 10 feet and weight of 899 kg, the rover is the largest vehicle humans have sent to other planets, Zorn said.

The Curiosity program has cost a total of 2.5 billion dollars, including 1.8 billion dollars for spacecraft development and science investigations, NASA said.

Curiosity, launched on Nov. 26, 2011, will travel almost 352 million miles (567 million km) to reach Mars.

Mars Curiosity Rover Success Depends On 'Crazy' Landing (BBC)

"The average person on the street thinks it's crazy. Even the team that's working [on] it - sometimes we think it's crazy."

BBC News, July 30, 2012

Adam Steltzner is responsible for getting Nasa's \$2.5bn Curiosity rover mission to the surface of the Red Planet on Monday 6 August.

This mobile Mars Science Laboratory (MSL) should bring about a revolution in our understanding of the geological history of the planet... provided it can land safely.

Steltzner and his team have devised a breathtaking approach to the problem that involves a rocket-powered crane.

"It's so ambitious, it's so audacious, it's so unconventional. It doesn't feel like there's a lot of shelter," he tells the BBC's Horizon programme.

"You can't say, 'Oh, I'm doing what they did before and, oh, it just didn't work out; I didn't get lucky'.

"No, we're not doing what we did before. We're doing something completely novel, hanging it way out there. You feel exposed."

But although Steltzner admits to the odd moment of panic in the middle of the night, he and his team actually have high confidence they can pull this one off.

"Reasoned engineering thought," he says, will get them through the white-knuckle ride that is entry, descent and landing - or EDL.

This is how the drama will unfold.

The 900kg rover will approach Mars enclosed in a protective capsule - the biggest capsule Nasa has ever used, bigger even than the Apollo Command Module.

It will arrive at the top of the atmosphere travelling 20,000km/h.

All that energy has got to be dumped. When the rover's wheels touch the ground six-to-eight minutes later, they must be moving no more than about 1m/s.

What scares the uninitiated most perhaps is the complexity of it all.

It starts with very precise navigation through space.

If the rover has any chance of reaching its equatorial target of Gale Crater, it must first hit an "entry keyhole" in the sky just a kilometre or so across.

As the capsule thunders downwards, it ejects ballast blocks to move its centre of gravity and tilt its angle of attack.

This will give the vehicle lift. And with the aid of thrusters and some dead-reckoning, the entry capsule will fly a path through the upper atmosphere.

The underside of the capsule will get hot as it rubs up against the Martian air - the heat shield will experience temperatures above 2,000C.

More ballast blocks are then ejected to straighten the vehicle before, at 11km altitude and with the descent velocity now reduced to 1,400km/h, the capsule deploys a supersonic parachute.

This immense canopy will open instantaneously and must absorb an impulse of almost 30 tonnes.

Half a minute later, what is perhaps the most important event occurs - the separation of the heat shield.

Unless it comes off, Curiosity's descent radar cannot see the ground.

"The radar is fundamental," says Matt Wallace, the flight system manager on the project.

"You have to land softly or else you'll break the rover. To land softly, you have to know how high you are, obviously, from the ground. But more importantly you have to know how fast you are going - both vertically and horizontally.

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"It's a pulsed-Doppler system and has the benefit of being extremely accurate in both velocimetry and altimetry, and it's very hard to fool."

The parachute will further slow the fall to about 450km/h, and it's at that point, at an altitude of about 8km, that we see the so-called "crazy" stuff.

A "sky crane" holding the rover drops away from the parachute, using thruster rockets to further slow its descent as it heads down towards the surface.

At just 20m above the ground, the sky crane hovers and lowers the rover down to the surface on three nylon cords.

Once the wheels make contact, the cords are cut, and the crane flies away to crash at a safe distance. Steltzner and his crew can breathe again.

All of this is automated; it's all pre-programmed. Earth and Mars are so far apart (250 million km) that communications links endure a 14-minute delay. Mission Control cannot intervene as if this were some online computer game.

My favourite number in this drama concerns the quantity of pyrotechnic devices.

These initiate key events, such as the severing of the nylon bridles or the opening of the chute housing.

All must blow - and in sequence - to ensure success. The number is 76. Step by step: How the Curiosity rover will land on Mars

As the rover, tucked inside its protective capsule, heads to Mars, it dumps the disc-shaped cruise stage that has shepherded it from Earth.

The capsule hits the top of the atmosphere at 20,000km/h. It ejects ballast blocks and fires thrusters to control the trajectory of the descent.

Most of the entry vehicle's energy is dissipated in the plunge through the atmosphere. The front shield heats up to more than 2,000C

The parachute deploys when the capsule is about 11km above the ground but still moving at supersonic speed.

A key event is the dropping of the heat shield. This permits imaging and radar instruments to monitor the approaching surface.

At about 1.5km above the ground and still moving at 80m/s, the rover and its sky crane drop away from the parachute and capsule backshell

Rockets on the sky crane slow the descent to 1m/s. Nylon cords spool the rover to the surface. Untethered, the crane flies to a safe distance and crashes.

The rover is equipped with a nuclear battery and should have ample power to keep rolling across the Martian surface for many years.

But if all of this does sound a bit crazy, there is purpose.

We've grasped most of all there is to know about the simple geological history of Mars.

To deepen our understanding necessitates taking more sophisticated instrumentation to harder-to-reach places.

That means a bigger rover and a more robust landing system that can put down on the proverbial sixpence.

Consider all the surface missions Nasa has sent to the Red Planet, from the Vikings in the 1970s to the Phoenix probe in 2008.

Please turn on JavaScript. Media requires JavaScript to play.

Each has had a more accurate landing system than its predecessor, but only with Curiosity's EDL technology could you confidently attempt to get inside Gale Crater, one of the deepest holes on Mars.

"Scientists want to go to somewhere rough because that's where the rocks are exposed. The engineers in the past wanted to go somewhere flat where their machines would be preserved," explains Prof Sanjeev Gupta, a UK researcher on the Curiosity science team.

"But we've now moved on to the next stage. Issues of life and habitability are really locked in the rock record, and to see those rocks you need to go to canyons and mountains - to get the chronology, to see the relationships and understand past climate changes.

"You won't get that on flat plains."

On Mars, NASA's Curiosity Rover Will Begin Difficult Hunt For Evidence Of Past Life (graphic) (PLAINDLR)

By John Mangels

Cleveland Plain Dealer, July 30, 2012

Twice in the past, NASA has announced the discovery of probable microbes on Mars, only to back off from the dramatic proclamations of extraterrestrial life as doubts intensified.

"We're now on the doorstep to the heavens," the space agency's boss, Daniel Goldin, gushed in 1996, when NASA scientists reported what appeared to be fossils of primitive bacteria inside a Martian meteorite that had landed in Antarctica. President Bill Clinton said the find could be "one of the most stunning insights into our universe that science has ever uncovered."

Within months, though, plausible "non-ET" scientific explanations emerged, just as they did in 1976 after NASA researchers thought they'd detected a whiff of biological activity in a scoop of Martian soil analyzed by the robotic Viking lander.

Now, with an Aug. 6 touchdown looming for the space agency's most advanced rover – a sophisticated science-lab-on-wheels that will spend nearly two years scouring a crater the size of New Jersey where ancient water likely pooled – NASA is taking a cautious stance about the \$2.5 billion mission's prospects of confirming that Mars once harbored life, as some scientists suspect.

"You could always be surprised," said Michael Meyer, the lead scientist for NASA's Mars Exploration Program. "It has the potential, yes. Do I think it will? I don't know. Probably not, just knowing how difficult this is. I half expect that we'll find [just] enough information that we'll be desperate to go back."

Officially, the mission's marching orders are to find out if past conditions on Mars could have supported life, stopping short of an actual determination that it did. That's left for future visits.

NASA's nuclear-powered rover, aptly named Curiosity, packs cutting-edge tools to scout for life's chemical and molecular building blocks – ingredients that set the stage for biological processes to happen, or that could be the byproducts of long-extinct Martian microbes.

But after 36 years of probing the Red Planet with satellites, landers and, most recently, rovers, scientists have learned how hard life detection is, especially from 154 million miles away, and with less-than-definitive clues.

If bacteria or other simple life existed in Mars' warmer, wetter distant past, its traces may have been largely wiped out by the sterilizing cosmic radiation that blasts the planet's surface.

Whatever chemicals are there can be tricky to interpret. The organic molecules that may signal life's presence – part of a category of indicators called bio-signatures – also can result from processes that have nothing to do with life. Amino

acids, for example, can be a remnant of living cells, but may also have arrived on Mars aboard interplanetary dust without ever having constituted life.

And existing Martian microbes, if there are any, could lurk in out-of-the-way places such as deep caves, steep crater walls or warm volcanic vents, out of a rover's reach.

"This is going to be a mission that requires a lot of patience," Mars Science Laboratory project scientist John Grotzinger warned at a recent NASA news briefing. "This is not something for which there is a slam-dunk discovery, but many bits of information that come together. It's going to take us a while to get there."

Still, Curiosity should reveal much about Mars' past habitability, and the extraordinary climate changes that transformed it from a more Earth-like planet of lakes and shallow seas into a cold, barren desert world.

"I think one of the most fundamental issue for Mars is understanding when some of these climatological issues happened," said Case Western Reserve University planetary geologist Ralph Harvey, who helped choose the science instruments Curiosity carries. "The hope is we'll see a bunch of layers of rock where we actually see climate change reflected in the changes in mineralogy."

Tackling profound questions

The question of whether life is confined to Earth or exists elsewhere in the vast cosmos is perhaps the most profound issue science has tried to address. As our second-closest solar system neighbor, and the planet most like our own, Mars seemed a good place to start.

Scientists' views about the planet's potential to cultivate life have changed wildly over time.

In the 17th and 18th centuries, early telescope astronomers glimpsed its polar ice caps, saw evidence of dust storms and noted a celestial orientation that gave Mars roughly Earth-length days and Earth-like seasonal changes.

By the late 1800s, astronomers reported a series of dark-colored, nearly straight, lines snaking hundreds of miles across Mars' surface. Scientist Giovanni Schiaparelli dubbed them "canali" (Italian for "channels"), and described them as waterways, though he was non-committal about whether they were naturally or artificially created.

American astronomer Percival Lowell had no such reservations. He championed the popular belief, which persisted into the early 20th century, that Schiaparelli's canali were a network of engineered canals. Lowell believed they were dug by an advanced Martian civilization that hoped to route water from the icy poles to irrigate their drying, dying planet.

The 1965 flyby of NASA's Mariner 4 satellite, snapping the first close-up photos of Mars, finally put the canal idea to rest as an optical illusion. But Mariner's limited, hit-and-run camera pass captured only dust and craters in grim black and white. That temporarily gave scientists the impression that Mars was as geologically dead as the moon.

Interest rapidly revived, though, with the Mariner 9 orbiter's stunning results just six years later. The satellite's bonanza of 7,329 photos, covering the entire planet, showed a dynamic Mars. There were hulking volcanoes, mammoth canyons, global, wind-whipped dust storms, and evidence that flowing water had carved the surface in the past.

On Earth, water is one of life's three vital precursors, along with chemical building blocks like carbon-based organic molecules, and an energy source to fuel the process. (Think of the sun driving plant photosynthesis on Earth, or the heat from deep ocean volcanic vents nurturing sea creatures.)

Scientists didn't know if that combination of precursors was ever present on Mars, or even if the formula that led to life on Earth is the same elsewhere in the universe. Nonetheless, NASA launched the twin Viking landers to Mars in 1975 with the ambitious goal of searching for extraterrestrial life – and not extinct remnants from the past, but microbes still alive in the rusty Martian soil.

The Viking results were less than conclusive.

The landers' instruments didn't detect any organic molecules in the dirt, meaning a key ingredient for life wasn't present.

A separate experiment that added a few drops of nutrient broth to a pinch of soil and looked for respiration-like gases – a sign that organisms were in there, eating the broth and exhaling – came up positive. That led some of the Viking scientists to insist Martian life had been found.

But subsequent studies showed that naturally occurring chemicals in the Mars soil could have broken down the nutrients and produced the gases, without life being involved. The results are still being argued about, 36 years later.

"The majority of scientists believe that the best explanation was that Mars' surface has a lot of absorbed oxygen on the rocks, and that basically, when you drop dirt into that broth, it fizzed," said CWRU's Harvey, who's skeptical that life ever existed on Mars. "But ... there are multiple explanations for almost everything you might see in the data."

Revised tactics for exploring Mars

With the consternation about the Viking results, and amidst the tumult caused by the putative Martian meteorite "fossil bacteria" in 1996 (which Harvey helped debunk), NASA changed its tactics.

Viking's "home-run" strategy of expecting to plunk down the first spacecraft on Mars and find microbes teeming at the landers' metallic feet wasn't panning out. On Earth, life was everywhere. Mars clearly wasn't like that, at least not harsh, arid present-day Mars.

If life was still there, it was stealthy. It made sense to search for extinct microbial life first, and even before that, to figure out where its ingredients or remnants – those complex organic molecules – might be located.

The logical place to look was in a formerly watery setting, since water was a crucial element for life. And that required an understanding of Mars' geology, mineralogy and climate history, to identify where ancient rivers, lakes and oceans might have lapped.

"The thought is, let's make this systematic and make sure that every exploration step we take, we really have a solid set of facts about Mars and its history," said Paul Mahaffy, a Mars scientist at NASA's Goddard Space Flight Center in Maryland.

Curiosity's predecessors on Mars, especially the 2004 NASA rovers Spirit and Opportunity, executed that "follow-the-water" plan, pinpointing spots where liquid etched its chemical fingerprints in rock outcrops.

Opportunity, still plugging away after eight years on the planet, has found deposits of the mineral jarosite in one location, and a thick vein of gypsum at another spot. Gypsum arises from relatively neutral water, while jarosite forms in highly acidic settings like hot springs.

"We think what acidified it was volcanic action," as Mars' climate dried later in the planet's history, said Geoffrey Landis, a physicist at Cleveland's NASA Glenn Research Center who is part of the rovers' science team. Taken together, the mineral discoveries show a changing, increasingly less hospitable water environment.

Building on the water finds, Curiosity will shift to a "follow-the-carbon" strategy, looking for the organic molecules that may hint at past life. It also will continue NASA's quest to understand when, how and why Mars' climate changed, which could dictate whether microbes ever got a foothold.

Curiosity will plop down in Gale Crater, a massive site that contains both water and climate clues. "Gale is one of the lowest places on Mars," Grotzinger said. "Water flows downhill, and that's where we're going. Gale Crater is like a bowl capturing any water that may have been present."

Gale also holds a mountain taller than Washington's Mt. Ranier, with a Grand Canyon-like exposure of rock layers that record the history of Mars' changing environment. If Mars is a book, "this is a place where a very thick chunk of the pages are visible," Harvey said.

Curiosity's mineral-analyzing equipment should help read those pages, perhaps deciphering the mystery of Mars' surface water loss.

Certain minerals "are only going to form in very specific environments," Harvey said. "So the arguments go away as to does this represent an ocean, does it represent a lake, or a wet spot on a lava flow. We know there have been severe climate changes on Mars through history. What we don't know is how abrupt they were – whether they were slow and steady, or changed one way and [went] back a little bit. Those kinds of things can be revealed by a look through the rocks, and how those rocks changed over time."

For its life-detection hunt, among Curiosity's most important tools is the drill at the end of its seven-foot robotic arm. The bit can plunge 2 inches into Martian rocks, 10 times deeper than the grinding wheels Spirit and Opportunity used to scratch away surface layers.

(The electricity to run the drill and otherwise power the car-sized rover comes from tapping the decay heat of a chunk of radioactive plutonium, a technology pioneered by NASA Glenn.)

The drilling depth is crucial if Curiosity is to have a chance at finding organic molecules.

Over time, the relentless cosmic rays that bombard unprotected Mars will erase any organic molecules hiding in the topsoil. Rocks offer some temporary cover. At the farthest reach of Curiosity's drill, small, simple organics may survive radiation hits for as long as a billion years. But larger, complex organics, which are more likely to be the remnants of life, disintegrate at the drill's two-inch depth in a few hundred million years.

So the search for past-life indicators may depend on Curiosity locating a "fresh" micro-meteorite crater whose rocks have only recently – in the last 10 million years or less – been exposed to the blistering surface radiation.

"Given the fact that in other locations on Mars we see those fresh craters, there's a fair chance we'll find one in Gale," said Alex Pavlov, a planetary scientist at NASA Goddard.

Caution with Curiosity discoveries

Since organic molecules don't always originate from life, scientists will have to carefully assess anything Curiosity may find.

The rover's onboard lab is much more sophisticated than what the Viking landers carried. It can gauge molecular weight – an indicator of complexity – but it lacks the ability to detect some subtle hints that could tip the judgment on past Martian life from "maybe" to "definitely."

"It's more than likely that whatever you find will be debated in terms of what it means," said Meyer. "And you may not be able to resolve that debate unless you bring a sample back."

That's a sore subject at NASA, which had intended to launch an unmanned spacecraft as soon as 2013 to ferry Martian rocks to Earth for advanced study. Budget cuts put the mission on indefinite hold, though work is still underway on some of its elements, particularly a solar-electric propulsion system being developed at NASA Glenn that could lower the cost of getting the samples back.

"It's almost inconceivable to me that if current plans go as they are, we won't have that data by the time I die," fumed Harvey, who each year heads an arduous expedition to recover meteorites, including a few from Mars, that land on the Antarctic ice, where they're more readily spotted.

Without a solid timetable for Mars exploration beyond the launch next year of an atmosphere-scanning satellite called MAVEN, NASA's fortunes rest squarely on Curiosity. Engineers think its nuclear-fed batteries could keep the rover rolling years longer than its 98-week primary mission.

Finding unambiguous signs of past, primitive life on Mars probably is too much to hope for, this time around.

"The bar would be extremely high to making any extraordinary claims like that," said Mahaffy, who's in charge of Curiosity's organic molecule-detecting experiments.

But "the success or failure of the mission is not going to hinge on our finding organics," Mahaffy said. "It's one of many things that we're interested in looking at. We think that really understanding early Mars – understanding the history of Mars better, and the potential for life there – is really what the mission is all about."

If Curiosity doesn't reveal life's imprint, Mars "might be telling us to keep looking."

Why Do We Keep Going Back To Mars? (SPACE)

By Mike Wall

SPACE.com, July 30, 2012

The huge NASA rover speeding toward an Aug. 5 landing on Mars may be the most capable and complex Red Planet explorer ever launched, but it's far from the first.

The 1-ton Curiosity rover — which will search for evidence that Mars is, or ever was, capable of supporting microbial life — represents humanity's 40th effort to explore the Red Planet over the last half-century.

The huge number of attempted Mars missions may seem surprising, especially since many of our solar system's other planets and moons remain relatively unstudied. But the Red Planet keeps calling us back — and for good reason, experts say.

"Mars is such a compelling scientific target," said Scott Hubbard of Stanford University, the former "Mars Czar" who restructured NASA's Red Planet program after it suffered several high-profile failures in the late 1990s.

"You can get to it every 26 months, and it's the place in the solar system most likely to have had life emerge," Hubbard told SPACE.com. "If you add that to Mars being also the most logical ultimate target for human exploration, I think that Mars will continue to be part of the space exploration portfolio." [7 Biggest Mysteries of Mars]

Fifty years of Mars exploration

The Mars exploration era began in October 1960, when the Soviet Union launched two probes four days apart. The spacecraft, known in the West as Marsnik 1 and Marsnik 2, were designed to perform flybys of the Red Planet, but neither even reached Earth orbit.

The United States got in the game in 1964, launching the Mariner 3 spacecraft on an intended Mars flyby. The mission failed, but Mariner 4 succeeded, cruising past the Red Planet in July 1965 and sending 21 photos back to Earth.

The nation built on that accomplishment, sending a series of orbiters, landers and rovers to Mars over the following five decades.

Notable NASA successes include the Viking 1 and Viking 2 missions, which sent orbiters and landers toward the Red Planet in 1975; the Spirit and Opportunity rovers, which landed in January 2004; the Mars Reconnaissance Orbiter, which arrived at the Red Planet in 2006; and the Phoenix lander, which discovered subsurface water ice in 2008.

But failure remains a regular part of Mars exploration. NASA setbacks include the Mars Polar Lander and Mars Climate Orbiter, two missions that were lost upon arrival at the Red Planet in late 1999. And none of the 19 Mars efforts the Soviet Union/Russia has launched over the years achieved its goals in full.

Overall, the success rate for Mars missions is south of 50 percent.

"Mars wins most of the time," Doug McCuistion, director of NASA's Mars Exploration Program, told reporters earlier this month. [History of Robotic Mars Missions (Infographic)]

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Too interesting to ignore

Scientists are deeply interested in Mars partly because of its perceived past potential to host life as we know it. The Red Planet is cold, dry and desolate today, but Spirit and Opportunity have found plenty of evidence that it was once far warmer and wetter.

"When you look at geology, atmospheres, chemistry, and so forth and rack up your reasons to explore, anything that has to do with the possible origins of life on another world is always the first among equals," Hubbard said. "It's such a fundamental question. It goes to this 'Are we alone?' uber-question, or super-question."

Mars is not the only solar system body that may have been capable of supporting life at some point. For example, organisms might thrive today in the subsurface oceans of Jupiter's moon Europa and Saturn's moon Enceladus, some scientists say.

But these two ice-covered bodies are much farther away from Earth than Mars is, meaning they'd be much more difficult — and expensive — to reach. So the Red Planet's proximity is another big reason why so many spacecraft have visited it over the years. (Planetary alignments make Mars missions feasible every 26 months, and a probe can get there in eight months or less.)

Mars' status as a prime target for future human colonization also helps drive more robotic missions to the Red Planet, Hubbard said. After all, a thorough understanding of the planet — including whether or not it ever hosted life — is necessary before sending astronauts there.

"If Mars already has life, you have to understand the effects on humans," McCuistion said in April. "So this is a critical question — not just the innate human question of 'Are we alone?' but also safety of humans on the surface of the planet."

Finally, NASA's long history at Mars has built up momentum that helps push future missions along. NASA structures its planetary exploration efforts in stages, Hubbard said. Flybys come first, followed by orbiters, then landers and/or rovers. A sample-return mission is the last step in this robotic chain.

"We are now at the phase of Mars exploration where, as the National Academies have said, we're ready to do a sample return," Hubbard said.

By contrast, "we are just now getting to the point of doing a flyby of our poor little dwarf planet Pluto," he added, referring to NASA's New Horizons mission, which is slated to cruise past Pluto in July 2015.

Mars Rover's Eyes Made In San Diego (SDUT)

By Gary Robbins

U-T San Diego, July 30, 2012

The most sophisticated spacecraft ever sent to Mars will descend on the red planet on August 5th during a landing that will be so fast, tricky and dangerous NASA is calling it "seven minutes of terror."

The rover Curiosity will use a parachute and retrorockets to slow from 13,000 mph to 2 mph so it can softly touch down in Gale crater, a 96-mile-wide depression that has a three-mile-high mountain at its center. NASA has lost several spacecraft in the past trying to guide probes to or near such geological wonderlands.

The potential payoff of a successful landing is huge. Curiosity is equipped with close to a dozen instruments, including four cameras from a San Diego aerospace company that could help clarify how Mars evolved over billions of years, and whether the planet does — or did — have microbial life.

Malin Space Science Systems developed Curiosity's "eyes," or its two main landscape cameras. The company, which has 30 employees, also developed a camera that is attached to the rover's robotic arm. And Malin created the imaging system that will record the spacecraft's wild descent to the surface.

"I can think of lots of things that could go wrong, but we've built the best cameras possible and expect them to perform well," said geophysicist Michael Ravine, the UC San Diego graduate who serves as advanced projects manager for Malin.

The company has sent 17 cameras into space over the years to image the moon, Mars and even regions of the Earth. Another of its cameras is en route to Jupiter. Malin has been especially successful on Mars, taking stunning images of gullies and sedimentary layers that deepened the belief that the planet once had lots of lakes, streams and rivers. The camera it placed on the spacecraft Juno will study Jupiter, starting in 2016. Malin also might be chosen to place one or more cameras on a spacecraft that will visit a comet, or Saturn's eerie moon Titan.

NASA has a lot of confidence in Malin, whose cameras have spent the equivalent of 35 years snapping images from space.

"The really impressive thing is that MSSS is a small company that's very responsive to what NASA's looking for, and building high quality products at competitive prices," said John Grotzinger, chief scientist of NASA's Mars Science Laboratory/Curiosity mission.

"Malin's president (Michael Malin) sees opportunities for scientists and comes up with the instruments they need. They also have (geologist) Ken Edgett, a guy who has seen more pictures of Mars than anyone else alive."

There's likely to be lots more to see in the coming months. "We have the right rover going to the right place with the right payload," Ravine says.

Even so, the landing will be a white knuckle affair for people like Ravine. Over the years, about 40 spacecraft have been launched to Mars. About half of the missions have failed.

In 1993, the American-made Mars Observer stopped communicating with NASA three days before it was to begin orbiting the planet. Contact was never restored. The British built Beagle 2 lander is believed to have crashed into a crater on Mars. And last fall, Russia's Phobos-Grunt spacecraft, which was supposed to travel to Mars' moon Phobos, became stuck in Earth orbit during launch. It's still stuck.

But there also have been achievements. In 1997, the Mars Global Surveyor swung into orbit around Mars. It produced revealing photos of the planet, from pretty and gritty sand dunes to valleys that resembled those on Earth.

Our Curiosity To Go A'roving (SMH)

Sydney Morning Herald, July 30, 2012

WHEN the Mars rover Curiosity lands on the red planet next month, Australia will be the only place on Earth with a direct view to the touchdown.

Those at the controls at CSIRO's Tidbinbilla tracking station outside Canberra will be the eyes and ears of the mission in the vital minutes when Curiosity lands on the dusty surface to begin its 23-month mission on August 6.

The tracking station, part of NASA's Deep Space Network, will be one of three around the globe monitoring the mission.

"But at the time of landing we have an exclusive view because Mars will be in our field of view at that time," said Canberra Deep Space Communication Complex spokesman Glen Nagle.

Mr Nagle describes the 107 staff at the observatory as "the air traffic controllers of space". Few landings, however, have generated such anticipation.

Tidbinbilla will receive the rover's first signals before relaying the data to mission control in America and will have sole responsibility for communications during the landing.

Entry into the atmosphere, descent and landing will take seven minutes - with touchdown due at 3.31 pm on Monday August 6, Melbourne time.

The target landing site is Gale Crater, a 150 kilometre-wide crater named after Australian amateur astronomer Walter Gale who discovered seven comets and was also a keen observer of Mars and Jupiter.

Monash University researcher Marion Anderson, who has been part of the project since 2002, helped select the landing site.

Chosen for its scientific and practical features, the area is located on the boundary of the planet's north plains.

"It's free of large boulders and sand dunes, which could bog the rover," she said.

The area is of scientific interest because there is evidence it would once have been wet. And the rocks that contain clay could have preserved evidence of life that once called the red planet home.

A geologist, Ms Anderson said the rover was able to drill in to the rock to a depth of 10 centimetres to obtain samples.

But none of the samples will be returned to Earth. Curiosity is a mobile science laboratory on a one-way mission to Mars. The most sophisticated rover to date, the 900 kilogram machine will be scooping up soil and drilling through rock to collect samples and test them on-site before sending the data back to Earth via satellite.

About the size of a Kombi van, the rover will also act as a weather station taking atmospheric measurements, as well as recording wind and temperature data. Images of the red planet will also be sent back.

And while the Tidbinbilla Tracking Station staff will be first to receive the data, they won't know until it has been analysed by mission scientists whether it's been a success or not.

"We really want to make a bunch of anxious mission scientists happy," Mr Nagle said. "We'll be watching the monitor of the mission control centre for the scientists' reaction.

"If they're all jumping up and down and smiling then we know it's good information we've sent to them. We call that monitor the glee-meter."

NASA Sponsors Mars-landing Party At Wade Oval August 5 (CSN)

By Ken Baka

Cleveland Sun News, July 30, 2012

NASA Glenn Research Center invites the public to Wade Oval in University Circle from 1-6 p.m. Aug. 5 for family fun and to learn about the Aug. 6 landing of the rover Curiosity on the Martian surface.

The landing, expected at 1:31 a.m. Aug. 6, will mark the beginning of a two-year mission to investigate if Mars ever was habitable to life.

Visitors will learn about Mars and robotics, see student-built robots, enjoy dance routines by Rock N Robots, get a free photo taken as an astronaut on Mars, meet Glenn scientists and get signatures from astronaut and retired U.S. Air Force Col. Gregory H. Johnson, who piloted space shuttles in 2008 and 2011.

Food and beverages will be available.

If weather is inclement, activities will be at Cleveland Museum of Natural History, 1 Wade Oval Drive.

NASA Langley Offers Rare Look At Mars Mission (RICHTD)

By Bryan Devasher

Richmond (VA) Times-Dispatch, July 30, 2012

More than two dozen social-media users will get a unique look at NASA's latest Mars mission when they gather Friday at Langley Research Center. The event is part of a NASA Social, which will simultaneously take place at six NASA centers across the country. The 30 people selected for Langley's social gathering will get briefings on the landing of the Mars Curiosity rover, participate in a question-and-answer session with scientists involved in the mission and view a number of the center's space projects. The Curiosity rover, which is the size of an SUV and weighs about 2,000 pounds, is expected to touch down early Monday. Its mission is to discover whether the ingredients for life exist on Mars. Langley scientists worked on the entry, descent and landing phase of the mission — the so-called "seven minutes of terror" between when the spacecraft enters the Martian atmosphere at 13,200 mph and rover is deployed on the planet's surface — as well as developing sensors in the craft's heat shield that will record heat and atmospheric pressure during the descent. Michael Finneran, lead for social media at Langley, says the socials fit well into the space agency's outreach program. NASA has been using the gatherings — formerly called tweetups — to host thousands of social-media fans at shuttle launches and other events since 2009. "We're trying to excite people, inspire them, educate them, inform them and tell them what they're getting for their taxpayer dollars," he said of the gatherings. Finneran said the 30 participants were culled from more than 250 applicants who registered through NASA's main website. Langley attendees include an active-duty Marine, several educators and a Harley-Davidson motorcycle enthusiast. While many of the participants live in Virginia, some will be traveling from as far away as San Diego and Minnesota. "We have people with a lot of different interests, but their one common interest is the interest in space," he said. "That's what brings them together." Friday's social is the second for NASA Langley. A tweetup was held in November, when participants witnessed a splashdown test of the crew capsule for the next generation of U.S. manned space vehicles. Angela Gibson of Carrollton was among those at that event. Gibson, who is an educator with the American Public University System, has attended four NASA social-media events and will be participating in Friday's at Langley. She said the biggest benefit of the events is getting access that others don't. "It's a fantastic opportunity to meet researchers, engineers, scientists and other wonderful staff at Langley," she said. "Participants can expect to use social media to share out to the world information, pictures, and videos of what they see, hear and experience." Gibson, a self-professed "spacetweep," considers herself and other social attendees as de facto envoys for NASA. "All of us who participate in person or virtually with each NASA Social are in many ways ambassadors for NASA," she said. "If we inspire one person, one child, to pursue their dreams, or even to look up at the stars in wonder, then we've done our job."

Mars Mission Would Provide Boost To U.S. Economy (HC)

By Chris Carberry

Houston Chronicle, July 30, 2012

The United States has a confidence problem. While the economy seems to be slowly improving, many Americans believe our best days are behind us. We are constantly barraged with stories of our inevitable decline - and of the rise of other nations at our expense. Yet the United States can still maintain its position as the leader in technology and innovation, and space exploration capabilities and technology can play a key role.

When provided with a far-reaching, ambitious mission, NASA is capable of having a much more dramatic impact on our national morale - and, as a result, our economy - than any other federal agency. A bold and sustainable space program has the power to inspire our students to enter into science and engineering studies, create highly skilled jobs that will fuel our economy for years and stimulate the national psyche.

To fully harness this potential, the United States should commit to the goal of landing a crew on Mars by the year 2030. A human mission to the Red Planet will be one of the most important and inspirational events in world history. It will show in no uncertain terms that we are once again taking forward-looking, inspired steps in science. The world will take notice. To gauge the impact a Mars landing could have, one need only recall that when Mars Pathfinder landed in 1997, the NASA websites received 550 million hits in a single week - at a time when far fewer people had Internet service. Imagine the level of online activity that would be wrought by a human Mars mission.

The prospects for innovation over the upcoming decades are numerous and would give the United States a chance to take the helm during what could be one of the most exciting periods in human history. Computer technology, nanotechnology, medical science, biochemistry and many other scientific disciplines are moving at break-neck speed in laboratories, universities, hospitals and companies all across the country. This means commercial companies are competing like never before to help create efficient new space capabilities.

But this progress could hit a brick wall if we don't assure the private sector and the public that we have a skilled and well-educated work force capable of keeping this momentum going. One way to create assurance is to guarantee a sufficient number of American students enter the fields of science, technology, engineering and mathematics (STEM). Space exploration can encourage STEM in a way no other activity can. What we need is a catalyst to motivate our leaders and the nation to commit to ambitious new space goals.

A potential catalyst for change is taking place this August. The Mars Science Laboratory (MSL) will be landing on Mars Aug. 6, 2012. MSL is by far the most ambitious mission to ever be sent to another planet. It should not only send back the most dramatic images ever taken on the surface of Mars, it could move us much closer to learning whether Mars has ever been able to sustain life. The landing also comes close to the 50th anniversary, in September, of President John F. Kennedy's famous "We choose to go to the moon" speech at Rice University. It is time we recommitted ourselves to courageous and difficult goals. It is time to explore.

Carberry is executive director and co-founder of Explore Mars, Inc. To learn more about the Mars Science Laboratory and Curiosity Rover, please visit www.GetCurious.com.

Apollo Moon Landing Flags Still Standing, Photos Reveal (SPACE)

By Clara Moskowitz

SPACE.com, July 30, 2012

An enduring question ever since the manned moon landings of the 1960s has been: Are the flags planted by the astronauts still standing?

Now, lunar scientists say the verdict is in from the latest photos of the moon taken by NASA's Lunar Reconnaissance Orbiter Camera (LROC): Most do, in fact, still stand.

"From the LROC images it is now certain that the American flags are still standing and casting shadows at all of the sites, except Apollo 11," LROC principal investigator Mark Robinson wrote in a blog post today (July 27). "Astronaut Buzz Aldrin reported that the flag was blown over by the exhaust from the ascent engine during liftoff of Apollo 11, and it looks like he was correct!"

Each of the six manned Apollo missions that landed on the moon planted an American flag in the lunar dirt.

Scientists have examined images of the Apollo landing sites before for signs of the flags, and seen hints of what might be shadows cast by the flags. However, this wasn't considered strong evidence that the flags were still standing. Now, researchers have examined photos taken of the same spots at various points in the day, and observed shadows circling the point where the flag is thought to be. [Video: Moon Photos Prove Apollo Flags Still Stand]

Robinson calls these photos "convincing."

"Personally I was a bit surprised that the flags survived the harsh ultraviolet light and temperatures of the lunar surface, but they did," Robinson wrote. "What they look like is another question (badly faded?)."

Most scientists had assumed the flags hadn't survived more than four decades of harsh conditions on the moon.

"Intuitively, experts mostly think it highly unlikely the Apollo flags could have endured the 42 years of exposure to vacuum, about 500 temperature swings from 242 F during the day to -280 F during the night, micrometeorites, radiation and ultraviolet light, some thinking the flags have all but disintegrated under such an assault of the environment," scientist James Fincannon, of the NASA Glenn Research Center in Cleveland, wrote in the Apollo Lunar Surface Journal.

Start Over

More Quizzes

In recent years, photos from the Lunar Reconnaissance Orbiter have also shown other unprecedented details of the Apollo landing sites, such as views of the lunar landers, rovers, scientific instruments left behind on the surface, and even the astronauts' boot prints. These details are visible in photos snapped by the probe while it was skimming just 15 miles (24 kilometers) above the moon's surface.

LRO launched in June 2009, and first captured close-up images of the Apollo landing sites in July of that year. The \$504 million car-size spacecraft is currently on an extended mission through at least September 2012.

The Flag Was Still There! Camera Reveals American Symbols Endure On The Moon 40 Years Later (NYDN)

By Christine Roberts

New York Daily News, July 30, 2012

The iconic American flags planted by astronauts on the moon are still flying after more than four decades.

The most recent photos of the moon taken by NASA's Lunar Reconnaissance Orbiter Camera show that the flags still exist — except the one planted by Neil Armstrong and Buzz Aldrin after they became the first humans to touch the lunar surface July 20, 1969.

"Astronaut Buzz Aldrin reported that the flag was blown over by the exhaust from the ascent engine during liftoff of Apollo 11, and it looks like he was correct!" LROC principal investigator Mark Robinson wrote in a blog post Friday.

Each of the six manned Apollo missions that touched down on the moon planted flags at their landing sites.

The flags were not meant to be symbolic of territorial claims. Instead, they were intended to signify "humanitarian accomplishment," Smithsonian curator Allan Needell told CBS News.

Scientists have long searched for proof that the flags survived after the final manned Apollo mission, Apollo 17, left the moon Dec. 14, 1972.

The LROC photos, which were taken at various times of the day and show rotating shadows around the points where the flags are believed to be, offer "convincing" evidence that the icons still exist, Robinson says.

It was feared the flags would be lost due to the rough lunar environment.

"Personally I was a bit surprised that the flags survived the harsh ultraviolet light and temperatures of the lunar surface, but they did," Robinson wrote. "What they look like is another question."

The moon experiences temperature swings from 242 degrees during the day to -280 degrees during the night, according to scientist James Fincannon of the NASA Glenn Research Center in Cleveland.

Annie Platoff, a librarian at the University of California who is currently studying the flags, said that the nylon icons were not meant to last forever.

"It was just to be there during the, the event — the landing and departing from the moon," Platoff told CBS. "We didn't have a requirement that the flag, the U.S. flag, had to withstand all the environments for eons."

The Lunar Reconnaissance Orbiter, which launched in June 2009, has shown other astounding details of the Apollo landing sites, including lunar rover tracks and astronauts' boot prints.

The \$540 million spacecraft is currently orbiting the moon on a mission that will extend to at least September 2012.

American Flags Planted During Apollo Moon Missions Still Wave After 40 Years (DAYMAIL)

Daily Mail (UK), July 30, 2012

Four decades after the last astronauts landed on the moon and planted an American flag in lunar soil, scientists wondered: 'Does that star spangled banner yet wave?'

Finally new images from NASA's Lunar Reconnaissance Orbiter Camera (LROC) have given proof in the night, that the flags are, indeed, still there.

All but one of the six flags left by American astronauts remain standing, according to an analysis of the shadows they cast on the surface of the moon.

During each of the six American moon landings, astronauts left American flags behind as symbols of their nation's scientific and engineering achievement.

The first was the monumental July 20, 1969, Apollo 11 landing -- in which Neil Armstrong declared on live television, 'one small step for man, one giant leap for mankind.'

The final mission was Apollo 17 on December 14, 1972.

Scientists used new, detailed images from NASA's lunar camera to determine that the flags were casting shadows that circled them as the moon moved in its normal orbit -- proving that they were still standing on their poles.

'From the LROC images it is now certain that the American flags are still standing and casting shadows at all of the sites, except Apollo 11,' Mark Robinson, an investigator with the lunar satellite program, wrote on Friday.

'Astronaut Buzz Aldrin reported that the flag was blown over by the exhaust from the ascent engine during liftoff of Apollo 11, and it looks like he was correct!'

The American missions to the moon remain the only manned flights to touch down on a heavenly body.

Dr Robinson wrote that one of the most common questions he and his team have received since the launch of the lunar orbiter in 2009.

'Personally I was a bit surprised that the flags survived the harsh ultraviolet light and temperatures of the lunar surface, but they did,' he wrote.

'What they look like is another question (badly faded?).'

The conditions on the surface of the moon are harsh. Temperatures swing between 250 and -280 degrees Fahrenheit

New Images Prove Lunar US Flags Still Fly On The Moon (NEWSAU)

[News.com.au](#), July 30, 2012

DO the flags planted on the moon by astronauts stand the test of time?

From the latest photographs of the moon taken by NASA's Lunar Reconnaissance Orbiter Camera (LROC), all but one is still there.

Forty years after the last astronaut landed on the moon, LROC images show that all but one of the six US flags remain in place on their poles.

The flags were left on the moon during the six lunar landings to symbolise the United States' scientific and engineering achievement.

The first was the monumental July 20, 1969, Apollo 11 landing in which Neil Armstrong declared on live television, 'one small step for man, one giant leap for mankind'. Apollo 17 took part in the final mission in 1972.

"From the LROC images it is now certain that the American flags are still standing and casting shadows at all of the sites, except Apollo 11," Mark Robinson, an investigator with the lunar satellite program, wrote in a blog.

"Astronaut Buzz Aldrin reported that the flag was blown over by the exhaust from the ascent engine during liftoff of Apollo 11, and it looks like he was correct!"

Scientists have examined images of the Apollo landing sites before for signs of the flags, and seen hints of what might be shadows cast by the flags. Now, researchers have examined photos taken of the same spots at various points in the day, and observed shadows circling the point where the flag is thought to be.

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Scientist James Fincannon, of the NASA Glenn Research Center in Cleveland, wrote in the Apollo Lunar Surface Journal: "Intuitively, experts mostly think it highly unlikely the Apollo flags could have endured the 42 years of exposure to vacuum, about 500 temperature swings from 242 F during the day to -280 F during the night, micrometeorites, radiation and ultraviolet light, some thinking the flags have all but disintegrated under such an assault of the environment."

Photos from the Lunar Reconnaissance Orbiter (LRO) have also shown other unprecedented details of the Apollo landing sites, such as views of the lunar landers, rovers, scientific instruments left behind on the surface, and even the astronauts' boot prints. These details are visible in photos snapped by the probe while it was skimming just 24km above the moon's surface.

LRO launched in June 2009, and first captured close-up images of the Apollo landing sites in July of that year. The \$504 million car-size spacecraft is currently on an extended mission through at least September 2012.

Beyond A Shadow Of A Doubt: US Flags Still Standing At Apollo Moon Landing Sites (COLSPACE)

By Robert Pearlman

collectSPACE, July 30, 2012

Forty-one years ago on Monday (July 30), Apollo 15 astronauts David Scott and James Irwin planted an American flag on the moon. It was the fourth star-spangled banner to be deployed on the lunar surface, out of the six that would ultimately be raised by each of the United States' manned missions to land on the moon between 1969 and 1972.

"I'll hit it a few times so it'll stay up here for a few million years," Irwin said to Scott, as he used a hammer to drive the flag's pole into the ground on July 30, 1971.

Well shy of Irwin's estimate, it took less than four decades for doubts to begin that the Apollo 15 flag — along with the five others that preceded and followed it to the moon — was still standing.

Now, a NASA probe orbiting high above Hadley Rille has gave proof that the flag is still there.

By the Sun's yellow glare

Since its arrival at the moon two years ago, NASA's Lunar Reconnaissance Orbiter (LRO) has taken detailed photos of the lunar surface, including the very first views of the equipment that was left behind at the Apollo landing sites since the astronauts left the moon to come back to Earth 40 years ago.

The spacecraft's images are of high enough resolution that in addition to the moon landers, lunar rovers and surface deployed experiment packages, the astronauts' boot print tracks are also visible. But the flags are not thick enough to be resolved directly when viewed from above.

And that assumes they still exist.

"It is not really clear whether the flags are even there any more because they were not anything special, they were made out of nylon," Mark Robinson, principal investigator for the LRO Camera (LROC), said in September 2011. "In the extreme heat and [ultraviolet] UV environment on the moon, personally I would be surprised if there is anything left on them."

But as Robinson's camera circled the moon, it flew over the Apollo landing sites at different times of the lunar day. The sun's angle changed, and with it the shadows cast by the Apollo artifacts.

"The most convincing way to see that the flags are still there, is to view a time series of LROC images taken at different times of day, and watch the shadow circle the flag," Robinson wrote in a blog entry on the LROC website this week. "From the LROC images it is now certain that the American flags are still standing and casting shadows at all of the sites."

Fallen first flag

All that is, except one — the first flag on the moon.

The LROC images of the moon's Tranquility Base, where Neil Armstrong and Buzz Aldrin made history as the first men to walk on another celestial body, reveal no shadow being cast where the flag once stood.

But that is less a mystery than it is a verification of what Aldrin saw as he and Armstrong blasted off the moon.

"I was concentrating intently on the computers, and Neil was studying the attitude indicator, but I looked up long enough to see the flag fall over," Aldrin recounted in his 1973 memoir, "Return to Earth."

"Buzz Aldrin reported that the flag was blown over by the exhaust from the ascent engine during liftoff of Apollo 11, and it looks like he was correct!" Robinson wrote on the LROC website.

Space vs. the stars and stripes

While the LRO images confirm that the American flags at the other five landing sites are still standing, they may still be unrecognizable as "Old Glory."

The shadows verify the physical cloth still exists, but the flags' red and blue colors may be no more.

"I was a bit surprised that the flags survived the harsh ultraviolet light and temperatures of the lunar surface, but they did," Robinson wrote. "What they look like is another question."

The same radiation that Robinson believed might degrade the flags, may have still stripped them of their colors, Paul Spudis, senior staff scientist at the Lunar and Planetary Institute in Houston, wrote in a blog entry for Smithsonian Air&Space magazine in July 2011.

"Even on Earth, the colors of a cloth flag flown in bright sunlight for many years will eventually fade and need to be replaced," Spudis explained. "So it is likely that these symbols of American achievement have been rendered blank, bleached white by the UV radiation of unfiltered sunlight on the lunar surface."

On the LROC website users can flip through the images of each Apollo landing site as taken throughout the day.

NASA NEWS

For NASA, There's No Liftoff From Politics (USAT)

By Dan Vergano

USA Today, July 30, 2012

Born in the Cold War, beset by tragedies and buoyed by triumphs, the \$17.7 billion space agency once more faces debate in the post-space shuttle era. Once again, an administration's plans for NASA face congressional criticism, scrutiny from a blue-ribbon panel and demands for more funds that set parts of the agency against one another.

"You cannot have a public space agency without politics playing a role. That's only right when the taxpayers are paying the bills," says planetary scientist Daniel Britt of the University of Central Florida. This month in Washington, Britt and his colleagues visited congressional staffers to voice support for more missions to explore nearby planets, projects cut by NASA. "We tell them that space exploration is an area where the U.S. leads the world, and we'd like to see it stay that way," Britt says.

Such calls are not so unusual. Even as NASA's largest Mars mission, the Curiosity rover, headed for the Red Planet this summer, standard space agency politics took place on Earth. Astronaut Donald Pettit testified to the Senate about International Space Station research, and NASA Administrator Charles Bolden, spoke to a National Research Council panel assessing the "strategic direction" of the space agency.

Some in Congress, such as Sen. Kay Bailey Hutchison, R.-Texas, want more manned missions to the moon. Some, such as Rep. Adam Schiff, D-Calif., want more robot missions to Mars. Then there are those such as Rep. Ron Paul, R.-Texas, who said NASA "is dead, and the corpse must be buried as soon as possible" at a Florida debate.

In his tenure, Bolden has often defended the 2010 Obama administration space policy, which would send astronauts to an asteroid by 2025 and to Mars around the mid-2030s. Big-ticket priorities of the space agency are:

- A large rocket and capsule to get to such places, known as the Space Launch System (SLS) and Multipurpose Crew Vehicle.

- Commercial rocket company missions, such as the May SpaceX "Dragon" trip, to the International Space Station at least through 2020.

- A 2018 launch of the \$8.8 billion James Webb Space Telescope, successor to the highly productive Hubble Space Telescope, whose cost overruns along with Curiosity's have drained funding from planetary science missions.

Each one comes with political fighting attached. In June, Bolden and Rep. Frank Wolf, R-Va., of the House Appropriations committee settled a dispute over NASA using commercial companies, such as SpaceX or Boeing, to send

astronauts to the space station. NASA wanted four providers and Wolf wanted one-and-a-half to keep costs down. They settled on two-and-a-half.

Such scraps mix into the yearly haggling over NASA's budget. In February, the administration requested \$17.7 billion for NASA in 2013, a \$59 million cut from last year. The House has appropriated \$17.6 billion while the Senate has slotted \$19.4 billion, which sounds like more but includes transfer of National Oceanic and Atmospheric Administration programs to NASA. The 2013 budget awaits a final vote.

"The glass is either half-full or half-empty at NASA," says space policy expert John Logsdon, author of *John F. Kennedy and the Race to the Moon*. The agency won approval to proceed with building the SLS last year but faces doubts in Congress over the lack of a long-term vision. "NASA's budget only supports a program that is fragile and doesn't make long-term sense," Logsdon says. As an example, he points to the SLS, which will launch in 2017 and carry astronauts only in 2021, with a less-defined schedule thereafter.

Squabbling may be just what Congress wants, suggests University of Houston political scientist Alan Steinberg. In a 2011 *Space Policyjournal* study, he noted that although the monetary value of the NASA budget has marched steadily upward since 1973, in reality it has declined as a percentage of the federal budget, from 1.35% to 0.6%. "I think this has allowed congressmen to have it both ways," Steinberg says, as supporters note increased budgets and detractors are pleased that, factoring inflation, the space agency doesn't take a bigger bite out of the federal budget.

The reality is NASA's budget peaked in 1965, in the midst of the moon race. When the moon race was over in 1969, President Richard Nixon decreed NASA would have to fight for its budget with other agencies. "The program has never really adjusted to that change," Logsdon says. "We give NASA a special place in our national life, one that is outsized compared to its actual budget. It is remarkable what they do accomplish with the resources available."

Editorial: There's Still Hope For NASA (HC)

Houston Chronicle, July 30, 2012

To borrow from Mark Twain, reports of NASA's death are greatly exaggerated.

The space agency and the Johnson Space Center are very much alive, if not as visible as they were in the days when Mission Control was doing its regular televised turns during manned space missions.

That is the reality-grounded message being delivered by Mike Coats, the JSC's director, as reported by Eric Berger in July 19's *Chronicle* ("We're not going out of business," Page B1). It was one we heard along with Berger during an hour-plus conversation the director had with the editorial board.

Despite budget and personnel cuts, JSC is handling the formidable task of running the International Space Station and managing development of the Orion spacecraft (first flight in 2014) while wrestling with the even more formidable task of keeping public support for space exploration from lagging. It has been a while since NASA has had a "Wow!" moment.

Even so, Coats' enthusiasm is catching. The former astronaut has an all-American-boy manner and look even in middle age. Part John Glenn and part Neil Armstrong, if we had to draw a comparison. And like both of those space heroes, he's very disciplined and focused on the mission at hand.

At the top of that mission list is welcoming the role of private firms into space, rather than resisting those efforts or berating them. That's going well enough, Coats says, as private operators gain the respect of NASA employees and vice versa. The recent success of SpaceX's Dragon spacecraft's mission to the space station helped that cause.

But the going gets tougher in the political arena, where NASA and JSC have taken some serious hits in their budgets and faced even more serious questioning of their mission over the past few years. The results are obvious and troubling.

It galls Mike Coats that "we're not a space-faring nation right now" because of the retirement of the space shuttle.

Instead, he laments, "we're paying the Russians a lot of money to fly our people up there."

He's galled because we're paying a lot of Russian engineers when he'd like to be hiring American engineers.

That bothers us, too. Part of the problem, we conclude after hearing Coats, is that the NASA budget too often gets caught up in the tangle of pork-barrel and partisan politics. That shows in his many anecdotes about visiting with members of Congress and U.S. senators over the years as an astronaut and an administrator and hearing that so many express little interest in space - until they learn that there are jobs in their district or state that come from the space program.

More's the pity. That kind of support is an inch deep when what is required is commitment based not on the pork NASA produces, but on the long-term value it adds to our economy. That is well-established. Until the break-up of the former Soviet Union, 11 percent of this country's federal budget was devoted to research and development, Coats notes. As part of the so-called "peace dividend," that amount was cut to 3 percent. Now, it's fallen below even that amount, he says.

In light of the budget deficit and the federal debt above \$16 trillion, it is difficult to make the case for expanding spending in any area. But if there were one, this would be it. The cost-benefit ratio is clear and inarguable.

Short of that, the best budget medicine for NASA would be removing its budget from the whims and uncertainties of politics by making it a multi-year budget. Doing so would match its missions, which are almost all long-term in nature.

Coats says Rep. John Culberson, R-Houston, has expressed keen interest in making this change. We encourage the congressman to continue his work. It would wring some of the politics from the budget process and stabilize the space agency.

My Friend Sally Ride's Final Mission: Making Science Cool (WP)

By Susan Okie

Washington Post, July 28, 2012

Sally Ride seized the chance to go to space because she wanted to find out what it would feel like. Sally loved testing the limits of her brain and body — solving the puzzles in *Scientific American* as a teenager, running five miles a day while doing research in physics at Stanford University, winning tournament tennis matches, learning to fly a NASA T-38 jet.

After she blasted off to become America's first woman in space, the support crew at Mission Control asked Sally how she'd enjoyed being launched on a rocket. She gave it Disneyland's top rating: "Definitely an E ticket." Looking back at her first spaceflight years later, she called it "the most fun I'll ever have in my life."

When we were best friends and high school classmates in Los Angeles in the late 1960s, Sally told me that she wanted to be famous, but she wanted to achieve that goal by winning a Nobel Prize. A ninth-grade science teacher had introduced her to physics and astronomy, and she intended to study the stars. After her retirement from NASA and academia, Sally, who died this past week at 61, turned her focus back to teachers — like the one she always credited with planting the seed that eventually got her to space. She hoped to motivate a new generation of teachers who might impart a love of science to their students.

It wasn't until 1977, when she was completing her graduate work in physics at Stanford, that Sally spotted a notice in the university's student newspaper announcing that NASA was recruiting young scientists — for the first time including women — to become astronauts. She knew instantly that this was what she wanted to do. I was thrilled, but not surprised, when she called early one morning in 1978 to tell me that she was one of six women selected.

Sally easily fitted into the mostly male, can-do engineering culture of NASA. It was a culture that valued level-headedness and good judgment; the operative slogan was "don't screw up."

Assigned to the team helping to design the space shuttle's computer-operated mechanical arm, which would be used to deploy and recover satellites, Sally threw herself into the job and proved adept at manipulating the arm. That skill, as well as her coolness under pressure while assigned to a key job at Mission Control, impressed veteran astronaut Robert Crippen, who was to command the shuttle's seventh flight, scheduled for the first half of 1983.

Before offering Sally a spot on Crippen's crew, Christopher Kraft, director of Houston's Johnson Space Center, warned her that she would become a historic figure and the focus of worldwide attention. "I think he wanted to give me a chance to back out," she later recalled.

When I visited the space center several months before the flight, I watched her go from demanding sessions in a shuttle simulator — practicing for every possible mishap— to a photo shoot for the cover of *Ms.* magazine. Wearing a crisp blue flight suit, Sally rolled her eyes when a makeup artist applied blush and the photographer requested "a restless, smug half-smile."

Still, she refused to worry about the pressures of becoming a national hero. "I have great confidence in my ability not to go nuts," she told me.

Those pressures proved greater than she expected. Sally's historic flight was front-page news all over the world. For almost half a year, her days were a succession of public appearances, goodwill trips, speeches and interviews. She couldn't go to the grocery store without being asked for an autograph. She told me that the only time she felt she could be alone was when she was standing at a lectern, preparing to deliver a speech.

When talking about science or the space shuttle, Sally was a natural teacher — enthusiastic, engaging and clear — but she detested personal questions. Married then to fellow astronaut Steven Hawley, she was determined to keep her private life to herself. Eventually, public excitement waned, and she returned to the relatively anonymous routine of an astronaut. "Fortunately, I have an extremely forgettable face," she quipped.

But she always enjoyed speaking with children. Kids asked questions that adults were embarrassed to ask — how the space shuttle's toilet worked, how to make a peanut-butter-and-jelly sandwich while weightless. Sally realized that elementary and middle-school students were endlessly curious about space travel and that sharing her experience was a way to get them excited about science and engineering.

When she proposed writing a book about a shuttle flight, half a dozen publishers were enthusiastic — until they learned that what Sally had in mind was a children's book, not her life story. "To Space and Back" (which I co-authored), published in 1986, was the first of seven science books that Ride wrote for children. The others were written with her longtime partner, Tam O'Shaughnessy. It's characteristic of Sally's love of privacy that their 27-year relationship did not become publicly known until the announcement of her death.

When the space shuttle Challenger exploded in 1986, killing seven astronauts, including schoolteacher Christa McAuliffe, the disaster stunned the nation — and put an end to NASA's prospects of sending more teachers into space. Ride served as a member of the presidential commission investigating the accident. A few days after the disaster, she called me in a fury because, as one of the reporters helping to cover the disaster for *The Washington Post*, I had called

space center employees whom I had met through her. It took years for our friendship to recover from what she saw as a betrayal.

In the years after Sally left NASA in 1987 and became a physics professor at the University of California at San Diego, she seemed to grow comfortable with her place as a hero — particularly as a role model for girls. In 2001, she started her own company, Sally Ride Science, to create books for students on key scientific concepts and careers, and to sponsor science festivals for girls in elementary and middle school. The media-shy former astronaut now regularly donned her NASA flight suit to speak at day-long festivals on university campuses that still attract hundreds of girls in the fifth through eighth grades.

At one such festival in Northern Virginia, I watched her spend more than an hour sitting at a card table in the hot sun, signing autographs and answering questions from a long line of excited girls, many of whom hoped to grow up to be astronauts.

I last saw her about 18 months ago. We met for breakfast at her favorite seaside inn in San Diego. She was enthusiastic about the recent direction of her company, which had shifted its focus from engaging middle school students to engaging their teachers. She believed that students' natural interest in science was too often snuffed out by stereotypes about what scientists do and by subtle messages from teachers, parents and peers. She said that teachers too often offer students a heavy diet of facts instead of a chance to experiment and have fun.

"When I was growing up," she recalled in a 2009 speech, "science and engineering were really cool." Kids dreamed of becoming rocket designers or studying moon rocks. "That's generally not the case today," she said. "And that's a problem."

With funding from industry, her company creates research-based professional-development curricula and brings elementary and middle school teachers from across the country to attend four-day trainings. The sessions have been shown to be effective in changing teacher practices and student attitudes.

Sally had a new mission: She was determined to reach as many science teachers as she could — and through them, the girls and boys they teach — to help make the study of science interesting and meaningful to kids. Her own science teachers did that for her. Sally is gone, but let's hope that the countless teachers and students she inspired will carry on with the task.

Susan Okie is a physician, a former medical reporter for The Washington Post and a clinical assistant professor of family medicine at Georgetown University.

FISCHLER: Sally Ride Wasn't Only A Pioneer (KINGSTON)

By Shirley Fischler

Kingston (NY) Daily Freeman, July 30, 2012

"Ride, Sally, Ride!" screamed the T-shirts, echoing the words of the pop song, "Mustang Sally."

The year was 1983; the occasion was Dr. Sally Ride's initial space shuttle shot, making her the first American woman astronaut in space. The T-shirts were worn by enthused onlookers at Cape Canaveral, Fla., as the physicist-turned-engineer-turned-astronaut soared into history.

Dr. Sally Ride died last week, of pancreatic cancer. She was only 61 years old.

But her passing went virtually unnoticed (even though President Obama honored her memory in a brief statement noting her contributions) — obscured by the horror of 12 deaths in Aurora, Colo.; hidden by the ongoing hideousness of

burgeoning conflict in Syria; submerged by the Sturm und Drang of Romney vs. Obama and the hype around the London Olympics.

One of the reasons Sally Ride's death went almost unnoticed was because she wanted it that way. Ride asked NASA to squelch any news of her cancer — this after decades of refusing to write a memoir or allow a movie to be made of her story.

And what a story it was! Once a ranked tennis player (Billie Jean King urged Ride to drop out of college and become a professional tennis player!), Ride accumulated four degrees at Stanford University, culminating in a Ph.D. in astrophysics in 1978.

How did Sally Ride move from college to space? By answering a NASA newspaper ad looking for astronaut recruits! But it would take five years from recruitment to realization. During her training at NASA, Ride learned parachute-jumping and how to deal with weightlessness and the G forces of launch and re-entry. More importantly, though, she learned how to fly a jet plane and switched her field from astrophysics to engineering. This change would lead to the main reason why she would take to space in 1983.

With her new skills, Sally Ride helped in the design of a robotic arm for the space shuttle. It was her expertise with the robotic arm that got her a place on a flight on Challenger, as she used the arm to deploy and retrieve a satellite.

Sally Ride's life as a pioneering woman in space and science — and a superb role model for young women worldwide — wasn't over with that 1983 flight. She would fly on Challenger again in 1984, then be a member of two panels investigating the crashes of Challenger (1986) and Columbia (2003).

The words she uttered before her first space ride, when she was dismayed by the "big deal" being made of her gender, could well be said after the shuttle crashes: "It's too bad our society isn't further along." Sally Ride had done her best to "move society along," but perceived clearly that it was not enough. Continued...

Dr. Ride retired from NASA in 1987 to become a science fellow at the Center for International Security and Arms Control at Stanford. In 1989, she became director of the California Space Institute at the University of California, San Diego, as well as a professor of physics there.

Perhaps Sally Ride's most meaningful contribution, however, was — and is — her drive to interest children — particularly girls — in science and math. She authored six science books for kids and, in 2001, founded Sally Ride Science, a company that provides teacher training and science-based school programs.

Dr. Sally Ride, scientist, engineer, astronaut, author, inventor and developer said after the shuttle Challenger landed in 1983, "I'm sure it was the most fun that I'll ever have in my life."

Her lifelong aim in life was to impart that fun to others.

"Ride, Sally Ride!"

Thanks, Sally (MARJO)

Martinsburg (WV) Journal, July 30, 2012

Space exploration, at least from the United States, was a man's world - or, rather, a male's out of this world - until 1978. The Soviet Union sent a woman, Valentina Tereshkova, into orbit in 1963.

But until NASA accepted female astronaut candidates in 1978, only U.S. men had soared beyond the atmosphere. Then, in 1983, the first American woman went into space aboard the shuttle Challenger. At the time, the 32-year-old also was the youngest astronaut from this country.

Her name was Sally Ride, and she went on to a second shuttle mission in 1984, then to a career with NASA that included investigating the 1986 Challenger tragedy. Later, Ride founded her own company, taught college physics and wrote five science books for children.

Ride died this week, at age 61, of cancer.

She was "a national hero and a powerful role model," commented President Barack Obama, adding, "She inspired generations of young girls to reach for the stars."

Both physically and mentally, traveling into space is beyond the capabilities of the vast majority of human beings. Still, many women could have become astronauts before Ride broke the barrier.

What makes her a role model is her determination to do so - to never give up in a quest that defeats most, both male and female, who undertake it. In that, as well as her later life, Ride indeed was an inspiration for young people of both genders.

Sally Ride's Decision (OTTCIT)

Ottawa (CAN) Citizen, July 30, 2012

In the days since her death, all the ways astronaut Sally Ride was a pioneer have been overshadowed by the one way in which she chose not to be. She kept her long relationship with a woman private, revealing it only in her approved obituary.

She died this month, at 61, from pancreatic cancer.

It's isn't quite fair to say Ride was in the closet. Her close friends and family knew, and accepted her partner of 27 years, Tam O'Shaughnessy. Her sister, who is herself a gay Presbyterian minister, has told journalists that Sally Ride was simply private, when it came to all aspects of her personal life.

Of course Ride's sexuality was nobody's business but her own. But the question of where privacy stops, and the closet begins, is a subtle one. It's about a thousand quotidian decisions that would not cause the slightest hesitation for a straight person. It would not have been considered an outburst or a revelation for a straight astronaut to casually drop the phrase "my husband" into a speech or small talk with acquaintances. There's a fine line between hiding and not disclosing.

Paradoxically, the fact that Ride did keep her sexuality to herself has turned it into a big deal at the time of her death.

That said, it likely would also have been a big deal had Ride chosen to come out in the 1980s, for good or ill. Ride could have tried to be a role model for gay people, just as she chose to use her status as the first female American to fly in space to be a role model for women and girls.

It's easy for others to wish Ride had made that choice. But it can be exhausting to be a pioneer. Ride had already endured questions about whether she'd need a bra in space, and jokes by television comics about how she had to find a purse to match her shoes before takeoff. It's quite possible she simply didn't feel like coping with more ignorance, with wearing down more stereotypes.

"It's too bad this is such a big deal," Ride said about her gender, at a NASA news conference before her first space flight in 1983. "It's too bad our society isn't further along."

It's worth noting that she endured those bad jokes and dumb questions 20 years after the first woman travelled to space, Soviet cosmonaut Valentina Tereshkova.

Perhaps she even felt she had to choose one of her causes over the other, that parents wouldn't buy science books for their kids if they knew those books were written by a lesbian couple. (She and O'Shaughnessy wrote several books

together.) Or perhaps she suspected, or knew, that NASA would tolerate a woman in space but not a lesbian. Her marriage to a man spanned the same few years as her space flights in the early 1980s.

The fact that Ride did keep her sexuality private says a lot about the United States in which she lived, and is a reminder that she didn't shatter all of its barriers.

In a more tangible sense, so is the fact that O'Shaughnessy is not entitled to survivor benefits. Whether it was intended this way or not, Ride's quiet, posthumous coming out has caused a lot of people to think about what it means to be gay in the United States today.

Read more: <http://www.ottawacitizen.com/life/Sally+Ride+decision/7000883/story.html#ixzz224hcTS9t>

Why Sally Ride's Sexuality Really Matters (NEWSCIENTIST)

By Lisa Grossman

New Scientist, July 30, 2012

My girlfriend was the one who pointed out to me that Sally Ride had a female partner.

I was a mess on Monday when I learned that Ride, who became the first American woman to fly in space in 1983, had died. I had no idea she was even sick – at her request, NASA had kept her 17-month battle with pancreatic cancer secret.

Ride was one of my childhood heroes. I dressed as her for Halloween when I was aged eight and my lifelong passion for space was first budding. Ride's legacy is mostly one of inclusion: bringing more women into science, encouraging girls to think they can do anything. She was a living example of how to crush gender stereotypes, even as she dodged sexist questions from the media. Her first flight on the space shuttle Challenger was before I was born. Thanks to her, I grew up in a world where my sex was not a barrier to the stars.

It runs even deeper for me, as a science writer. When I found out she had double majored in physics and English in college, I felt an intense feeling of identification – she was like me. I too loved both science and words, and felt a bit of tension about it – but if the first American woman in space could cross that line, I could too.

And I felt that same sense of recognition when my girlfriend read me this line from Ride's obituary, that she was "survived by her partner of 27 years, Tam O'Shaughnessy." I was elated. Again, Sally Ride was someone like me.

This is why I think Ride's sexuality matters. If her gender matters for diversity reasons, her sexuality matters too, for the same reason.

Role models only work if you see yourself reflected in them. When young people imagine their possible futures – what career to pursue, where to live, who to spend time with – one of the most important questions in deciding what path to take is, "Will I find people like me there?"

Psychologists call this "ambient belonging", and it's been shown to have an effect on things like college students' choice of subjects. If you feel that your gender, race, sexuality or love of science fiction sets you apart, then seeing people like you in a certain field will make you more likely to go into it. And the reverse is also true.

Which makes things complicated when it comes to someone like Ride. She was neither out nor deeply in the closet, it seems. Ride doesn't appear to have kept her partnership with O'Shaughnessy particularly secret. They worked together and wrote books together. Would they have legally married if they could? We may never know. But Ride's sex was visible in a way that her sexuality wasn't. She didn't need to put much effort into hiding it for us to overlook it.

Even when you're actively looking, it can be hard to find reflections of yourself in the world. I know that it's not just me. The March meeting of the American Physical Society held the first-ever session on sexual and gender diversity issues in physics this year.

One of the organisers, Elena Long of Kent State University, had searched for resources for LGBT+ physicists – or even just evidence that others existed – and found nothing (LGBT stands for lesbian, gay, bisexual and transgender, while the plus sign includes other sexual orientations or gender identities including intersexed, queer, questioning, asexual or pansexual).

One of the main conclusions of the meeting was that having role models who are open about their sexuality, and having a support network was necessary for LGBT+ physicists to feel safe and comfortable in their departments – and crucial to a successful career.

"I think showing successful academics who are out is an important way to dispel the notion that being out precludes or limits one's professional opportunities," wrote one anonymous attendee.

"There are other people like me who are further in their careers," wrote another. "I know a number of queer students or allies that are students, but I have no visible, contemporary queer scientist role models."

Now we have Sally Ride.

SpaceX Has Revolutionized Space Industry, But Killed Celebrity Astronauts In The Process (POLIMIC)

By Susan Kraykowski

PolicyMic.com, July 30, 2012

There was a time in American history, when just about everyone over the age of 5 knew these names: Scott Carpenter, L. Gordon Cooper, John H. Glenn, Jr., Virgil I. "Gus" Grissom, Walter H. "Wally" Schirra, Jr., Alan B. Shepard, Jr. and Donald K. "Deke" Slayton. We always listed them this way, too – in alphabetical order, with their nicknames and suffixes affixed to them as though they made a permanent honor roll in our minds. Schoolchildren could recite them; I could. I always misspelled Alan Shepard's name for some reason and to this day, have to look it up to make certain I get it right.

These men were our rock stars, in the era before there were rock stars. They were our heroes; our everymen; the finest of the bravest and best. They were the ones who had The Right Stuff

to go into space – they were the first astronauts. Idolatry doesn't even begin to describe how Americans felt and thought about these seven individuals; celebrity doesn't describe their status. They were interviewed relentlessly; visited the president at the White House; they were the Grand Marshalls of the Rose Parade on New Year's Day. Their wives were on the cover of Life Magazine, for heaven's sake!

When Alan Shepard made that first, 15 minute, suborbital flight – launched from Cape Canaveral, Florida, in May of 1961; my second-grade class watched on television from countdown to splashdown that morning. We drew pictures of helicopters circling above the Friendship 7 capsule as it floated in the Atlantic Ocean. We knew what the word "telemetry" meant and how to spell "astronaut," "helicopter," "capsule," and "rocket."

"Godspeed, John Glenn!"

The following February, John Glenn orbited the earth three whole times before splashdown; a singular and wondrous achievement. We knew the difference between orbital flight and sub-orbital flight by then. We knew about heat shields and g-forces and the airless vacuum of space.

Children didn't need imaginary superheroes; we had seven "Captain Americas" who stood for everything brave and daring and scientific. We didn't need science fiction when we had science fact happening at that very moment. And we knew the dangers, as did everyone else.

They put their lives on the line. Prior to every mission a strange and (as I look back on it) somewhat macabre ceremony took place in Florida or Texas – or wherever the astronauts' wives and families were gathered to watch the liftoff. The wives of the astronauts who weren't flying would arrive at the home of the wife whose husband was flying that day. The television cameras would film the little procession up to the front door as though the ladies were simply gathering for Kaffeklatsch. But in reality they were there to support each other and nobody really knows what terrors they shared.

America's astronaut worship peaked when we achieved the moon landing in 1969. Then, human nature being what it is; idolatry slid into insouciance and most of the way to indifference. Been there; done that. Our interest revived for a time when the Space Shuttle program commenced in 1981. Building the International Space Station and the romance of "Ride, Sally Ride!" captured our imaginations.

The American people always need a challenge. We celebrate those who surmount them successfully. We are at our best when we pull ourselves away from the distractions and settle down to figuring out how to accomplish difficult and dangerous things ... together.

Sally Ride's Domestic Partner Won't Get Her Federal Benefits (TIME)

By Sally Kohn

Time, July 30, 2012

Sally Ride was the first American woman in outer space. Upon hearing the news of her death last week, media outlets and celebrities alike celebrated Ride as a hero. But under federal law, Ride's domestic partner of 27 years will not receive death benefits or Social Security payments. Is that any way to treat a hero?

Even though the majority of Americans now support the right of same-sex couples to marry and more states are embracing marriage equality, 1,138 federal benefits, including Social Security and family medical leave, are still denied to same-sex couples even if they're married because of the Defense of Marriage Act enacted in 1996. And while 60% of Fortune 500 companies offer domestic-partnership benefits to employees — so unmarried same- or opposite-sex partners qualify for health insurance, paid family leave and more — the federal government does not.

According to NASA documents, Sally Ride's domestic partner Tam O'Shaughnessy could receive life-insurance payments if Ride designated O'Shaughnessy as her beneficiary. But despite the fact that our nation owes Ride a debt of gratitude for her unique service, our nation will not be paying her life partner the survivor annuity and basic death benefits provided to the surviving family members of heterosexual astronauts.

Obituaries say Ride left NASA right around the time she began her relationship with O'Shaughnessy. They went on to start a business, Sally Ride Science, and lived together in San Diego. Ride did not broadcast her relationship but didn't hide it either, according to her sister Karen "Bear" Ride. Had Ride worked at NASA while living with O'Shaughnessy, the discrimination would have been even more pronounced. According to NASA documents, Ride could not have qualified for extended family medical leave to care for her partner or get health or life insurance for her. And if Ride had, God forbid, died during a space mission, O'Shaughnessy would not have received those death benefits either.

This is not the fault of NASA, which seems in its policies to do everything possible to recognize and respect domestic partnerships within the constraints of the law. Rather, this is a discriminatory federal policy that affects all

government employees and, since same-sex marriages are not recognized for federal purposes under the Defense of Marriage Act, all Americans. In May, a Senate committee on homeland security and government affairs passed legislation that would extend federal benefits to same-sex domestic partners. The bill enjoys support from Republicans and Democrats, but it remains stalled in Congress.

Of course, it's important to recognize that we've come a long way. In 1983, when Ride became the first American woman in space, if she had been openly gay or even discovered to be quietly in a relationship with a woman, she would have likely been denied security clearance and possibly fired. Since then, the government has revised its practice of denying security clearances on the basis of sexual orientation. But that doesn't change the fact that hundreds of thousands of federal employees still face discrimination for being gay, including what benefits are available to their partners.

When Sally Ride was in the space shuttle, risking her life for the United States government, she enjoyed a view out the window that most of us can only imagine — a glowing blue and green orb of humanity idealized at a distance. Sadly, on the ground, the reality of how we treat one another can be far more ugly. We should spend less time puzzling over why Ride remained quietly in the closet and was not an activist for gay rights and focus our critique on the laws and systems of injustice for federal workers and their same-sex partners. Sally Ride was the first American woman in outer space. Our government should not treat her partner like an alien.

Brandenstein Pays Visit To Hometown (WATERWIS)

By Diane Graff

Watertown (WI) Daily Times, July 30, 2012

Former astronaut and retired U.S. Navy Capt. Dan Brandenstein paid a rare visit to his Watertown hometown Thursday and met with the Daily Times to discuss a wide range of subjects — everything from his memories of attending high school in the city and his illustrious career in space, to his views on the future of the U.S. space program.

Since retiring from space travel and exploration with the National Aeronautics and Space Administration (NASA) in 1992, Brandenstein, 69, worked in the private sector as chief operating officer of the United Space Alliance (USA). He retired from that position in February, after the U.S. government moved funds away from services provided by USA into other areas of the space program.

Brandenstein currently lives in Texas, but said he plans to spend portions of his summers and the occasional "white Christmas" with his wife, Jane, at the cabin they have owned since 2008 near Hayward.

Brandenstein arrived at the Daily Times wearing shorts and tennis shoes, fresh from a low-key, incognito visit to EAA events in Oshkosh. After his interview at the newspaper, he made his way up Main Street with friends to Mullen's Dairy like any returning city native, for a burger and a malt.

One of the fascinating aspects about Brandenstein is that he comes across as such a regular guy, a regular guy who was, well ... an astronaut. His demeanor is surprisingly informal and humble — dignified, yet somehow almost homespun. The subject matter he addresses with a high degree of expertise, however, is highly technical — NASA technical.

The former city resident also seems to be a great decision-maker. An admitted proud product of the military, Brandenstein said he always tries to weigh his options sensibly, make his decision, then stick to it, never looking back.

Brandenstein took time to reflect on his youth in Watertown. He said he graduated from Watertown High School in 1961, admitting he "wasn't at the top of the heap here, maybe the top 10 percent of the class."

"I wasn't asked to give any speeches at graduation," he said with a laugh, adding he left Watertown in September of 1965.

Brandenstein said he realized he wanted to be an astronaut in his freshman year of college, noting that, in his youth there was no such thing as an "astronaut," so that was not a career aspiration for boys of his generation.

"But I was always fascinated with flying," he said. "With the astronauts that (existed in the 1960s), I looked at their backgrounds and I noticed they all had common paths that led them to their careers. They were military test pilots and their educations were similar."

Earning a bachelor of science degree in mathematics and physics from the University of Wisconsin River Falls in 1965, Brandenstein began service in the U.S. Navy. He went on to fly 192 combat missions during the Vietnam War. His list of "special honors" on the NASA website is staggering. Brandenstein also served as a test pilot among other roles in the military and in 1977 he applied to the Navy to become an astronaut, which was the procedure at that time.

"The Navy sent my name to NASA and they conducted a large screening process and narrowed it down," he said. "I was then invited to Houston for physical tests and an interview, and a few months later you would either get a 'good phone call' or a 'not-so-good phone call' and fortunately, I got the good one."

Brandenstein was selected by NASA in 1978. He became an astronaut in 1979.

"I remember I was out in California and I was in the shower when I got that call that I was selected," he said. "I was pretty happy about that."

Later, Brandenstein was among the first astronauts chosen for the NASA space shuttle program. He said a total of 8,500 people applied and 35 were selected.

According to his NASA biography, Brandenstein was ascent spacecraft communicator and a member of the astronaut support crew for STS-1, the very first flight of the space shuttle. He is a veteran of four space flights and flew on the Challenger and Discovery shuttles. Brandenstein also commanded the crew of STS-49 from May 7-16, 1992, on the maiden flight of the space shuttle Endeavour. With completion of his fourth flight, Brandenstein logged more than 789 hours in space. In October of 1992 he retired from NASA and the U.S. Navy.

Brandenstein said that, unlike the early astronauts, when his time came to serve in space, NASA had a good idea of the stresses the human body undergoes during space travel, so he was rarely required to endure rigorous physical testing.

"By the time it was my turn, they realized that flying in space was like going to the grocery store," he said. "There were no real physical rigors. You just had to stay in shape. Space walking can be rigorous, you need arm strength to do that. I piloted the shuttle. The people who were doing the space walks had to do a little more training."

"I realized I was in the wrong union," Brandenstein added with a chuckle, thinking back about how he never went on a space walk. "But I am happy to take what I had."

Brandenstein's entire career was fraught with risk, but he said he learned to cope with it.

"I flew Navy combat missions. I was a test pilot. I believe in exploration, so I dealt with (the risks) by having confidence in myself and the crews that were involved and in our training," he said. "We always made sure our proficiencies were really high."

Brandenstein said the space shuttle Challenger's disintegration shortly after launch on Jan. 28, 1986, served not to deter him from shuttle missions, but to encourage him to continue his work. He said he and many others believed the Challenger disaster — and the shuttle Columbia explosion in 2003 — were tragedies that could not be avoided.

"It actually felt a little more comfortable for me after the Challenger disaster, because NASA scrubbed everything in the system and in the vehicle to make sure there were no risks like the O-rings had been. Most of us in the space office felt we were safer after the accident than before," Brandenstein said. "There was nothing you could do about the Challenger — same with the Columbia. It's sort of like when you are driving down the highway and an 18-wheeler hits you out of the blue. You don't worry constantly about that when you are out driving. So I just didn't worry about problems on the shuttle. But there were others who were very apprehensive on their way to the launch pad. I slept like a baby the night before."

Brandenstein said although the two space shuttle accidents did not phase him in terms of his desire to return to space, he was saddened for the people lost on the missions and for their families.

"You know them well. You know their families well, but you know the risks when you enter this career," he said. "I lost more friends in Vietnam than I have fingers and toes, but if (death) happens, that's the reality of the type of job you have. And if this isn't acceptable to you, then you should move on to a job where you're not in that type of situation."

Brandenstein said his parents, the late Mr. and Mrs. Walter Brandenstein of Watertown, were always very supportive of him in every way.

"They motivated me to do well in school and they paid for my college, so that was very nice of them and quite demanding on their resources," he said. "They were proud of me, but at the same time they were apprehensive about the risk. My mom would say, 'Don't do that,' all the time. My wife was the same way."

Brandenstein said among his greatest achievements as an astronaut was the fact that he and his crew completed 100 percent of their missions. He said in terms of his work on Earth, he is most proud of his family. He and his wife of 47 years have one daughter living in Austin, Texas. He also said he is proud of his leadership skills.

"I always liked leading a team," he said. "It became my way of life. I was chief of the astronaut office for six years and in the corporate world I was chief operating officer of United Space Alliance. People and good communications are really the key to a lot of things."

Brandenstein's fondest memories of space include his overall successful completion of his missions and he said he simply found the view from the space shuttle astounding. He said a person can see 1,600 miles in each direction from the 250 to 300 miles above the Earth's surface at which the shuttle orbited.

"The astronauts who went to the Moon saw the Earth as a small, blue ball. Where we were orbiting, you could see highways, bridges, big buildings. You still felt connected to the Earth," he said. "I remember when we did a night launch and it was dark as we crossed the Atlantic. When we got over Africa the sun came up. When you are in orbit, the sunrises and sunsets are spectacular ... the Earth is really beautiful. It's too bad there are so many people mucking it up."

Brandenstein said he was disappointed to see the U.S. government's recent cancellation of the Constellation Program, a NASA human space flight initiative.

"The cancellation of that by the current administration damaged the U.S. space program," he said. "It led to a gap in our capabilities and this put us back quite a bit. To accomplish something, you need firm goals and that seems to be lacking ... If I were 'king for a day,' I would go back to the Moon and develop procedures and processes there for use on Mars, because the Moon and Mars are very similar."

He said the U.S. should be building laboratories on the surface of the Moon.

"That is what would be most beneficial and cost effective," he said. "We have really only had a weekend vacation on the Moon. The Moon is only a three-day trip away and the gravity is the same as Mars. There is lots more to do there, with the ultimate goal being to reach Mars."

When asked how many times he had circled the Earth in his career, Brandenstein thought about it unsuccessfully, then reached into his wallet for what he called his "cheat-sheet."

"I've got a cheat-sheet here somewhere," he said, producing a worn and deeply wrinkled piece of paper with blurred writing on it. "It says '521,'" he said, adding that figure is nowhere near the world record anymore.

"On the space station these days they (orbit the Earth) 16 times a day and they are up there for six months," he said.

In retirement, Brandenstein said he will fly his airplane, golf and do some woodworking. He plans to build furniture. He said he won't miss space travel — much.

"I'll miss it, probably, a little," he said. "But I worked hard on my decision to retire from flying in space. It was a good phase of my life, but I moved on. The decision to retire took me three tries. After the third one I said, 'Let's do it and don't look back.'"

Brandenstein said his wife didn't think he would be able to "throttle it back," in terms of retiring.

"But I have lots of hobbies and I don't have to set the alarm clock anymore," he said.

Brandenstein has no regrets about his career.

"I had a good time," he said. "I enjoyed what I did and I am reasonably satisfied with how it turned out. I have to pinch myself at times when I think about my life, but I guess it was real. It wasn't a dream."

EXPLORATION SYSTEMS

NASA May Go Back To The Future And Use Saturn V Engines On Mars Rocket (HUNT)

By Lee Roop

Huntsville Times, July 30, 2012

A Huntsville company competing to power NASA's new heavy-lift rocket to Mars says the best engines for the job may be the same massive F-1 engines that lifted the Saturn V Apollo rockets nearly 50 years ago.

"We know you need a lot of thrust," Dynetics Inc. Vice President Steve Cook said last week, "and if you want to do it affordably, we think you need a liquid (fueled motor). So, now you say, 'What engines do I have?'"

"Well, we've already done this before," Cook said to answer his own question. "You had 13 fully successful Apollo flights with never an in-flight failure of, guess what, the F-1 engine."

Dynetics is negotiating a contract with NASA to find out if a modernized version of the F-1 really makes sense. If NASA awards Dynetics the contract as expected, it will also lead to construction of the biggest piece of rocket hardware in Huntsville since Apollo. "The point here is keeping the rocket in the Rocket City and taking it to a whole other level," Cook said.

NASA plans to use solid rocket boosters for the first flights of its 70-metric-ton rocket called the Space Launch System. But it is letting the aerospace industry compete over which boosters will be used on the later 130-metric-ton version.

Companies will first spend 30 months on what NASA calls "risk-reduction" tasks. That means building test hardware and doing engineering demonstrations to show NASA they've accounted for the foreseeable risks in their ideas.

The agency is funding six such risk-reduction projects at a total of \$200 million, and Dynetics has been selected and is negotiating a contract for three of them.

"History will tell you that where your costs go up dramatically in development is if there's a big risk out there that you haven't been able to mitigate down to where you can say, 'I understand that,'" Cook said.

With NASA's mantra for the new rocket being "performance, reliability and affordability," risk-reduction now is key. Hitting an expensive snag later could prove fatal to the program, given the mood in Congress about government spending.

The first of Dynetics' demonstrations involves the F-1 engine. The company's basic idea for the new booster is putting two modern versions of a liquid-fueled F-1 engine on tanks and strapping two of the tank sets to the heavy-lift rocket. That's two boosters, four F-1 engines and more than 7 million pounds of thrust.

"The F-1 was not designed to be a low-cost engine," Cook said. "It was designed to get you to the moon. Whatever it took to get you to the moon." But with modern methods and technologies, Cook said Dynetics believes it can build cheaper, but powerful and reliable F-1s.

Team partner Pratt & Whitney Rocketdyne has three modified F-1 turbopumps in storage, Cook said. Those massive pumps are what fed the kerosene and oxygen fuel mixture to "feed the beast," as Cook called the F-1. "We're going to fire that turbopump," he said.

The turbopump is fed, in turn, by a gas generator. "Think of it as a 20,000 pound rocket engine strapped to the side of the F-1 that gets those turbopumps going," Cook said.

Dynetics will test a lower-cost version of a gas generator and add it to the turbopump to create what's called a power pack. Add a combustion chamber and a nozzle later and you basically have a rocket engine, Cook said.

Dynetics won't actually assemble and fire an F-1 unless NASA lets it go forward into the booster development phase. That's not a given. Other companies are pursuing other booster options, and NASA will have to choose. "But in the development phase, we could fire an F-1 in a few months," Cook said.

Risk-reduction task No. 2 is building the 17-inch diameter fuel and oxygen lines to feed the F-1 engine. Valves and lines like those and the systems to run them haven't been built in America since Apollo, Cook said, but Dynetics will build all three in Huntsville in the next 30 months, if it gets the NASA contract as expected.

Risk-reduction task No. 3 is building tanks to hold the propellants. Dynetics plans to do that in Huntsville using its new high-bay development facility and \$90 million in modern welding tools at Marshall Space Flight Center. Those tools were added for the now-canceled Constellation rocket program.

"The tooling was set up for something 18 feet in diameter," Cook said. "It turns out that the physics and the requirements of the Vehicle Assembly Building (at Kennedy Space Center in Florida) mean you'd really like to have a booster that's 18 feet in diameter."

It also takes a tank that big to hold the nearly 2 million pounds of propellant each booster system requires.

Dynetics plans to build a test tank in Huntsville 18 feet wide and 60 feet long (shorter than the final version) and take it by barge to the company's test facility in Iuka, Miss. for deep-freeze testing.

The tank "will be the biggest structure built for a launch vehicle in Huntsville since Saturn Apollo," Cook said. "We are going to prove that we can build a very robust stage out of aluminum using the facilities at Marshall and in research park."

Will Huntsville again feel the rumble and hear the thunder of an F-1 test as it did in Apollo's glory days? It won't happen. NASA tests its rocket engines at the Stennis Space Center in Mississippi these days.

But if NASA does choose to go back to the future and use new F-1s, expect a lot of traffic from Huntsville to Stennis. Fire an F-1 rocket engine, and anyone who can get past the gate won't miss that.

John Kelly: Super Rocket Review Positive, But Let's Not Celebrate Early (FLTODAY)

By John Kelly

Florida Today, July 30, 2012

NASA's new super rocket is moving forward, passing two important review milestones this week and progressing into preliminary design.

Space agency leaders talked up the progress this week and credited the streamlined nature of its internal reviews of the rocket's development. That's good, given the the United States' need to field a rocket for the nation's future human exploration missions as soon as possible. It's a cause for concern , however, if the review did not thoroughly answer questions about the program's development.

Here's why. NASA historically has been criticized by outside investigators and auditors for clearing big, multi-billion dollar projects like the Space Launch System without fully understanding the potential technical risks and without fully acknowledging possible cost-growth issues.

The result? Expensive, super-difficult projects get green-lighted based on overly optimistic assumptions. That tends to lead to gigantic schedule delays and eye-popping cost overruns.

NASA's track record on those kinds of problems is consistent, and not in a good way. The vast majority of NASA projects of this magnitude, during a period of decades, have come in years late and hundreds of millions of dollars — often billions of dollars — over budget.

The reason that auditors have most often cited is a review process that often gives an OK to unreasonably optimistic assumptions, including projections of the project leaping every technological hurdle in its path on the low side of each estimated schedule range. The result is often that if even one or two pieces of the plan go awry there is neither time nor money built into the plan to deal with the issues. As such, the projects blow their budget and their schedule.

The dilemma is not all NASA's fault. The flaws are built in from the start, in a budget environment where the agency is asked to do an unrealistic amount of work for the money provided. However, the agency makes matters worse by regularly low-balling cost and schedule estimates, assuming the best during the review stages of projects, and not acknowledging real problems on a project until the impacts are so big that they're destined to generate frustration by political leaders in the White House and Congress.

So, it's good that the reviews appear to be showing progress on the Space Launch System. The new super rocket is needed to launch the Orion exploration vehicle on missions to asteroids and later Mars. The development needs to be accelerated for the good of the space program and Florida's Space Coast. The gap in American-made space transportation systems warrants priority attention.

Here's hoping that this time, the streamlining of the NASA's reviews on this important project means faster, but not less thorough or less responsible. Let's hope that we're not soon writing about why the project is five years behind schedule and billions of dollars over budget. The future of the space program depends on NASA moving beyond that old, repeated mistake.

Private Partnerships Pave NASA's Path Back To Space Flight (OSHKSH)

By Jennifer K. Woldt

Oshkosh (WI) Northwestern, July 30, 2012

Partnerships with private space-flight companies are expected to pave the way for NASA's future space exploration and space station development plans.

The United States has not had a way to transport crews into space other than relying on other countries to provide seats in spacecraft since the final flight of Space Shuttle Atlantis in July 2011.

The Commercial Crew program is a partnership between NASA and private companies to develop innovative designs to take NASA astronauts to space in the future. Showcasing those partnerships is a centerpiece of NASA's participation this year in the Experimental Aircraft Associations' AirVenture 2012

"NASA lead the building of a cathedral we call the International Space Station. Now we are looking to the commercial industry for innovative ways to transport cargo and crew to our cathedral in the stars," Ed Mango, the program director for NASA's Commercial Crew program said Thursday.

Four companies working with NASA through the program - Space Exploration Technologies, Sierra Nevada, Boeing and Blue Origin - are working on space-flight projects with a mix of private funds contributed by the company and federal funds from NASA. The partnerships with NASA also allows the companies to draw on the federal space agency's 50 years worth of space-flight knowledge to develop their projects. Three additional companies - ATK, Excalibur and ULA - are working on projects without funding from NASA.

Hawthorne, Calif.-based Space Exploration Technologies, also known as SpaceX, is working with the Commercial Crew program to develop its Falcon 9 rocket and Dragon spacecraft to transport people to space.

In May the company used the rocket and spacecraft to transport cargo to the International Space Station, making it the first commercial vehicle to successfully dock with the space station.

SpaceX will now begin working on making modifications to transport a crew of seven to the station, said Dr. Garrett Reisman, a former NASA astronaut who is now a senior engineer at SpaceX.

"We are very proud of the success of this mission," Reisman said during an appearance at AirVenture. "But we're not stopping here. The company was not founded to deliver T-shirts and underwear to space. The company was founded to deliver human beings to space."

SpaceX plans to fly the Dragon spacecraft with the Falcon 9 rocket to the International Space Station with a non-NASA crew in 2015, Reisman said.

That's ahead of the schedule NASA has set for the Commercial Crew program. NASA hopes to have several of the Commercial Crew programs flying missions to the space station between 2015 and 2017, but those dates depend on how much money the government and private companies invest, how fast the companies want to advance and how much help is needed, Mango said.

Encouraging innovation

In the past NASA has given companies rigid requirements for designing and building vehicles for space travel. The commercial crew program is different.

While NASA still has a set of important requirements that must be met before authorizing its astronauts to travel into space on privately-developed vehicles, the Commercial Crew program gives private companies the ability to pursue innovative designs and technologies, said Karen Scott, of NASA's Commercial Crew program.

"It's up to them," Scott said. "But in the end, we're the ones that will put that NASA stamp on their rockets."

The partnership with NASA is a great benefit for space companies, said Jim Voss, a former NASA astronaut who now is the head of development for Sierra Nevada Corp., which is working on the Dream Chaser spacecraft. Dream Chaser is a small shuttle-like vehicle that launches on an Atlas V rocket and is flown back to a runway landing.

Voss said the commercial crew program is a cost-effective and cost-efficient way for private companies and NASA to work on developing a way to replace the space shuttle program to take Americans into space. He said it has also been

helpful to be able to draw on the experience NASA has accumulated during its years of space exploration. "Our nation does have a path forward to have a way for Americans into space without having to rely on other nations," Voss said.

The Dream Chaser, which looks like a small space shuttle, is being designed to carry seven crew members to and from the space station as well as serve as an emergency vehicle that can be left at the space station to serve as a "lifeboat" in case crew members need to come back to earth quickly, Voss said.

The spacecraft is in a testing phase now, but Voss said Sierra Nevada Corp. hopes to use the spacecraft to take astronauts to the space station in 2016.

NASA will soon be deciding which companies will continue to participate in the next phase of the program, Scott said. At the end of that 22-month phase, companies will need to have developed a spacecraft, launch vehicle, ground and missions operations systems in order to have whole transport capabilities, Scott said.

"It's a big package they'll have to have," she said. "We really want them to be able to get to a test flight."

Whether companies that don't make the cut continue with their designs without NASA funding and assistance will be up to each individual company, but Reisman said answer is clear for SpaceX.

"We're in it for the long haul," Reisman said. "We're going to do this regardless."

Private Space Transportation Reaching New Heights (FORBES)

By Tom Coughlin

Forbes, July 30, 2012

Every once and a while it is important to write about your hidden passions and dreams. Thus this blog talks about exciting developments in private space transportation, a semi-secret interest of mine for decades. I spent a day at a conference called NewSpace 2012 in Santa Clara, CA to find out just how real the development of inexpensive space transportations was and how close we might be to achieving my youthful dreams of going into space.

There were a number of private launch companies as well as NASA officials that participated in the event. It was also interesting to note a growing wave of amateur space enthusiasts who are creating open source satellite and guidance plans and software and even making their own back-yard rockets! Well, they probably can't launch them from their back yard, but they can build parts in their back yards and garages.

SpaceX from Southern California, successfully launched and recovered the first private supply rocket to the International Space Station (ISS) in May of this year. They showed video of that launch as well as discussed their plans for creating human rated vehicles to create an alternative to Russian Soyuz spacecraft for human flights to the ISS. The United Launch Alliance has had 62 successful satellite launches since 2006 and it is working on a human-rated Atlas rocket launch by 2015-2016. Sierra Nevada Space Systems showed video of a successful flight of their Dream Catcher orbital space vehicle this year.

Armadillo Aerospace announced that they have a license to launch their STIG B-1 rocket on August 25 or 26, 2012 at the SpacePort American in New Mexico. This rocket will launch a 5 kg experimental payload to as high as 100 km (62 miles). The vehicle will experience about 3 minutes of a micro-gravity environment. The company plans monthly launches of this vehicle which can eventually take 5 kg to 150 km elevation and 50 kg to 100 km. A number of other space and space component and software companies either exhibited or spoke at the conference, which featured a business plan competition for space-oriented companies.

Steve Jurvetson from Draper Fisher Jurvetson, a VC investor in SpaceX spoke about the need to come up not only with great ideas, but great opportunities. He spoke about why the company invested in private space transportation and

explored the growth of transistors, qubits and human opportunities. As he stated most new ideas are a combination of older ideas in new ways and the SpaceX concept is an example of this—a modular reusable rocket.

The idea of personally exploring outer space appeals to many but the closest most folks can get now is to create an inexpensive satellite that can go out into space on the growing number of private launch vehicles. Robert Twiggs, formerly from Stanford but now at Morehead State University in Kentucky is one of the fathers of the small cheap satellite. Over a decade ago he helped pioneer the idea of the cube-sat satellite that is a small self contained box that could ride with other such boxes in the payload of a rocket where it could conduct low gravity experiments, biological experiments or do other interesting activities when released into space.

At the Newspace conference he showed some even more compact satellite platforms including an idea of matchbook sized satellites called moonbeams which could be launched for far less than conventional satellites and allow almost anybody to design and send an experiment or other package into space. Several outfits at the show offered products enabling construction of cubesat and even smaller satellite products including Celestial Circuits, JP Aerospace and Kentucky Space. In addition, NASA Ames was offering a open source software for mission control.

I met at least one person at the show who signed up to go on one of the Virgin Galactic space tourist flights. The Space Tourism Society and Moonandback Travel can help you book your space tourism itinerary. If you need a crew for your future space missions, Astronauts4Hire are ready to serve you and the International Space University offers space studies and space management degrees.

After decades of expensive and infrequent space travel we seem to be at the cusp of a new generation of much less expensive and faster growing commercial space transportation options. This is opening new opportunities for even high school students and hobbyists to launch satellites into low earth orbit and dream of going there themselves. Now what will I put into my little satellite?

The Reality Of Investing In Space Exploration (INVEST)

By Stephen D. Simpson

Investopedia, July 30, 2012

Space exploration has long been one of those endeavors that many try to argue has to be the domain of national governments. Not only does space exploration carry a huge price tag and uncertain economic returns that are anathema to companies, but many pundits and observers have worried that their involvement will somehow sully the virtues of pure science and/or lead to unrestrained land-grabs that will be hard to adjudicate in on-the-ground courtrooms.

Nevertheless, private company involvement in space is not only a reality today, but it has been reality for quite some time. NASA didn't build the Saturn-V rocket, Boeing did. Likewise, private companies have been building, launching and operating satellites for decades, as well as supplying NASA, the European Space Agency and other government/military space programs with vehicles, components and so on.

All of that said, it does seem that we are finally on the cusp of real private involvement in outer space. From space station resupply vessels to space tourism to, perhaps, even off-world mining, companies like Orbital Sciences, SpaceX and Virgin Galactic seem to be serious about establishing a viable place for private industry outside our atmosphere.

That said, it is still not all that easy for investors to participate in this evolution.

Once the Domain of Giants

To some extent, investors have always been able to participate in companies exposed to outer space, but it has never really been to a meaningful extent. Companies like Boeing, Lockheed, Northrop Grumman and Alliant Techsystems

have long been in the business of building rockets, spacecraft, components, satellites and the myriad other components and systems, like communications and tracking, that go into operating space programs.

The problem here has always been the extent to which space-based revenue is directly visible and significant to the overall performance of the company. Many companies' space programs have been closely tied to military projects, and it can be difficult to draw the line between "space revenue" and "defense revenue."

Moreover, while major projects can carry gaudy price tags (the last shuttle, Endeavour, cost over \$2 billion), that's actually not all that much money when you consider that these projects are generally spread across many years and multiple companies (Boeing, for instance, has reported over \$73 billion in trailing twelve month revenue.) Consequently, it's hard to say that investing in Boeing was really any sort of real investment in space exploration or development.

While giant companies like Boeing have always claimed a lion's share of the commercial space market, that has not prevented some smaller companies from getting into the business. While there are a host of small private companies that have offered products and services to NASA over the years, I'm referring mainly to companies like Orbital Sciences and Astrotech (once known as Spacehab).

Orbital Sciences has had a long and sometimes difficult history. While the company has established itself as a viable builder of launch vehicles (including the Taurus, Pegasus, and Minotaur), the company has had difficulties beyond the periodic launch failure. The company's venture into satellite telephony went badly and its commercial satellite operations have a mixed record as well. Nevertheless, the company has largely stayed on NASA's good side and is developing new vehicles for both satellite launches and space station supply missions.

In With the New

What is perhaps most striking about the newest crop of space companies is their ambition. Whereas Orbital Sciences has been content to focus on satellites and unmanned vehicles, many of these new companies are looking to build vehicles to take humans into space.

Arguably the most well-known companies today are SpaceX and Virgin Galactic. SpaceX, founded by Elon Musk of PayPal and Tesla Motors fame, has built SpaceX into the only privately-held company so far to build its own rocket and cargo vehicle and deliver a payload to the International Space Station. SpaceX has already started work (in cooperation with NASA) on spacecrafts that can carry humans, and the company has talked about launching a mission to Mars before the end of the decade.

Virgin Galactic's aspirations are not quite as lofty. Virgin Galactic has been building itself around the goal of becoming a space tourism company - taking passengers on suborbital and orbital space flights. While Virgin Galactic is not ignoring the possibility or opportunity of also facilitating suborbital science launches and/or satellite launches, this is a company largely built around the idea of true commercial space – private citizens paying a private company for trips into space. As part of this venture, Virgin Galactic has also formed a company (The Spaceship Company) with a subsidiary of Northrop called Scaled Composites to develop the spacecraft to be used by Virgin Galactic.

The Bottom Line

For all of the progress made in just the last five years, the reality is that Orbital Sciences is really the only option investors have for an investment that is directly tied to space and space exploration. Commercial space is just too small a part of what companies like Boeing do to support that investment angle. While there is talk that SpaceX may launch an IPO in a year or two, that doesn't help investors today.

While it is still more science fiction than fact, there probably will be a time when investors have an array of companies to invest in that are committed to the commercialization of space. Whether that's in the form of suborbital

space planes, commercial launch service providers, vehicle builders, exploration companies or even far-off ideas like asteroid mining or interplanetary travel, nobody knows. But for all of the excitement that likely will attend these developments, investors ought to remember that it is mundane details like viable addressable markets, competitive advantages and sustainable returns on capital that will always separate the winning ideas from the losers.

SPACE OPERATIONS

Japanese Cargo Ship Reaches Space Station (CBS)

By William Harwood

CBS News, July 30, 2012

Wielding the International Space Station's robot arm, astronaut Joseph Acaba captured a Japanese cargo ship early Friday, one week after launch from the Tanegashima Space Center in southern Japan. With the HTV-3 spacecraft firmly locked to the end of the arm, Japanese astronaut Akihiko Hoshide took over, maneuvering it to an Earth-facing port on the station's forward Harmony module for berthing.

"HTV capture is complete," Hoshide called down after the spacecraft was grappled at 8:23 a.m. EDT (GMT-4). "Congratulations to all the teams in Houston and (Japan)."

Spectacular video from the station showed the bus-size HTV suspended against the black backdrop of space as the two spacecraft sailed 253 miles above the southern Indian Ocean.

"Congratulations on a great capture. We'd like to welcome Kounotori aboard," astronaut Catherine Coleman replied from Houston, referring to the cargo craft's Japanese nickname -- "white stork."

After carefully aligning the HTV's forward hatch with Harmony's Earth-facing port, a gang of motorized bolts were driven home to lock the spacecraft in place by 10:34 a.m. Hatches were scheduled to be opened Saturday, but the astronauts were running ahead of schedule and they had the option of entering the craft earlier if time allowed.

Developed by the Japan Aerospace Exploration Agency, or JAXA, as a contribution to the space station program, the HTV is designed to carry both pressurized and unpressurized cargo, including equipment too big to pass through the space station's hatches.

Making the program's third flight, the HTV is loaded with 3.9 tons of pressurized cargo, including a research aquarium, five small "CubeSat" satellites and their launcher, a catalytic reactor for the station's water processing system and a water pump. Also on board: Japanese food, beverages and crew clothing.

The HTV is carrying another 1.2 tons of gear in its unpressurized section, including experimental NASA communications hardware and instruments and sensors that will be mounted outside the Japanese Kibo lab module.

The flight plan calls for the cargo ship to remain in place until Sept. 6.

Japanese Unmanned Spacecraft Arrives At Space Station (SPACE)

By Clara Moskowitz

SPACE.com, July 30, 2012

The third in a series of robotic Japanese spaceships has safely arrived at the International Space Station today (July 27), bearing a delivery of food, equipment and student science experiments for the orbital outpost.

The unmanned, school bus-size H-2 Transfer Vehicle-3 (HTV-3), also called Kounotori 3 ("White Stork" in Japanese), flew to about 40 feet (12 meters) away from the ISS, where it was grabbed at 8:23 a.m. ET (1223 GMT) by

the space station's 58-foot long (18 m) robotic arm, which was controlled from inside by astronauts Joe Acaba of NASA and Aki Hoshide of JAXA (the Japanese Aerospace Exploration Agency).

Using the Canadarm2 robotic arm, Acaba and Hoshide maneuvered Kounotori 3 to the Earth-facing docking port on the space station's Harmony node at 10:34 a.m. ET (1434 GMT).

"I think we couldn't have had a better day and we're looking forward to a great HTV mission," Capcom Cady Coleman told the astronauts from Mission Control in Houston.

"You guys were great, thanks a lot for helping us out," Acaba replied. "Thanks a lot for all the food."

Today's arrival follows the failed docking attempt on Monday (July 23) of an unmanned Russian Progress spacecraft. The Progress 47 craft was testing a new rendezvous system, which apparently failed to work as planned. The vehicle, which had already been at the space station, had undocked in order to test the new system in a re-docking. Russia plans to try again on Sunday (July 29) to dock the Progress 47.

Kounotori launched atop a Japanese H-2B rocket from the Tanegashima Space Center in southern Japan on July 20. It is the third such vehicle launched from Japan, following the flights of HTVs 1 and 2 in September 2009 and January 2011, respectively. [Photos: Japan Launches 3rd Robotic Supply Ship to Space Station]

The spaceship is loaded with 4 tons (3,600 kg) of cargo, including care packages with food, clothing and other items for the space station's crew. The vehicle, which is 33 feet (10 m) long and 13 feet (4 m) wide, is also carrying a camera called the ISERV (International Space Station SERVIR Environmental Research and Visualization System).

The camera is to be installed on the station, for use by ground-based scientists who can manipulate it via remote control. The system is intended for studies of natural disaster sites and environmental issues on Earth.

Two student-designed experiments are also packed aboard Kounotori 3. These projects won the YouTube Space Lab competition, which allowed students between the ages of 14 and 18 to envision space station experiments and describe them in videos submitted to YouTube. The winners were chosen by public voting.

Amr Mohamed, 18, of Alexandria, Egypt, and Dorothy Chen and Sara Ma, both 16, of Troy, Mich., came out on top, with experiments investigating how microgravity affects the hunting strategy of zebra spiders, and how different nutrients and compounds affect the growth and virulence of bacteria grown in space, respectively.

While Mohamed elected to experience cosmonaut training in Star City, Russia, for his prize, Chen and Ma chose to watch their projects launch aboard Kounotori 3 July 20 from the Tanegashima Space Center.

Six astronauts currently live aboard the \$100 billion, football field-size space laboratory. They hail from the United States, Russia and Japan.

Kounotori 3 is just one of a fleet of unmanned cargo delivery spacecraft that carry supplies to the space station. Russia and Europe have each built and launched similar robotic vehicles, and a commercial U.S. spacecraft, Dragon from California company SpaceX, has recently entered the field with its first visit to the station in May.

ISS Astronauts Grapple JAXA's HTV-3 (AVIATION)

By Mark Carreau

Aviation Week, July 30, 2012

Japan's HTV-3 moments from capture over the Indian Ocean. Image Credit: NASA TV

Astronauts aboard the International Space Station successfully captured the Japan Aerospace Exploration Agency's HTV-3 re-supply craft as it rendezvoused with the orbiting science lab early Friday.

NASA's Joe Acaba, positioned in the station's Cupola observation deck, reached out with the 58-foot-long Canadarm2 to grapple the 16.5 ton HTV-3 at 8:23 a.m., EDT, a short delay after the scheduled capture time to ensure sufficient lighting.

Captured at 40 feet from the station, the bus-sized long cargo carrier was to be maneuvered with the robot arm to the station's U. S. segment Harmony module for berthing shortly before noon, EDT, by JAXA astronaut Akihiko Hoshide. HTV-3 will remain docked through early September and depart filled with trash for a destructive re-entry.

"It looks beautiful from here," NASA's Mission Control radioed Acaba and Hoshide as the delicate grapple operation neared. "We are go for HTV-3 capture."

The third of JAXA's unpiloted ISS re-supply ships was launched from the Tanegashima Space Center in southern Japan on July 20 with more than four metric tons of internal and external supplies and research gear.

Friday's operation unfolded smoothly. The failure of the backup reaction control system during the rendezvous activities had no impact on the operations.

Acaba and Hoshide were assisted in the Canadarm2 operations by NASA astronaut Sunita Williams.

In addition to food, clothing and other supplies, the HTV-3 delivered the station's first aquatic habitat, an aquarium that will serve as home to medaka and zebra fish. The fish, which were not included in the current missions, will serve as subjects in studies focused on their skeletal and muscle develop in microgravity.

The new ground-controlled internal ISERV camera will gather imagery for climate change studies and disaster management.

The HTV-3's external station cargo includes NASA's Space Communications and Navigation Testbed, or SCAN.

Developed at the the Glenn Research Center and Jet Propulsion Laboratory, SCAN will pioneer the use of reprogrammable software defined radio for future spacecraft communication and navigation technologies.

JAXA's small satellite orbital deployer will eject five cubesat payloads.

HTV-3 Arrives To Make Large Delivery Of Supplies And Research Cargo To ISS (NASASF)

By Pete Harding

NASASpaceFlight.com, July 30, 2012

The Japanese H-II Transfer Vehicle-3 (HTV-3) automated resupply spacecraft has arrived at the International Space Station (ISS) following its launch into space from the Tanegashima space center in Japan last Friday (July 21). HTV-3's capture was at 8:23 AM EDT, ahead of berthing at 10:34 AM EDT, which marked a large delivery of critical supplies and research cargo to the orbital outpost.

HTV-3 rendezvous, capture and berthing operations:

Following HTV-3's injection into a roughly 200km x 300km orbit by the H-IIB booster last Friday, HTV-3 began a series of burns to bring itself in to the ISS just less than one week later. For this mission, the second stage of the H-IIB booster performed a de-orbit burn shortly following launch for a destructive re-entry, as part of a capability demonstration that JAXA have since confirmed was successful.

The HTV-3 rendezvous burns – performed using four newly designed Japanese engines, as the two previous HTVs used engines made by US company Aerojet – began with Phasing Maneuver-1 (PM-1), followed by Height Adjustment Maneuver-1 (HAM-1), followed by PM-2, which led into Co-elliptic Maneuver-1 (CM-1) and CM-2, and then HAM-0, CM-3, HAM-2, following which HTV-3 was inside the Communication Zone (CZ) with the ISS, and ready for Approach Initiation (AI).

Once inside the CZ, HTV-3 began to use the Proximity Operations (PROX) system, located in the Japanese Experiment Module (JEM) on the ISS, to communicate with the station. The same system will also be used by Orbital Sciences' Cygnus cargo vehicle to communicate with the ISS. Using PROX, HTV-3 performed an AI burn and, and once it reached a desired point below the station, made an R-bar Injection (RI) burn.

The R-bar – a term commonly heard during Space Shuttle dockings to the ISS – stands for Radius bar, and is effectively an imaginary line drawn between the center of the ISS and the center of the Earth, thus ensuring that any vehicle which approaches “up” the R-bar is directly below the ISS.

Once HTV-3 performed the RI burn, it entered the ISS Keep Out Sphere (KOS), following which HTV-3 proceeded to a point 30m below the station, following which it then proceeded to the capture point, thus concluding the rendezvous phase of the mission, and beginning the capture phase. Following HTV-3's arrival at the capture point, the spacecraft was put into free drift, inhibiting any thruster activity from occurring during this time.

The free drift command was sent to HTV-3 via the Hardware Command Panel (HCP), which sends commands between the ISS and HTV via the PROX link, in the same way that the Crew Command Panel (CCP) sends commands between the ISS and Dragon spacecraft via the COTS UHF Communication Unit (CUCU).

The HCP previously stood for HTV Command Panel, but the “HTV” has since been replaced with “Hardware” since the Cygnus spacecraft will also use the HCP, as it will utilise the PROX link to communicate with the ISS, as the HTV does.

The HCP, located in the Cupola module on the ISS, allowed Expedition 32 Flight Engineers Joe Acaba and Aki Hoshide to control the Space Station Remote Manipulator System (SSRMS) via the Cupola Robotics Workstation (RWS), with the RWS in the US Lab in “hot backup” standby mode.

The Cupola RWS offers increased situational awareness over the Lab RWS due to the Cupola's seven windows – one of which (window 2) was damaged recently by a piece of Micro Meteoroid Orbital Debris (MMOD).

While the MMOD strike was only small, and with the Cupola windows being comprised of multiple, replaceable debris panes, pressure panes, and scratch panes to protect against such incidents, Mission Control Houston (MCC-H) requested the ISS crew to close the protective external shutter over Cupola window 2 until the damage could be analysed and cleared. As expected, the analysis showed that the damage was not of concern, and the window 2 shutter was cleared to be re-opened.

With their added situational awareness from the Cupola, Acaba and Hoshide maneuvered the SSRMS over the Flight Releasable Grapple Fixture (FRGF) on HTV-3, and “fired” the snares on the SSRMS to close over the grapple pin, following which rigidization of the SSRMS was completed, where the FRGF/HTV is “pulled tight” against the SSRMS, thus securing the HTV-3 firmly in the station's grip.

This marked the first time that a Japanese astronaut, in the form of Aki Hoshide, assisted in the capture of a Japanese spacecraft – another badge of honour for Hoshide, who also helped to install the Japanese Pressurised Module (JPM) “Kibo” onto the ISS during the STS-124 Shuttle mission in May 2008.

Following HTV capture, the SSRMS maneuvered the spacecraft to the Ready To Latch (RTL) position below the Node 2 Nadir Active Common Berthing Mechanism (ACBM) port – the same one to which the SpaceX Dragon berthed to two months ago – and the process to attach the HTV to the ISS then began via the Node 2 Nadir ACBM extending hooks to pull the HTV's Passive CBM (PCBM) into the ACBM. Four sets of four bolts (16 in total) drove to secure the HTV to the ISS.

HTV-3 hatch opening – including pressurization of the CBM vestibule, opening of the Node 2 Nadir hatch, removal of the Center Disk Cover (CDC) and four Controller Panel Assemblies (CPAs), connection of vestibule jumpers including Inter-Module Ventilation (IMV) ducts, installation of the Vestibule Barrier Assembly (VBA), and finally opening of the HTV-3 hatch – is scheduled to be completed later today or tomorrow, depending on how fast the ISS crew can work.

ISS preparations for HTV-3's arrival:

Preparations for the HTV-3's arrival at the ISS have been ongoing over the past week, as detailed in an exclusive set of ISS on-orbit status notes, available to view on L2 – LINK.

"Ground specialists successfully uploaded three configuration tables in preparation of the installation of the Space Communications and Navigation (SCaN) Testbed on ExPRESS Logistics Carrier-3 (ELC-3) following the HTV-3 berthing," noted the information.

"Following each configuration, a flight software reboot of the ELC was performed for the new tables to be applied. No issues were reported during the upload and reboot process."

Another set of notes added that ground controllers performed the Hot Backup powerup of the Mobile Servicing System (MSS) while the crew performed multiple offset grapple approaches.

"During the final approach, the crew reacted to ground-commanded safing by performing a transition to the hot backup string and backing away. The transition and backaway proceeded nominally."

The notes also mentioned that the Node 2 Nadir CBM hatch mechanism was actuated from the latched position to the fully unlatched hard stop position. The hatch will remain in this configuration until HTV-3 berthing.

"The successful actuation of the hatch mechanism to the fully unlatched configuration meets Flight Rule F2-1, ISS Driven HTV Launch Commit Criteria", continued the notes. CBM hatches are unlatched prior to vehicle launches in order to prevent a latch issue from precluding access to a vehicle and thus wasting its on-board supplies.

HTV-3 cargo overview:

The HTVs consist of two cargo-carrying sections: The Pressurized Logistics Carrier (PLC) to carry internal cargo, and the Unpressurized Logistics Carrier (ULC) to carry external cargo.

The PLC has space for eight ISS racks in total, however the four aft racks in the PLC are fixed and can only be of the HTV Resupply Rack (HRR) type, whereas the four forward racks can be either HRRs or any other type of International Standard Payload Rack (ISPR), making the HTV the only vehicle capable of delivering racks to the ISS since the retirement of the Space Shuttle (neither the ATV, Dragon or Cygnus can deliver racks to the ISS).

On the HTV-3 mission, the PLC is carrying eight HRRs, all of which are loaded with Cargo Transfer Bags (CTBs), and larger M0-1 and M0-2 bags via front-mounted cargo carrier panels attached to the HRRs. The PLC is also equipped with a standard ISS United States Operating Segment (USOS) Common Berthing Mechanism (CBM) hatch, to facilitate the transfer of large cargo items, such as racks.

The HTV-3 PLC is carrying many important cargo items, since it is the first vehicle to deliver a large load of cargo to the USOS since the retirement of the Space Shuttle, as the ATV docks to the Russian Segment (RS) with its smaller hatchways, and the SpaceX Dragon C2+ flight was a test flight, and thus did not include any valuable cargo.

One major cargo item inside the PLC is a new CubeSat deployment system for the ISS, consisting of the Multi Purpose Experiment Platform (MPEP), complete with two JEM-Small Satellite Orbital Deployers (J-SSODs), and five CubeSats. Once unpacked from the PLC, the two J-SSODs will be attached to the MPEP, and the five CubeSats will be installed into the J-SSODs, whereupon the MPEP will be installed onto the Japanese Airlock (A/L) slide table.

The Japanese A/L is located in the Japanese Pressurized Module (JPM), and is used to pass experiments (but not spacewalkers) between the interior and exterior of the ISS. It features a slide table that extends both inside and outside the ISS, allowing experiments to be loaded onto the slide table by the internal ISS crew, then following A/L depressurization, be retrieved by the Japanese Experiment Module Remote Manipulator System (JEM RMS) on the outside of the ISS.

This is the process that will be used for the MPEP, which, once extended outside the ISS on the JEM A/L slide table, will be grappled via its FRGF by the JEM RMS, and then maneuvered to an attitude to allow the J-SSODs to release the CubeSats in their desired direction. The MPEP with J-SSODs will then be brought back inside the ISS for future re-use.

The benefits of launching CubeSats to the ISS inside the PLC include lower vibration environments, which can damage small CubeSats, and the ability to have the CubeSats checked-out post-launch but pre-deployment by the ISS crew.

Another important cargo item inside the PLC is the ISS SERVIR Environmental Research and Visualization System (ISERV), a modified commercial telescope which will be mounted in the Window Observational Research Facility (WORF) rack and used for Earth observations, to provide disaster relief through the SERVIR program.

Click here for HTV News Articles: <http://www.nasaspaceflight.com/tag/htv/>

The Aquatic Habitat (AQH) is also carried in the PLC, which, when installed in the Japanese Multipurpose Small Payload Rack (MSPR), will provide a habitat for Medaka fish aboard the ISS, aiding research into how fish born in space will react and adapt to the microgravity environment.

On the external side, the HTV-3 ULC carries one Exposed Pallet (EP), which is grappled by the Space Station Remote Manipulator System (SSRMS) via the EP's Power & Data Grapple Fixture (PDGF) and extracted from the ULC once the HTV arrives at the ISS, and is then handed off to the JEM RMS via the EP's FRGF, and attached to the Japanese Exposed Facility (JEF) via the Exposed Facility Unit (EFU)/Payload Interface Unit (PIU), which together form an Equipment Exchange Unit (EEU).

For the HTV-3 mission, a new type of EP is being flown, which, in addition to its visual differences from previous EPs, "eliminates an exposed pallet pull-in mechanism and replaces its hold-down mechanism with a position inspecting mechanism".

Following its attachment to the JEF, the external payloads that are mounted to the EP are removed via Extra Vehicular Robotics (EVR) and installed onto their specific locations on the ISS.

The HTV-3 EP is carrying two external payloads – firstly, the Multi-mission Consolidated Equipment (MCE), which includes five small research payloads, which will be removed from the EP with the JEM RMS and installed onto JEF EFU #8.

The second EP payload, the NASA-developed Space Communications and Navigation (SCaN) Testbed, which will be used for research into Software Defined Radio (SDR), will be removed from the EP via the Special Purpose Dexterous Manipulator (SPDM) "Dextre" and installed onto ExPRESS Logistics Carrier-3 (ELC-3) via the Flight Releasable Attachment Mechanism (FRAM) interface.

Following removal of both payloads, the EP will be re-inserted into the HTV ULC for disposal when HTV-3 re-enters Earth's atmosphere, which is currently scheduled for some time around HTV-3's ISS unberthing date of 6 September.

Unmanned Cargo Carrier Docks With Space Station (JAPAN)

Japan Times, July 30, 2012

The Kotonori unmanned cargo transporter docked early Saturday with the International Space Station carrying 4.6 tons of supplies, including food, clothing and experiment-related equipment, the Japan Aerospace Exploration Agency said.

Astronaut Akihiko Hoshide, 43, was set to open the hatch and crawl into the Kotonori later in the day to transfer the packages to the space station.

This is the third cargo vehicle sent into space by JAXA. It was placed into orbit by an H-IIB rocket that blasted off July 21 from the Tanegashima Space Center in Kagoshima Prefecture, and made its way to the ISS while orbiting at an altitude of 400 km under the control of the agency's Tsukuba center in Ibaraki Prefecture.

"The docking went quite smoothly," JAXA project manager Yukio Koyari told a news conference in Tsukuba. "We were nervous because (the Kotonori) was made of domestically manufactured equipment, but we were glad Hoshide and other crew members managed to maneuver it into place and will continue operations."

"I was impressed and proud of the Kotonori, as it is a demonstration of Japanese technology," Hoshide, who arrived at the space station earlier this month aboard a Russian craft, said on Twitter.

The Kotonori carried five small satellites that will be sent into orbit from Japan's Kibo lab. It is also equipped with a device that will record images of the cargo transporter's re-entry into the atmosphere and collect data on how it burns up, for use in future manned spacecraft programs and other purposes.

The Kotonori is scheduled to separate from the space station on Sept. 7.

JAXA Module With Student Experiments Safely Berthed To ISS (AMSPACE)

By Patricia Phillips

AmericaSpace, July 30, 2012

JAXA's HTV-3 spacecraft was successfully docked to the International Space Station (ISS) on Friday. The unmanned cargo transport ferried supplies as well as the experiments of three students to the orbiting laboratory. Photo Credit: NASA

The spacecraft carrying the experiments of three international students successfully docked with the International Space Station (ISS) at 10:34 a.m. EDT Friday, July 27. Expedition 32 Flight Engineer Aki Hoshide used the International Space Station's Canadarm2 robotic arm to install the Japan Aerospace Exploration Agency (JAXA) H-II Transfer Vehicle, or HTV-3, to its docking port.

Aboard: science experiments from Dorothy Chen and Sara Ma, both 16, of Troy, Mich. and Amr Mohamed, 18, of Alexandria, Egypt. The trio won a YouTube Space Lab competition, co-sponsored by YouTube, Lenovo, and Space Adventures, that sent their work into low-earth orbit for research. Over 150,000 YouTube users worldwide helped determine winners by voting for their favorite experiment.

Chen and Ma were interested in studying the growth of bacteria in space. Using different nutrients and compounds, the team wants to see if bacterial growth can be blocked, potentially leading to discoveries about inhibiting germ growth back on Earth.

This is the third of the JAXA's HTV spacecraft to travel to the International Space Station. The HTV is joined by the European Space Agency's ATV, Russia's Progress spacecraft and SpaceX's Dragon spacecraft in servicing the station. Photo Credit: JAXA

Mohammed decided to use zebra spiders to test potential changes for hunting style in space. The spiders normally jump on prey, a challenging task in microgravity. The young scientist wants to learn if the spiders will adapt their hunting behavior in a new environment.

Astronaut Sunita Williams, under direction from the students, will perform the experiments this fall. The cargo craft also carried food and clothing for the astronauts, an aquatic habitat experiment, a remote-controlled Earth-observation camera for environmental studies, a catalytic reactor for the station's water regeneration system and a Japanese cooling water recirculation pump.

The vehicle will remain at the station until September 6 when, like its predecessors, it will be detached from the Harmony node by Canadarm2 and released for a fiery re-entry over the Pacific Ocean.

Japan's Kounotori 3 Berths With International Space Station (ASIANSCI)

By Srinivas Laxman

Asian Scientist, July 30, 2012

Early on Saturday morning, the Japanese Aerospace Exploration Agency's (JAXA) unmanned cargo spacecraft, Kounotori 3, berthed at the International Space Station (ISS).

Kounotori 3 (or HTV-3), which means 'white stork' in Japanese, has a total cargo capacity of about 6,000 kg and is the second operational flight to the ISS.

The spacecraft was launched by JAXA's H-11B rocket on July 21 from the Tanegashima Space Center in Japan.

On Friday night, the spacecraft initiated its final approach towards the space station before being captured by the ISS's robotic arm.

After being maneuvered by the arm, Kounotori 3 was successfully berthed to the ISS during the early hours of Saturday. The process of transferring cargo from Kounotori to the ISS then began.

Kounotori 3 is expected to remain berthed to the ISS for about a month. It is also equipped with a system which will allow it to gather environmental data during its re-entry to earth.

"This success marks a notable milestone in this mission. We will continue to strive to ensure the transfer of supplies, departure from the ISS and re-entry into the atmosphere as planned," said JAXA president Keiji Tachikawa.

With the retirement of NASA's space shuttles, the remaining options for sending supplies to the space station are the Russian Soyuz, the European Space Agency's unmanned Automated Transfer Vehicle (ATV), and the Japanese HTVs (Kounotori).

The U.S. plans to engage private aerospace sector to operate to the space station, allowing NASA to focus on deep space exploration.

It may be recalled that on May 25 this year SpaceX's Dragon spacecraft successfully berthed at the space station. It was a historic event because it was the first time that a spacecraft belonging to a private company flew to the ISS.

Japanese HTV-3 Berthed To International Space Station (UNIVTDAY)

By Nancy Atkinson

Universe Today, July 30, 2012

The HTV-3 Japanese cargo spacecraft was successfully captured with the International Space Station's Canadarm 2 robotic arm, and then installed to a docking port. JAXA astronaut Aki Hoshide berthed the HTV supply ship, called Kounotori3, or "white stork," at 14:19 GMT (10:19 EDT) on July 27, 2012 to the Earth-facing side of the Harmony node on the ISS.

Above is a timelapse of the capture and berthing provided by SpaceVids.

Earlier, working from the robotic workstation inside the station's cupola, NASA Flight Engineer Joe Acaba, with the assistance of Hoshide, captured the 16.5-ton cargo ship with the station's Canadian Space Agency-provided robotic arm, and as the spacecraft flew within about 12 meters (40 feet) of the ISS.

The unmanned cargo ship is 10 meters (33 feet) long and 4 meters (13 feet) in diameter and is capable of delivering both internal and external supplies and hardware to the station.

The name Kounotori was chosen because the ship's arrival represents an important delivery. The space station crew later opened the hatches and began the process of removing about 3,175 kg (7,000 pounds) of supplies from inside the Kounotori3's Pressurized Logistics Carrier. That cargo includes food and clothing for the astronauts, an aquatic habitat experiment, a remote-controlled Earth-observation camera for environmental studies, a catalytic reactor for the station's water regeneration system and a Japanese cooling water recirculation pump.

Kounotori3's Unpressurized Logistics Carrier is carrying more than 1,000 pounds of cargo to be attached to an experiment platform at the end of the Kibo module on August 6.

Kounotori3 launched from the Tanegashima Space Center in southern Japan on July 21. It will stay attached to the ISS until September 6 when, like its predecessors, it will be detached from the Harmony node by Canadarm2 and released for a fiery re-entry over the Pacific Ocean. The outer hull of the spacecraft is fitted with monitors to provide data about its re-entry.

Next Space Station Crew To Try 'Fishy' Science (SPACE)

By Denise Chow

[SPACE.com](#), July 30, 2012

When the next Russian-built Soyuz capsule launches to the International Space Station in October, it will deliver three new crewmembers to the orbiting outpost. But the trio of spaceflyers will be sharing their ride with some special cargo: 32 small fish for a science experiment at the space lab.

NASA astronaut Kevin Ford and Russian cosmonauts Evgeny Tarelkin and Oleg Novitskiy are scheduled to launch to the International Space Station on Oct. 15 from the Baikonour Cosmodrome in Kazakhstan. Their Soyuz TMA-06M capsule will also be carrying 32 medaka fish — a type of fish native to Southeast Asia — to the orbiting complex.

"They'll be on our Soyuz with us — 32 fish, plus the three of us," Ford told reporters in a news briefing Thursday (July 26).

The medakas will become part of an experiment carried out on the station to investigate the effects of microgravity on fish. The astronauts aboard the outpost will monitor changes in the fish as they live in orbit. [7 Everyday Things that Happen Strangely In Space]

"When we come onboard, one of the first items will be to get these fish transferred and into their habitat and get the experiment underway," Ford explained.

The fish will stay in a special aquatic habitat that is being delivered to the space station by a robotic Japanese cargo freighter. The Japanese unmanned H-2 Transfer Vehicle-3, or HTV-3, launched into orbit on July 20, and arrived at the space station today (July 27).

Scientists are particularly interested in how the skeletal systems of fish change in the near weightless environment aboard the space station, said Julie Robinson, an International Space Station program scientist.

It has long been known that exposure to microgravity for extended periods of time can carry negative consequences, including loss of muscle and bone density. To prevent lasting harmful effects, space station astronauts adhere to rigorous exercise regimens, and doctors on the ground closely monitor their health.

But experiments such as the one with medaka fish do not hold potential benefits for only spaceflyers. The results of these types of studies can have far-reaching effects on Earth, too.

"It's an experiment, essentially, for osteoporosis," Ford explained.

The lessons learned from studying the skeletal systems of fish in space can inform scientists on the ground about how bones degrade over time here on Earth. This type of scientific research is part of what inspired the motto for this space station-bound crew: From the Earth, for the Earth.

"The idea is that the space station is up there for everybody, and even though it's essentially 15 countries that put [forward] their resources, it's really there for everybody on the planet."

But for Ford, Tarelkin and Novitskiy, the medaka fish will also be their companions for the thrilling journey to the International Space Station.

"I won't have my 'gone fishing' hat, though," Ford joked.

I, For One, Welcome Our New Fishy Overlords (DISC)

By Ian O'Neill

Discovery News, July 30, 2012

Yes, it's the moment we've all (secretly) been waiting for: Fish In Space!

But before you go getting too excited and start asking the big questions -- like: if there's a bubble in a microgravity aquarium, what happens if the fish falls into it? Let's ponder that for a minute... -- it's worth pointing out that the fish aren't actually in space right now (their habitat has just been delivered to the space station) and this fishy experiment isn't just to see how fish enjoy swimming upside down, there's some serious science behind it.

Like... to see how fish enjoy swimming upside down.

From the NASA news release:

While aquariums provide a relaxing pastime for humans on Earth, recreation is not the goal behind the new Aquatic Habitat, or AQH, aboard the International Space Station. Instead, researchers will use this unique facility to look at how microgravity impacts marine life.

The un-fished (as in, there's no fish in it, yet) AHQ arrived at the ISS today at 10:34 a.m. ET when the unmanned Japanese H-II Transfer Vehicle "Kounotori 3" berthed with the orbiting outpost. The HTV-3 is now attached to the station's Harmony module ready for the six astronauts on board to unload the supplies.

This isn't the first time marine habitats have been launched into space, although it is the first high-tech closed water circulatory system to be installed on the space station, courtesy of the Japanese space agency, JAXA. Marine habitats were flown on the shuttle missions STS-47, STS-65, and STS-90, and the AQH builds on experience with supporting fish life in low-Earth orbit. And as you might have guessed, this aquarium isn't in the same league as your household's algae-ridden goldfish bowl.

"In order to keep water quality in good condition for the health of the fish, we had to do many tests on the filtration system, especially the bacteria filter," said Nobuyoshi Fujimoto, associate senior engineer at JAXA's Space Environment Unitization Center. "The special bacteria filter purifies waste materials, such as ammonia, so that we can keep fish for up

to 90 days. This capability will make it possible for egg-to-egg breeding aboard station, which means up to three generations may be born in orbit. This would be a first for fish in space."

The habitat will automatically feed the fish, it has a high-tech air circulation system and climate control, plus a specimen sampling system. LEDs will simulate the day-night cycle and a webcam will provide a Big Brother-esque voyeuristic experience for scientists (and, presumably, the public) to keep an eye on the day-to-day activities of our fishy star trekkers.

To be honest, the technology behind the space marine habitat sounds more complex than the space station itself!

So, what victims species of fish will have the honor of living in such luxurious digs?

Small, transparent freshwater fish called Medaka (*Oryzias latipes*) will be the first species to move in after the aquarium is installed inside the Japanese Experiment Module Kibo. Researchers hope to study the genetic alterations that occur during long-duration spaceflight. As the equipment is set up to support multiple generations of Medaka, the impact of microgravity and space radiation can be observed.

As mankind looks to the stars in the hope of one day becoming a true spacefaring race, we need all the help we can get. Space isn't a nice place for our physiology -- muscle atrophy, bone wastage and other health issues associated with increased radiation exposure could cut our interplanetary dreams short. Also, as we live in an increasingly aging population, age-related health issues are becoming a huge concern. So studies such as these are imperative to help us find solutions to some of the most challenging biological problems not only in space, but it can be applied to everyday medical treatments.

Oh, and wondering how fish swim in microgravity will be fun to watch too -- but if the space spiders are anything to go by, the fish should adapt just fine. Shame about the butterflies, though.

The ISS Gets An Aquarium (GIZMAG)

By David Szondy

Gizmag, July 30, 2012

The International Space Station (ISS) is a little homier now thanks to its new aquarium. This addition isn't just intended to brighten up the lunch room - it's a serious piece of experimental hardware built by the Japanese Space Agency (JAXA) and delivered to the ISS on Friday, July 27, 2012 by the unmanned Japanese cargo ship, Kounotori3 (HTV3). The special aqueous habitat will be used to study the effects of the space environment on marine life.

The Aquatic Habit (AQH) is a high-tech aquarium designed to operate in zero gravity. It requires a minimum of maintenance by the crew (it even feeds the fish itself) and can eventually be used to house amphibians as well as fish. It's not the first such habitat in space. Earlier examples flew on space shuttle missions STS-47, STS-65 and STS-90. However, this is the first to be installed aboard a space station. Sitting in a standard payload rack in the Japanese Experiment Module (JEM), the AQH is sealed, self-contained unit with a closed-water circulatory system.

The AQH is actually made up of two chambers for habitation that measure 15 cm x 7 cm x 7 cm (5.9 x 2.8 x 2.8 inches) and holds approximately 700 cc (23.6 oz) of water. Learning lessons from previous versions, the AQH has a more advanced life support system that not only circulates water, but constantly monitors conditions in the habitat. Waste is automatically removed, pressure levels and oxygen levels maintained and temperature regulated.

"In order to keep water quality in good condition for the health of the fish, we had to do many tests on the filtration system, especially the bacteria filter," said Nobuyoshi Fujimoto, associate senior engineer at JAXA's Space Environment Unitization Center. "The special bacteria filter purifies waste materials, such as ammonia, so that we can keep fish for up

to 90 days. This capability will make it possible for egg-to-egg breeding aboard station, which means up to three generations may be born in orbit. This would be a first for fish in space."

The astronauts don't even need to feed the fish the occasional ant's egg. An automatic system handles that as well. It's LED lights are programmed to simulate night and day conditions and there is a specimen removal mechanism. Two video cameras in the unit allow the fish to be monitored from the Earth.

One particularly notable innovation is the "air-water interface." This is made up of small plastic plates in the top of the tanks that use a grid to trap bubbles of air. If the AQH is successful, this will allow amphibians to fly on future missions.

On this mission, fish are the center of attention. Along with the AQH, there were a number of freshwater Medaka fish (*Oryzias latipes*) that traveled to the station in a special container. Medaka fish are a small fish commonly found in rice paddies in Asia and are regarded as ideal specimens for study. They and their eggs are transparent, which makes it easy to study their insides, they have a very fast breeding cycle, will breed in zero gravity and their genome has already been mapped, so studies of genetic changes due to radiation can be done easily.

The 90 day study will focus on the effects of radiation on bone degradation and genes, muscle atrophy and developmental biology - some of which may lead to better understandings of human health issues.

"We think studies on bone degradation mechanisms and muscle atrophy mechanisms are applicable to human health problems, especially for the aging society," said Fujimoto.

Russian Unmanned Spacecraft Docks On Second Try (REU)

By Alissa De Carbonnel

Reuters, July 30, 2012

Full-text stories from Reuters currently cannot be included in this document. You may, however, click the link above to access the story.

Progress M-15M Re-docks To ISS Following Resolution Of Kurs-NA Failure (NASASF)

By Pete Harding

NASASpaceFlight.com, July 30, 2012

Russia's Progress M-15M spacecraft, designated by NASA as 47P, has successfully re-docked to the International Space Station (ISS) for the second time, following its undocking one week ago. The re-docking results in the successful demonstration of the new Kurs-NA automatic rendezvous system, to be used on future Progress and Soyuz spacecraft.

Kurs-NA tests:

Progress M-15M/47P launched to the ISS on April 20, with a docking to the ISS at the Docking Compartment-1 (DC-1) "Pirs" port coming two days later on April 22.

After spending three months docked to the ISS, during which time the Progress was emptied of cargo and filled with trash, Progress M-15M undocked from the ISS last Sunday (22 July) in order to conduct a test of a new Kurs system.

Kurs is the system used by Progresses for automated rendezvous and docking with the ISS, with the current version of the well-proven system being Kurs-A. However, in addition to its Kurs-A antennas, Progress M-15M was also fitted with a new antenna system known as Kurs-NA.

While the original Progress M-15M docking to the ISS on April 22 used the traditional Kurs-A, in order to ensure that the Progress' cargo would not be wasted should the new Kurs-NA system fail, the second docking of Progress M-15M was conducted for the purposes of testing the brand new Kurs-NA system, with the consequences of failure reduced due to the Progress having already offloaded all of its cargo to the ISS.

Kurs-NA uses less power than Kurs-A, and also replaces the function of five existing Kurs-A antennas into one antenna, thus allowing for the removal of four antennas from future Progress and Soyuz spacecraft, which will reduce the risk of a docking failure as the four antennas in question, which are deployed post-launch but retracted prior to docking since they extend forward of the Progress docking interface, will no longer be present.

Progress M-15M re-docking following Kurs-NA failure resolution:

While the original plan for the Kurs-NA tests was for Progress M-15M re-dock to the ISS roughly one day after its undocking, this plan was scuppered by the failure of the new Kurs-NA shortly after it was activated during the Progress' first re-rendezvous attempt last Monday (23 July).

Although the re-rendezvous had already been initiated at the time of the Kurs-NA failure, the ISS was never in any danger, since the failure occurred when the Progress was still 161km away from the ISS, and the Progress was safely sent into a passive abort in a retrograde motion from the ISS.

The Russian flight control teams decided to wait until after the berthing of Japan's HTV-3 spacecraft to the ISS on 27 July before re-attempting the re-docking, which gave the ground teams time to troubleshoot the Kurs-NA issue.

After numerous unsuccessful attempts to activate the problematic Kurs-NA, Russian engineers eventually discovered that the problem was caused by lower than expected temperatures on Progress M-15M. In an attempt to resolve the issue, engineers turned on all available heaters on Progress M-15M, which kept Progress M-15M at a constant 22 degrees, which in turn resulted in Kurs-NA activating successfully, paving the way for tonight's docking.

Recent ISS Articles: <http://www.nasaspaceflight.com/tag/iss/>

With the activated Kurs-NA successfully locking on to the passive Kurs (Kurs-P) on the ISS, the re-rendezvous, fly-around and docking to the ISS at the DC-1 port under the new Kurs-NA system successfully occurred at around 9:00 PM EDT 28 July/1:00 AM GMT 29 July.

Experienced Russian cosmonauts Gennady Padalka and Yuri Malenchanko aboard the ISS were however ready at all times to take over from the automated Kurs-NA via the TORU manual control system, should it have been needed.

Progress M-15M future activity:

Following Progress M-15M's docking, the hatches between the ISS and Progress will be opened, and the Kurs-NA electronics box inside the Progress will be removed by the ISS crew, so that it can be returned to Earth, likely inside a SpaceX Dragon capsule, so that Russian engineers can analyse why the temperature issue affected the Kurs-NA system.

The data will aid in the eventual transition to Kurs-NA for all Progress and Soyuz spacecraft, targeted for around 2014.

Once the hatches are re-closed, Progress M-15M will undock from the ISS for the final time on 30 July in order to make way for the arrival of the Progress M-16M/48P spacecraft, which will both launch to the ISS and dock just six hours later on August 1, in a test of a new fast-rendezvous profile for Progress and eventually Soyuz spacecraft. (The Progress M-16M fast rendezvous will be covered in a future article on NASASpaceflight.com.)

Following undocking, Progress M-15M will conduct two experiments – Khlopushka, from August 6-14, and Radar-Progress, from August 15-20, following which Progress M-15M will de-orbit for a destructive re-entry over the Pacific Ocean.

Russian Cargo Ship Redocks With Space Station After First Attempt Failed (AP)

Associated Press, July 28, 2012

An unmanned Russian cargo spacecraft has redocked with the International Space Station after an aborted attempt five days earlier.

The Progress cargo ship had separated from the station a week ago to perform engineering tests and try out a new docking system and had been due to reconnect with the station on Tuesday. But problems developed with the avionics in the docking system.

The second attempt early Sunday was successful. Video streamed from Russian mission control reported no problems.

The Progress already had delivered its cargo, and was being kept at the station to load garbage. When full, it will be released and burn up upon re-entry into the Earth's atmosphere.

The docking system is to be removed from the Progress and sent to Earth for examination and refinement.

NASA: Second Time's A Charm For Russian Cargo Ship (CAPCOL)

By Stacey Pounsberry

Capitol Column, July 30, 2012

Russian cargo craft ISS Progress 47 successfully docked at the International Space Station's Pirs docking compartment Saturday after what NASA said was "a successful test of its new automated rendezvous system." For those who are interested in the mechanics of the process, videos of the docking and undocking of the Progress 47 are available online, courtesy of the U.S. space agency.

The ISS Progress 47's first attempt at docking with the ISS was unsuccessful. The cargo ship was suppose to dock at a docking port on the ISS's Russian segment Monday.

"The test was proceeding normally until about the time that the new Kurs-NA rendezvous system was to be engaged," NASA officials said in a statement. "As commands were being issued to activate the Kurs system, a failure was annunciated, triggering a passive abort."

According to NASA, Russian flight controllers released the resupply ship Sunday, July 22nd "to test an updated automated docking system, known as Kurs-NA, which is expected to be used for both Progress and piloted Soyuz spacecraft in the future." The new Kurs-NA system "uses a single antenna, which will allow four others to be removed." NASA says that's "half as many as the current versions." In addition to the streamlined antenna usage, "Kurs-NA will use less power and improve safety," making the upgrade both efficient and necessary.

ISS Progress 47 brought essential supplies to the crew of the ISS, carrying "up to 1,700 kilograms (3,748 pound) of supplies to the Space Station in a pressurized volume of about 6 cubic meters (212 cubic feet)," economizing weight and cargo space. An additional perk for the ISS, the Progress can also "raise the Station's altitude and control the orientation of the Station using the vehicle's thrusters."

Although the Progress Cargo Module is very similar to the Soyuz Orbital Module in design, there are also many differences. NASA says, "The Progress resupply vehicle is an automated, unpiloted version of the Soyuz spacecraft that is used to bring supplies and fuel to the [ISS]." One of the primary differences between the Soyuz Orbital Module and the Progress is the refueling or cargo bay used in place of the descent module, which is typically used to transport crewmembers aboard the piloted Soyuz. Similarities and differences aside, the next supply vehicle and crew module will use the new system to deliver its payload to the Space Station the next time it's needed.

NASA says once the supply vehicle is filled with trash, it's sent "into the Earth's atmosphere, where it will burn up on re-entry over the Pacific Ocean." The ISS plans on releasing the vehicle for what NASA calls "its final departure from the orbital complex" Monday, carrying up to "1,000 to 1,700 kilograms (2,205 to 3,748 pounds) of trash."

Russian Cargo Spacecraft Docks With Space Station On 2nd Try (SPACE)

SPACE.com, July 30, 2012

An unmanned Russian cargo ship parked itself at the International Space Station tonight (July 28), in a second attempt to test an updated space docking system, NASA says.

The robotic Russian Progress 47 spacecraft re-docked to the space station to test the new Kurs-NA docking system. The cargo ship safely approached the station and automatically attached itself to the Pirs docking compartment on the Russian segment of the massive orbiting laboratory at 9:01 p.m. EDT (0101 GMT July 29). Russia intends to use the Kurs-NA docking system on future unmanned Progress spacecraft and manned Soyuz vehicles.

The Progress' safe docking followed a failed first attempt four days ago, on July 23, which was aborted after a technical glitch prevented the spacecraft from reaching the orbiting outpost. After that attempt, the Progress 47's onboard computers kept the craft a safe distance away from the station while Russian engineers analyzed the failure.

Today's successful maneuver was a key demonstration of the new Kurs-NA docking system, which is an updated version of the Kurs system that has been integrated into Russian spacecraft for years. Engineers made several upgrades to the newer version, including better electronics that are expected to use less power and improve safety.

As part of the test, the robotic Progress 47 spacecraft approached the station to within about 29 miles (46 kilometers). At this range, the Kurs-NA system was activated, and the cargo ship carefully attached itself to the space station. [Infographic: How Russia's Progress Spaceships Work]

The Progress 47 docking test occurred a day after a different unmanned cargo freighter arrived at the space station. The Japanese H-II Transfer Vehicle-3, or HTV-3, was safely attached to the orbiting outpost Friday morning (July 27). The spacecraft is packed with fresh supplies, food and science experiments for the station.

The Progress 47 arrived at the space station in April to deliver clothing, food and other supplies to the astronauts living aboard the space lab. The cargo ship had been attached to the Pirs docking compartment since it first reached the station and completed its prime mission, but was purposefully undocked on July 22 to prepare for the Kurs-NA trial run.

After unloading all the cargo inside the Progress 47, the station crew re-loaded the spacecraft with trash and other unwanted items. Russia's disposable Progress vehicles are intentionally sent to burn up during re-entry into Earth's atmosphere at the end of their missions.

The Progress 47 cargo ship is scheduled to make its final departure from the space station on July 30 at 2:11 p.m. EDT (1811 GMT).

The space station's Expedition 32 crew, led by Russian cosmonaut and station commander Gennady Padalka, monitored today's docking test. There are currently six astronauts living at the orbiting complex, including Padalka, Russian cosmonauts Sergei Revin and Yuri Malenchenko, NASA astronauts Sunita Williams and Joe Acaba, and Japanese astronaut Akihiko Hoshide.

The next Russian cargo ship, Progress 48, is slated to launch on Aug. 1 from the Baikonur Cosmodrome in Kazakhstan.

Progress M-15M Space Freighter Re-Docks With Space Station (RIAN)

RIA Novosti, July 30, 2012

A second attempt to re-dock the Russian Progress M-15M resupply spacecraft to the International Space Station (ISS) with the help of a new rendezvous system has been a success, a spokesman for the Russian Mission Control Center said on Sunday.

"The re-docking took place in a normal mode at the estimated time," a Mission Control spokesman told RIA Novosti.

The unmanned space freighter, which had arrived at the ISS in April, undocked from the station early on Monday in order to perform a series of engineering tests during re-docking designed to verify the Kurs-NA automated rendezvous system.

The vehicle initially separated to a distance of about 100 miles from the station and held position for 24 hours before Tuesday's failed attempt to re-dock with the space station due to an apparent failure in the Kurs-NA sensors.

The failure triggered a passive abort - a standard procedure that took the Progress spacecraft to a safe distance of about 1.8 miles below the space station.

Second Time A Charm: Progress Spaceship Re-docks ISS (RTNET)

RT (RUS), July 30, 2012

The Russian freighter spacecraft Progress has successfully docked the International Space Station using a new digital automatic docking system. Last week an attempt to perform the maneuver failed.

The Progress M-15M engaged ISS's Pirs module around 01:00 GMT on Sunday. The docking was controlled by the Kurs-NA system, an upgraded version of the older automatic docking system, which is currently used on the Russian Progress and Soyuz vehicles.

The new version had most of its analogue signal processing circuits replaced with more accurate, robust and light digital ones. It also has a smaller external antenna, which needs not to be tilted back just before the docking locks are engaged, as is the case with the current system.

Russian members of the ISS crew had to adjust their timetable to monitor the maneuver from the space station. Their Sunday sleeping time was broken into two periods for the sake of the night docking.

The previous attempt to test the new Kurs on July 24 failed. The spacecraft, which earlier delivered fresh supplies into orbit, undocked the ISS, got into a position at a distance of some 161 kilometers from it and began re-docking. But when the Progress was just 15 kilometers from its target, the system ordered that the maneuver be aborted.

Engineers managed to track down the problem to a proximity sensor fault, head of the Russian ISS mission control Vladimir Solovyev told the media on Tuesday.

"We've been testing Kurs-NA hardware. We had to work on software too," he said.

"We failed with the first attempt. Then we calculated everything, did some simulations on the ground. Now we've done it," he added.

The Progress will remain docked for at least one more day. Then it will remain in orbit until mid-August to carry out a scientific experiment. Afterwards the spacecraft will be de-orbited over the Pacific Ocean.

Progress Spacecraft Docks With ISS (ITARTASS)

ITAR-TASS News Agency, July 30, 2012

The Russian spacecraft Progress on Sunday docked with the International Space Station in the second attempt.

Progress M-15M docked to the Pirs module at 05:00 Moscow time, a source at the Mission Control Centre based near Moscow told Itar-Tass.

Russian Cargo Spacecraft Re-docks With ISS (XIN)

Xinhua, July 30, 2012

The Russian cargo ship Progress has successfully re-docked with the International Space Station (ISS) early Sunday, after the failed attempt five days ago.

The unmanned Progress M-15M, which arrived at the ISS in April, undocked from the station early Monday morning to conduct engineering tests and try out the upgraded Kurs-NA rendezvous system.

But the first re-docking attempt failed due to certain problems in the freighter's new Kurs-NA rendezvous system, said Russia's Mission Control Center (MCC) on Tuesday.

No problems were reported about Sunday's second attempt in the video streamed from Russian mission control.

Progress freighters have been the backbone of the Russian space cargo fleet for decades. Russia lost a Progress cargo ship in 2011 for the first time in 30 years.

Progress Supply Ship Re-docks To ISS After Abort (UNIVTDAY)

By Nancy Atkinson

Universe Today, July 30, 2012

A Russian Progress supply ship has been successfully re-docked to the International Space Station after an initial re-docking failed. The ship has been at the station since April and it was undocked on July 22 to perform a series of engineering tests during re-docking to make sure an upgraded automated rendezvous system was working. However, the new Kurs rendezvous system, Kurs-NA, failed and the re-docking was aborted. After directing the ship to move to a safe distance away from the ISS, engineers assessed the problems, and then successfully completed the re-docking on July 28.

Complicating the decision of when to try the re-docking again was the arrival of the Japanese HTV-3 supply ship, which arrived on July 27. Russian engineers decided to wait until after the HTV was successfully berthed using the station's Canadarm-2 before a second attempt with the Progress. All systems worked perfectly on the second try.

The Progress, which is loaded with trash and items no longer needed on the station, will undock for good on July 30 and will depart the vicinity of the station for several weeks of tests by ground controllers before being sent into a destructive reentry over the Pacific Ocean in late August.

Astronaut Will Spin Tunes From Space (MINNST)

Minneapolis Star Tribune, July 30, 2012

NASA astronaut Joe Acaba will host a two-hour special radio broadcast on the Internet radio station Third Rock Radio while aboard the International Space Station. "The Joe Show: New Rock from Space" will debut at 3 p.m. CDT on Aug. 3.

Acaba, a fan of classic rock, will discuss his experiences aboard the orbiting lab while presenting new rock to listeners around the world.

"I'm excited to be the first astronaut to DJ from space on Third Rock Radio," Acaba said. "From the recordings launched aboard the Voyager spacecraft to the wake-up songs on shuttle missions, NASA and music have a long history together."

To stream Third Rock Radio over the Internet, visit www.thirdrockradio.net or the NASA homepage at www.nasa.gov.

Third Rock Radio was created by NASA and others to help cultivate new interest in science, technology, engineering and mathematics among hard-to-reach young Americans. 'Thrones' gets critics' nod

Florida's Space Coast Seeks To Reinvent Itself (CNN)

By John Couwels

CNN, July 30, 2012

As John Bundy loads his red commercial lawn mower into a flatbed trailer, it's hard to believe he used to manage a team of NASA shuttle workers.

Bundy, who sports a scruffy beard and speaks with a thick, Southern drawl, worked at the Kennedy Space Center for 31 years, the last six years as a manager in the Orbiter Processing Facility, a shuttle hangar.

Bundy is one of 8,000 shuttle workers laid off or facing termination from Florida's Kennedy Space Center after the end of NASA's shuttle program. This month marks one year since the program ended with the launch and landing of Shuttle Atlantis.

After his layoff in October 2010, Bundy searched for work for months before starting his own lawn business.

"I've tried a painting company, I've tried a couple of landscape companies, I've tried with the county as far as working outside with the parks and recs (recreations)," he said.

The shock of no longer working at Kennedy Space Center took months for Bundy to process.

Shuttle layoffs leave some workers adrift

"There is life after KSC, I promise you it will go on. You just got to get up and go to work," he said.

Brevard County, home of Kennedy Space Center, saw unemployment spike to more than 11% after the shuttle layoffs, according to Judy Blanchard with Brevard Workforce. In addition to the 7,400 shuttle workers already laid off, another 600 will be terminated by December, she said.

Today, most of Florida's former shuttle workers have found work, according to a recent survey conducted by Brevard Workforce, which receives state and federal funding to help these highly skilled workers find jobs.

Of the 5,690 former shuttle workers who responded to the survey, 57% said they are working, while the remaining 43% are either retired or unemployed. Of the 3,234 who said they have found employment, most of them, 72%, say they are working in Florida.

Florida authorities say they've made steps toward transforming the Space Coast into more than just a launch site for shuttles. That, according to the state's Space Coast Economic Development Commission, has helped "put a serious dent" in Brevard County's unemployment rate, which is 9%.

For years, the Space Coast Economic Development Commission in connection with Space Florida, the state's economic development agency, has worked to attract a more diverse aerospace industry that includes design and manufacturing.

In the past, rockets launched from Kennedy Space Center were designed, tested and built outside Florida.

"We were a launch site - which was important and that was a great legacy - but now we could be more," said Dina Reider-Hicks, a director with the Space Coast Economic Development Commission. "In maybe three years, you'll see this place stronger because it'll be diversified."

Today, several companies have committed to expand or begin operations in Brevard County, including Rocket Crafters, which is relocating its headquarters from Utah to Titusville, electronics systems provider Sierra Nevada Corporation and aircraft manufacturers Boeing and Embraer.

Video: Boeing to use KSC to build commercial spacecraft

But hundreds of former Kennedy Space Center shuttle workers still looking for jobs can't wait for these companies to set up shop in Brevard. Their severances and unemployment benefits are coming to an end.

Many former Kennedy Space Center employees still looking for work can be found Friday mornings at St. Gabriel's Episcopal Church in Titusville. There, they share news about the latest companies hiring or good news about fellow members who found jobs. Several sport T-shirts commemorating the last shuttle, Atlantis, STS-135.

The Space Coast Technical Network started as a way to share the difficulties of being laid off, but today it has grown into a nonprofit corporation.

"Our job is to go out of business, essentially," said Kevin Harrington, a former shuttle manager and the group's acting spokesman. He said the network hopes "to find everyone employment or entrepreneurial opportunities."

Although he has a thriving lawn business, John Bundy stops by the network's Friday morning meetings to catch up with his former co-workers and find out if any companies are hiring.

Bundy says he's hopeful he can return to the aerospace industry one day.

He believes another human space program will once again launch from Florida's Space Coast. He says the United States has the technical know-how to lead a human space program, but right now there's no political will to make it happen.

On Fridays, Bundy cuts grass at property across the Indian River from the Kennedy Space Center where the large Vehicle Assembly Building can be seen on the horizon, next door to his former office.

Bundy has no regrets and is thankful he is one of those who has a job and can pay his bills.

"Any time you're going to do a job that you're going to get paid for, it's honorable," he said. "You do the best job that you can ... it can be anything from washing dishes to processing space ships."

How NASA Launched The 2012 Olympics 12 Years Ago: A Pin Payload's Story (COLSPACE)

By Robert Pearlman

[collectSPACE](#), July 30, 2012

The Olympics officially launch today (July 27) in London, but it was a NASA mission from 12 years ago that first lifted off to space with 2012 Summer Games' memorabilia.

Space shuttle Atlantis blasted off on May 19, 2000, on a 10-day mission to the International Space Station. Aboard the orbiter were supplies for the nascent complex, which at the time comprised just two of its eventual 12 modules.

The STS-101 mission came a few months before the start of the 2000 Summer Olympics held in Sydney, Australia. To pay tribute to the international nature of the Games, the shuttle's crewmates carried a banner for the Olympics and a replica of the 2000 Sydney Torch.

But the flag and flameless beacon weren't the only items commemorating the Olympics that were on board Atlantis. Stowed inside a locker was a small package of souvenirs for the Summer Games set to take place 12 years into the future — though not in London.

Houston, (can) we have an Olympics

Every NASA space shuttle mission carried a small pouch of souvenirs, called the Official Flight Kit, or OFK, packed with mementos to thank the NASA employees and outside organizations who helped make the mission possible.

The space agency would also sometimes use the OFK to fly items for outreach projects and for groups supporting the local communities around NASA centers, such as the Johnson Space Center in Houston, Texas.

As Atlantis orbited high above the Earth, Houston was in the running to be the U.S. Olympic Committee's bid city to host the 2012 Summer Olympics, competing against New York, San Francisco, and Washington, D.C.-Baltimore.

(Ultimately, the U.S. committee selected the Big Apple — Houston was eliminated in 2002 — but New York City lost out to London when the International Olympic Committee voted in 2005.)

NASA, in support of bringing the Olympics to Houston — home of Mission Control and the U.S. astronaut corps — launched aboard Atlantis 1,000 lapel pins for the Houston 2012 Foundation. The organization described its role as "to identify, package and communicate the reasons why Houston is the best place for the 2012 Olympic Games."

The lapel pins were the shape of the space shuttle orbiter with the foundation's stylized Texas flag torch logo at their center. Under the red, white and blue torch was inscribed, "Houston 2012."

After Atlantis returned to Earth, the pins, which circled the planet 155 times and traveled 4.1 million miles (7.6 million kilometers) were returned to the Houston 2012 Foundation for distribution to its members and supporters.

Many, if not all, of the well-traveled pins were embedded inside acrylic with the inscription, "Flown on NASA Space Shuttle Atlantis, STS 101, May 2000."

Back to the future

In the dozen years that have gone by since the "Houston 2012" pins flew in space, at least a dozen of the pins have appeared at public auctions, where they've been sold into private Olympics and space memorabilia collections.

A recent example of the 3.25 by 2 by 1 inch (8.3 by 5 by 2.5 centimeters) acrylic-encased pin display sold on eBay for \$215 this past May.

With the London Games getting underway, collectors have commented how the flown pins may find renewed interest as an unusual memento from the 2012 Summer Olympics, especially as pin trading is an established tradition at each of the Games.

NASA Inks \$25.6 M Contract To Revitalize KSC Water Distribution (ORLBIZ)

By Megan Anderson

Orlando (FL) Business Journal, July 30, 2012

NASA has selected Zephyrhills-based RTD Construction Inc. to provide construction services to revitalize Kennedy Space Center's water distribution and waste water collection systems.

The maximum potential value for the two-year fixed price contract is \$25.6 million.

RTD Construction will replace more than 125,000 feet of water mains, valves, hydrants, fittings and connections as well as refurbish 33 sewer systems and replace more than 25,000 feet of sewer pipes.

Subcontractors included in the contract are Merritt Island-based MIL-CON Electric Co.; Cape Canaveral-based Santis Engineering; Lakeland-based Killebrew Inc; and Melbourne-based EE&G Construction & Electrical LLC.

SCIENCE

Giant Ice Avalanches Found On Saturn's Moon Iapetus (WIRED)

By Tanya Lewis

Wired, July 30, 2012

When planetary scientist Kelsi Singer studied images of Saturn's icy moon Iapetus, she found something unexpected: huge ice avalanches.

As far as moons go, Iapetus is as eccentric as they come. One half of the planet is light-colored and the other half is dark. It has 12-mile-high mountains — twice the height of Mount Everest. And a mountainous ridge bulges out at its equator, giving it the distinct appearance of a walnut.

The avalanches are "something we never expected to see on Iapetus," said Singer, a graduate student in earth and planetary sciences at Washington University in St. Louis and lead author of a paper published today in *Nature Geoscience*.

The prehistoric Blackhawk landslide fell from California's San Bernardino mountains and extends five miles into the Lucerne Valley. Image: Kerry Sieh / USGS

These icy landslides are similar to long-runout landslides on Earth known as sturzstroms (German for fallstreams), which can travel a distance equal to 20 to 30 times the height they fall from. Normal landslides typically only travel twice the height they fall from. The Iapetus landslides were probably triggered by objects impacting the moon's surface.

A famous example of a sturzstrom is the prehistoric Blackhawk landslide in southern California. This type of landslide can cover plains for tens of miles. "If you've got a house out in the plains, you kind of want to know that," said study co-author Paul Schenk, a planetary geologist at the Lunar and Planetary Institute in Houston.

Scientists don't agree on what mechanism allows them to travel so far, but there are several candidates including riding on a cushion of trapped air, sliding on groundwater or mud, sliding on ice, or slipping caused by strong acoustic vibrations. Singer suspects that on Iapetus, which lacks an atmosphere or groundwater, the landslides occur by frictional heating of the ice. "We're able to do an experiment that we can't do on Earth, because of the conditions," said Singer.

Singer's team analyzed images taken by NASA's Cassini spacecraft as it orbited Saturn in September 2007 and December 2004. By measuring the ratio of the landslide's vertical to horizontal motion, they estimated the friction involved. The height-to-length ratios suggested that friction was "flash heating" the ice until it was slippery enough to slide, without fully melting.

"Everyone knows that ice is slippery," Singer said, but "it's not settled scientifically exactly why." It could involve a phenomenon known as pre-melting, where only a thin layer of ice crystals melts. Because Iapetus is so cold, its ice acts much like rock does on Earth. So a similar flash heating mechanism might explain rocky landslides.

"This kind of landslide has been seen on every single body in the solar system," said geologist Jay Melosh of Purdue University, who was not involved in the study. Melosh favors the sound wave-induced model of long-runout landslides, but he called Singer's study "an important contribution to helping pin down the mechanism."

Saturn Moon Iapetus' Huge Landslides Stir Intrigue (BBC)

Saturn's moon Iapetus frequently plays host to a huge type of landslide or avalanche that is rare elsewhere in the Solar System, scientists report.

By Jason Palmer

BBC News, July 30, 2012

Sturzstroms or "long-runout landslides" move faster and farther than geological models predict they should.

They have been seen on Earth and Mars, but there is debate about their causes.

Now, images from the Cassini space mission, reported in *Nature Geoscience*, suggest that heating of icy surfaces helps the landslides keep going.

On Earth, landslides typically travel a horizontal distance that is less than twice the distance that the material has fallen.

Long-runout landslides, by contrast, can travel as much as 30 times the vertical falling distance.

A great many mechanisms have been proposed to explain this phenomenon, ranging from simple sliding on ice to the sound waves from the slide making rock and debris behave more like a fluid.

But there is little consensus on which of these theories, if any, is correct.

Now, Kelsi Singer of Washington University in St Louis, US, and colleagues report that the geography of Iapetus is a unique setting to test these theories.

"The landslides on Iapetus are a planet-scale experiment that we cannot do in a laboratory or observe on Earth," Ms Singer said.

"They give us examples of giant landslides in ice, instead of rock, with a different gravity, and no atmosphere. So any theory of long-runout landslides on Earth must also work for avalanches on Iapetus."

Iapetus is a geologically interesting place to look; it is a squashed sphere, fatter at its equator than its poles, and is mostly encircled by a ridge that reaches peaks some 20km high.

It also has a number of giant impact craters reaching depths of 25km.

The icy satellite has more giant landslides than any Solar System body other than Mars. The reason, says Prof William McKinnon, also from Washington University, is Iapetus' spectacular topography.

"Not only is the moon out-of-round, but the giant impact basins are very deep, and there's this great mountain ridge that's 20km (12 miles) high, far higher than Mount Everest," he explained.

"So there's a lot of topography and it's just sitting around, and then, from time to time, it gives way."

Ms Singer was looking for stress fractures in the moon's ice, but instead found evidence of 30 massive landslides - 17 along crater walls and 13 along the giant equatorial ridge.

Analysis of the images from these events suggests that the "coefficient of friction" - a measure of how much the slip-sliding of material in a landslide tends to slow it down - on Iapetus is far lower than expected for ice.

It appears that this faster-moving ice seen on Iapetus has a lower friction coefficient than that of slow-moving ice measured in Earth-bound laboratories.

The team suggests that the tiny contact points between bits of ice debris in such a landslide may heat up considerably, melting it and forming a more fluid - and thus less friction-limited - mass of material.

They suggest that physicists here on Earth test the idea in the laboratory, giving insight not only into what is happening on Iapetus, but closer to home as well.

Saturn Moon Gives Hope For Landslide Clues (SKY)

Sky News, July 30, 2012

Giant avalanches on an icy moon of Saturn may provide clues about devastating landslides on Earth, say scientists.

Thirty huge ice falls on Iapetus, a walnut-shaped moon girdled by steep 12-mile high mountains, were spotted in images from the American space agency Nasa's Cassini spacecraft.

In 17 cases, the avalanches plunged down crater walls while another 13 swept down the sides of the equatorial mountain range.

Scientists identified a strange feature of the avalanches. At high speeds, the falling ice began to behave like a liquid, travelling many miles before finally coming to rest.

Professor William McKinnon, from Washington University in St Louis, explained: "You might think friction is trivial, but it's not. An aerial view of the Bududa landslide that occurred in Uganda in June

"And that goes for friction between ices and friction between rocks. It's really important not just for landslides, but also for earthquakes and even for the stability of the land. And that's why these observations on an ice moon are interesting and thought-provoking."

Experts are still trying to explain a similar phenomenon seen in landslides and earthquakes on Earth.

"Long runout" rock landslides sometimes travel 20 or 30 times further than they fall, covering long distances horizontally or even surging uphill.

In the same way as the Iapetus avalanches, they appear to spill like a fluid rather than tumble.

Laboratory tests suggest that "flash heating" caused by friction may make rocks, or cold ice, slippery. Very cold ice, as occurs on Iapetus, behaves like beach sand.

The research is published in the journal *Nature Geoscience*.

Giant Avalanches On Saturn's Moon Could Be Behind Landslides On Earth (DAYMAIL)

By Anthony Bond

[Daily Mail \(UK\)](#), July 30, 2012

Giant avalanches on the Solar System's most spectacular mountain range could explain landslides on Earth, it has emerged.

Researchers have analysed the dimensions of landslides on the surface of Saturn's moon Iapetus, using images from the Cassini mission, and found many up to fifty miles in length.

They now believe that understanding the cause of long landslides on Iapetus could aid in the understanding of unusually long landslides on Earth, which are potentially destructive natural hazards.

The giant ridge on Saturn's moon Iapetus was only discovered in 2004 by NASA's Cassini spacecraft. The mysterious icy rim that circles the equator of the planet is more than 12 miles high and runs almost a thousand miles from end to end.

According to their calculations, these travel farther than expected under normal frictional conditions.

When the rimwall of Iapetus' Malun crater broke off and plunged more than five miles to the floor, it surged an astonishing 22 miles out from the base before finally coming to rest.

The researchers, whose findings are published online in *Nature Geoscience*, believe the sliding of material heats the underlying icy surface.

This renders the ground temporarily slippery and allows the landslide to travel an unusually long distance.

It is believed the Iapetus ridge, one of the most amazing features discovered in the Solar System, is the remains of a huge ring of debris that once orbited Iapetus but which eventually fell on to the moon.

Anyone standing at the base would be confronted with a mountain of ice higher than the biggest mountain on Earth and nearly as tall as Olympus Mons on Mars, the biggest volcano in the Solar System.

And it runs ram-rod straight off in either direction so they would not see it end, just the ridge disappearing over the horizon.

Most landslides travel a horizontal distance that is less than twice the distance they have fallen. Long-runout landslides, however, can travel many times as far as they fall.

These events, which are set apart also by the unusually large mass of rock involved, can bring tragedy to entire villages or towns.

Planetary scientist Kelsi Singer, of Washington University, Saint Louis, said Iapetus' 'extremely cold, airless surface provides an excellent laboratory for studying long-runout landslides'.

She said: 'We see landslides everywhere in the solar system, but Saturn's icy moon Iapetus has more giant landslides than anybody other than Mars.'

Professor William McKinnon, her supervisor, said the reason is Iapetus' spectacular topography.

He said: 'Not only is the moon out-of-round, but the giant impact basins are very deep, and there is this great mountain ridge that is 20 kilometres (12 miles) high, far higher than Mount Everest.

'So there is a lot of topography and it is just sitting around, and then, from time to time, it gives way.'

Landslides or avalanches on some scale are widespread in the Solar System but large mass movements are far less common.

Ms Singer, a PhD student, added: 'The landslides on Iapetus are a planet-scale experiment that we cannot do in a laboratory or observe on Earth.

'They give us examples of giant landslides in ice, instead of rock, with a different gravity, and no atmosphere. So any theory of long runout landslides on Earth must also work for avalanches on Iapetus.

'We show here that Iapetus is also unusual in terms of the number and runout lengths of large landslides.

'These landslides naturally provide information about the degradation processes and mechanical properties of Iapetus's surface, but more importantly, quantitatively expand the data set on long-runout landslides in the Solar System to the icy satellites.

'This leads to a testable hypothesis for the mobility of long-runout landslides on icy bodies, with broader implications for ice tectonics and avalanche mobility in general.'

One of the worst such landslides happened in 1903 when the mining town of Frank in southern Alberta, Canada, was wiped out without warning.

As the 600 residents slept, an enormous chunk of limestone fell suddenly from the top of nearby Turtle Mountain. It raced across the valley below, killing at least seventy people.

Gamma-Ray Glow Hints At Dark Matter In The Center Of Our Galaxy (SCINOW)

By Adrian Cho

ScienceNOW, July 30, 2012

The coming decade will be the decade of dark matter, some scientists say, as efforts to detect the mysterious stuff will either pay off or rule out the most promising hypothesis about what it is. But astronomers may have already detected signs of dark matter in the heart of our own Milky Way galaxy, a pair of astrophysicists now says.

Data from NASA's space-borne Fermi Gamma-ray Space Telescope reveal an excess of gamma-rays coming from the galactic center that could be produced as particles of dark matter annihilate one another, Kevork Abazajian and Manoj Kaplinghat of the University of California, Irvine, report in a paper posted to the arXiv preprint server. "There's definitely some source there, and it fits with the dark matter interpretation," Abazajian says. But other researchers say the excess could be an artifact of the way Abazajian and Kaplinghat model the gamma-ray flux, or it could originate from more-mundane sources.

Astronomers have ample evidence that dark matter provides most of the gravity that keeps stars from flying out of the galaxies. And cosmologists have shown that it makes up 85% of all matter in the universe. But physicists don't know what dark matter is.

The leading hypothesis is that dark matter could be made up of weakly interacting massive particles, or WIMPs, which are predicted by some theories. WIMPs would be massive enough to produce lots of gravity but would otherwise interact with ordinary matter only very weakly. Each galaxy would form within a vast cloud of WIMPs.

Physicists are searching for WIMPs in several ways. Some are trying to spot them using exquisitely sensitive underground detectors. Others hope to produce WIMPs at the world's largest atom smasher, the Large Hadron Collider in Switzerland. WIMPs might also annihilate one another when they collide to produce ordinary particles such as gamma rays, and astrophysicists are combing the heavens for signs of such annihilations.

Abazajian and Kaplinghat say that the more than 400 researchers working with the Fermi satellite may have already found that evidence. The two theorists analyzed data collected between August 2008 to June 2012, focusing on a 7-degree-by-7-degree patch of sky around the galactic center. For each of four energy ranges, they mapped the emission across the sky. They fit each map with a "baseline model" that included 17 point-like sources of gamma rays that Fermi had already found in that area, a "diffuse" background that accounts for the general emission from the galactic center, and a spatially uniform background.

They then fit the data with another model that included a contribution from dark matter annihilations, including theoretical estimates of the dark matter's distribution and how the particle annihilations produce gamma rays. Adding the dark matter annihilations greatly improved the fit, they found, suggesting that there is an excess of gamma rays that come from dark matter.

Other researchers, including Daniel Hooper of Fermi National Accelerator Laboratory in Batavia, Illinois, have made similar claims. In fact, Abazajian had previously argued against that interpretation. But the new analysis shows that the dark-matter hypothesis fits the data in three key ways, Abazajian says: It has the right energy distribution, the right spatial distribution, and the right intensity. "When I saw that I was like, 'Holy cow!'" he says. Abazajian cautions, however, that the gamma rays could emanate from a less exotic source, such as previously undetected pulsars.

They might also be explained in an even easier way, says Stefano Profumo, a theoretical astrophysicist at the University of California, Santa Cruz, and a member of the Fermi-satellite team. Abazajian and Hooper's analyses depend critically on the model of the diffuse galactic background, Profumo says. That model had been derived to describe a much bigger area around the galactic center, he says, and is "completely blind to the details at the galactic center." So its use the fits to the data could produce misleading results, he cautions. Still, Profumo agrees that the galactic center is a prime place to look for evidence of dark matter.

Moon Formation: Was It A 'Hit And Run' Accident? (BBC)

Scientists have proposed a fresh idea in the long-running debate about how the Moon was formed.

BBC News, July 27, 2012

What is certain is that some sort of impact from another body freed material from the young Earth and the resulting debris coalesced into today's Moon.

But the exact details of the impactor's size and speed have remained debatable.

In a report online to be published in *Icarus*, researchers suggest that the crash happened with a much larger, faster body than previously thought.

Such theories need to line up with what we know about the Moon, about the violent processes that set off the creation of moons, and what computer simulations show about the more sedate gravitational "gathering-up" that finishes the job.

In recent years, scientists' best guess for how the Moon formed has been that a relatively slowly moving, Mars-sized body called Theia crashed into the very young Earth.

That would have heated both of them up and released a vast cloud of molten material, much of which cooled and clumped together to give rise to the Moon.

That would suggest that the Moon is made up of material from both the early Earth and from Theia, which should be somewhat different from one another. Impact factor

What complicates that story is a number of observations of "isotopic compositions" - the ratios of naturally-occurring variants of some atoms - taken from the Earth and from lunar samples.

The mix of similar and different "isotope ratios" confounds the issue

While the Moon has an iron core like Earth, it does not have the same fraction of iron - and computer models supporting the Theia impact idea show just the same thing.

However, the ratio of the Earth's and the Moon's oxygen isotopes is nearly identical, and not all scientists agree on how that may have come about.

Confounding the issue further, scientists reporting in Nature Geoscience in March said that a fresh analysis of lunar samples taken by the Apollo missions showed that the Moon and the Earth shared an uncannily similar isotope ratio of the metal titanium.

That, they said, gave weight to the idea that the Moon was somehow cleaved from the Earth itself.

Now, Andreas Reufer, of the Center for Space and Habitability in Bern, Switzerland, and colleagues have run computer simulations that suggest another possibility: that a far larger and faster-moving body made an even more glancing blow with the young Earth.

They said this body would have lost only a small amount of material and most of it would have continued on after the "hit-and-run".

That results in a much hotter disc of debris from the collision, but matches up with what would be needed to make a Moon-sized body.

The authors suggest that since most of what became the Moon would have been liberated by the impact from the Earth, similarities between the isotope fractions should be more pronounced.

More analyses of different elements within lunar samples - and a great deal more computer simulations that result in a Moon like our own - will be needed to settle the debate.

NASA X-Ray Mirror Idea Inspired By Scotch Tape (No, Really!) (SPACE)

SPACE.com, July 30, 2012

Scotch tape, that transparent, sticky hero of offices everywhere, could be a NASA superstar as well.

The rolled-up adhesive tape is the inspiration behind a novel idea for a completely new kind of X-ray mirror for big telescopes in space. The concept, dreamed up by NASA scientist Maxim Markevitch, is this: Instead of building an expensive telescope mirror to capture high-energy "hard" X-rays in space, why not create a mirror from tightly rolled plastic tape at a much lower cost?

"I remember looking at a roll of Scotch tape and thinking, 'Was it possible to use the same design for capturing hard X-rays?'" Markevitch explained in a NASA statement. "I talked with a few people, and to my surprise, they didn't see any principal reasons why it couldn't be done."

Markevitch and a team of other X-ray space optics experts at NASA's Goddard Space Flight Center in Greenbelt, Md., have begun testing materials that could be used to build a rolled mirror sensitive enough to collect hard X-rays from deep space. [Giant Space Telescopes of the Future (Infographic)]

Capturing 'hard' X-rays

Several space telescopes already scan the heavens for X-rays today, including NASA's Chandra X-ray Observatory and black hole-hunting NuSTAR instrument, as well as Japan's New X-ray Telescope (which is also known as Astro-H).

But Chandra is sensitive to lower-energy "soft" X-rays, and NuSTAR and Astro-H have limited collecting areas that allow them to only "graze the surface" of possible discoveries in the hard X-ray realm, Markevitch said.

To really do the job, scientists need an imaging X-ray telescope with a collecting area perhaps 30 times larger than that of NuSTAR, he added. If such a telescope could be built, it could study galactic cosmic rays, super-fast subatomic particles generated in deep space.

Scientists believe cosmic rays and the magnetic fields between galaxy clusters can alter the physics within clusters. A better understanding of these physics could reveal more about the birth and evolution of the universe, Markevitch said.

But a telescope capable of making such finds using current technology — which would require building a large number of individual mirror segments, coating them with reflective material and then nesting them precisely inside an optical assembly — doesn't appear to be coming along anytime soon.

"However, to our knowledge, nothing of the kind is planned or even proposed in the U.S. or elsewhere because of the cost something like this presents," Markevitch said.

Just a concept — for now

Markevitch and his team hope a new way of thinking could help push such a project along.

Their idea calls for coating plastic tape on one side with multiple layers of reflective material, then winding the tape into a roll to form a large number of densely packed nested shells. This process could theoretically create a mirror with a huge collecting area, Markevitch said.

While the team is currently testing candidate materials, the idea is still a long way from getting off the ground.

"Maxim's Scotch tape idea is in an early stage," said team member Will Zhang, also of NASA Goddard. "In the next year, we will know whether it has a chance of working."

If the tape does indeed work, it could be "game-changing for hard X-ray astronomy," Markevitch said. "It could significantly reduce the cost of building large mirrors, bringing within reach the possibility of building a mirror with 10 to 30 times greater effective area than current X-ray telescopes."

Enceladus: Home Of Alien Lifeforms? (GUARD)

By Robin McKie

The Guardian (UK), July 30, 2012

Enceladus is little bigger than a lump of rock and has appeared, until recently, as a mere pinprick of light in astronomers' telescopes. Yet Saturn's tiny moon has suddenly become a major attraction for scientists. Many now believe it offers the best hope we have of discovering life on another world inside our solar system.

The idea that a moon a mere 310 miles in diameter, orbiting in deep, cold space, 1bn miles from the sun, could provide a home for alien lifeforms may seem extraordinary. Nevertheless, a growing number of researchers consider this is a real prospect and argue that Enceladus should be rated a top priority for future space missions.

This point is endorsed by astrobiologist Professor Charles Cockell of Edinburgh University. "If someone gave me several billion dollars to build whatever space probe I wanted, I would have no hesitation," he says. "I would construct one that could fly to Saturn and collect samples from Enceladus. I would go there rather than Mars or the icy moons of Jupiter, such as Europa, despite encouraging signs that they could support life. Primitive, bacteria-like lifeforms may indeed exist on these worlds but they are probably buried deep below their surfaces and will be difficult to access. On Enceladus, if there are lifeforms, they will be easy to pick up. They will be pouring into space."

The cause of this unexpected interest in Enceladus – first observed by William Herschel in 1789 and named after one of the children of the Earth goddess Gaia – stems from a discovery made by the robot spacecraft Cassini, which has been in orbit of Saturn for the past eight years. The \$3bn probe has shown that the little moon not only has an atmosphere, but that geysers of water are erupting from its surface into space. Even more astonishing has been its most recent discovery, which has shown that these geysers contain complex organic compounds, including propane, ethane, and acetylene.

Plumes spurting ice particles, water vapor and trace organic compounds from the surface of Saturn's moon Enceladus.

"It just about ticks every box you have when it comes to looking for life on another world," says Nasa astrobiologist Chris McKay. "It has got liquid water, organic material and a source of heat. It is hard to think of anything more enticing short of receiving a radio signal from aliens on Enceladus telling us to come and get them."

Cassini's observations suggest Enceladus possesses a subterranean ocean that is kept liquid by the moon's internal heat. "We are not sure where that energy is coming from," McKay admits. "The source is producing around 16 gigawatts of power and looks very like the geothermal energy sources we have on Earth – like the deep vents we see in our ocean beds and which bubble up hot gases."

At the moon's south pole, Enceladus's underground ocean appears to rise close to the surface. At a few sites, cracks have developed and water is bubbling to the surface before being vented into space, along with complex organic chemicals that also appear to have built up in its sea.

Equally remarkable is the impact of this water on Saturn. The planet is famed for its complex system of rings, made of bands of small particles in orbit round the planet. There are seven main rings: A, B, C, D, E, F and G, and the giant E-ring is linked directly with Enceladus. The water the moon vents into space turns into ice crystals and these feed the planet's E-ring. "If you turned off the geysers of Enceladus, the great E-ring of Saturn would disappear within a few years," says McKay. "For a little moon, Enceladus has quite an impact."

Yet the discovery of Enceladus's strange geology was a fairly tentative affair, says Professor Michele Dougherty of Imperial College London. She was the principal investigator for Cassini's magnetometer instrument. "Cassini had been in orbit round Saturn for more than six months when it passed relatively close to Enceladus. Our results indicated that Saturn's magnetic field was being dragged round Enceladus in a way that suggested it had an atmosphere."

So Dougherty and her colleagues asked the Cassini management to direct the probe to take a much closer look. This was agreed and in July 2005 Cassini moved in for a close-up study. "I didn't sleep for two nights before that," says Dougherty. "If Cassini found nothing we would have looked stupid and the management team might not have listened to us again."

Her fears were groundless. Cassini swept over Enceladus at a height of 173km and showed that it did indeed possess an atmosphere, albeit a thin one consisting of water vapour, carbon dioxide, methane and nitrogen. "It was wonderful," says Dougherty. "I just thought: wow!"

Subsequent sweeps over the moon then revealed those plumes of water. The only other body in the solar system, apart from Earth, possessing liquid water on its surface had been revealed. Finally came the discovery of organics, and the little moon went from being merely an interesting world to one that was utterly fascinating.

"Those plumes do not represent a torrent," cautions McKay. "This is not the Mississippi pouring into space. The output is roughly equivalent to that of the Old Faithful geyser in Yellowstone national park. On the other hand, it would be enough to create a river that you could kayak down.

"The fact that this water is being vented into space and is mixed with organic material is truly remarkable, however. It is an open invitation to go there. The place may as well have a big sign hanging over it saying: 'Free sample: take one now'."

Collecting that sample will not be easy, however. At a distance of 1bn miles, Saturn and its moons are a difficult target. Cassini took almost seven years to get there after its launch from Cape Canaveral in 1997.

"A mission to Enceladus would take a similar time," says McKay. Once there, several years would be needed to make several sweeps over Enceladus to collect samples of water and organics. "Then we would need a further seven years to get those samples back to Earth."

Such a mission would therefore involve almost 20 years of space flight – on top of the decade needed to plan it and to construct and launch the probe. "That's 30 years in all, a large chunk of any scientist's professional life," says McKay.

McKay and a group of other Nasa scientists based at the Jet Propulsion Laboratory in Pasadena are undaunted, however. They are now finalising plans for an Enceladus Sample Return mission, which would involve putting a probe in orbit round Saturn. It would then use the gravity of the planet's biggest moon, Titan, to make sweeps over Enceladus. Plume samples would then be stored in a canister that would eventually be fired back to Earth on a seven-year return journey.

Crucially, McKay and his colleagues believe such a mission could be carried out at a relatively modest cost – as part of Nasa's Discovery programme, which funds low-budget missions to explore the solar system. Previous probes have included Lunar Prospector, which studied the moon's geology; Stardust, which returned a sample of material scooped from a comet's tail; and Mars Pathfinder, which deployed a tiny motorised robot vehicle on the Red Planet in 1997.

"The criteria for inclusion in the Discovery programme demand that any mission must cost less than \$500m, though that does not include the price of launch," says McKay. "We think we can adapt the technology that was developed on the Stardust mission to build an Enceladus Sample Return. If so, we can keep the cost below \$500m. We are finalising plans and will announce our proposals in autumn."

Such a mission is backed by Dougherty. "I think Enceladus is one of the best bets we now have for finding life on another world in our solar system. It is certainly worth visiting but it is not the only hope we have. The icy moons of Jupiter – such as Ganymede, Callisto and Europa – still look a very good prospect as well."

And there is one problematic issue concerning Enceladus: time. "Conditions for life there are good at present but we do not know how long they have been in existence," says McKay. "They might be recent or ancient. For life to have evolved, we need the latter to have been the case. At present, we have no idea about their duration, though geologists I have spoken to suggest that water and organics may have been there for a good while. The only way we will find out is to go there."

The late entry of Enceladus in the race to find extraterrestrial life adds an intriguing new destination for astrobiologists in their hunt for aliens. Before its geysers were discovered, two main targets dominated their research: Mars and the icy moons of Jupiter. The former is the easiest to get to and has already received visits from dozens of probes. On 6 August, the \$2.5bn robot rover Curiosity is set to land there and continue the hunt for life on the Red Planet. "For life to evolve you need liquid water, and although it is clear it once flowed on Mars, its continued existence there is debatable," says Cockell. "By contrast, you can see water pouring off Enceladus along with those organics."

Many scientists argue that water could exist deep below the Martian surface, supporting bacteria-like lifeforms. However, these reservoirs could be many metres, if not kilometres, below Mars's surface and it could take decades to find them. Similarly, the oceans under the thick ice that covers Europa – and two other moons of Jupiter, Ganymede and Callisto – could also support life. But again, it will be extremely difficult for a robot probe to drill through the kilometres of ice that cover the oceans of these worlds.

Enceladus, by these standards, is an easy destination – but a distant one that will take a long time to reach. "No matter where we look, it appears it will take two or three decades to get answers to our questions about the existence of life on other worlds in the solar system," says Cockell. "By that time, telescopes may have spotted signs of life on planets elsewhere in the galaxy. Our studies of extra-solar planets are getting more sophisticated, after all, and one day we may spot the presence of oxygen and water in our spectrographic studies of these distant worlds – an unambiguous indication that living entities exist there.

However, telescopic studies of extra-solar planets won't reveal the nature of those lifeforms. Only by taking samples from planets in our solar system and returning them to laboratories on Earth, where we can study them, will we be able to reveal their exact nature and mode of replication – if they exist, of course. The little world of Enceladus could then have a lot to teach us.

Solar Wind Heading For Earth Could Spark Auroras Over Weekend (SILREPU)

By Carmel Doyle

Silicon Republic, July 30, 2012

A stream of solar wind is apparently heading towards Earth, and is set to arrive between 28-30 July, according to NASA. Apparently the solar wind could spark off solar storms and result in auroras.

According to NASA's Spaceweather.com, the stream of solar wind that's heading our way may result in geomagnetic storms. If such storms happen, it means that sky watchers in high latitudes could be in for some aurora sightings over the coming nights.

But what exactly is the solar wind? Solar wind comes from the sun's hot corona. Because the temperature of the corona is so high, the sun's gravity cannot hold onto it, according to NASA. This means that the solar wind streams off of the sun in all directions at speeds of about 1.6m kilometres per hour.

In addition, solar wind often changes speed. The space agency says this means high- and low-speed streams interact with each other and alternately pass by the Earth as the sun rotates.

The wind speed variations batter the Earth's magnetic field and can spark off geomagnetic storms. Solar wind data

Solar wind data is sourced from real-time information sent to Earth from the ACE spacecraft and reported by the Space Weather Prediction Center (NOAA).

The ACE spacecraft itself is situated at such a point between the Earth and the sun to allow it to give about a one-hour advance warning of impending geomagnetic activity.

According to NASA's Dr Tony Philips, who writes for Spaceweather.com, astronomers spanning the globe have also been monitoring a "magnificent prominence" - a magnetic filament filled with hot plasma - that has been arcing over the sun's western surface for the past few days.

As for the sun's corona, a telescope that was launched aboard a NASA sounding rocket on 11 July has seemingly captured the highest-resolution images ever taken of the sun's million-degree atmosphere.

"We have an exceptional instrument and launched at the right time," said Jonathan Cirtain, senior heliophysicist at NASA's Marshall Space Flight Center in Huntsville, Alabama.

"Because of the intense solar activity we're seeing right now, we were able to clearly focus on a sizable, active sunspot and achieve our imaging goals."

Aurora over Arkansas, taken in July. Image by Brad Emfinger

The sun's solar maximum, the peak of the sun's 11-year sunspot cycle, is expected to happen in early 2013. When it does happen, the solar maximum is expected to spark off heightened solar flares, coronal mass ejections (CME) and geomagnetic storms.

Already, on the weekend of 14 July, a coronal mass ejection (CME) crashed into the Earth's magnetic field, triggering a display of Northern Lights that were witnessed by sky watchers in places from North America, the Canadian border, Tasmania, New Zealand and the South Pole.

Sky watchers, it seems, might also be in for some aurorae treats in the coming nights!

Nasa Climate Research Move May Go To Parliament (NATIONTH)

The Nation (THAI), July 30, 2012

Parliament and Cabinet could give approval next month for the US National Aeronautics and Space Administration (Nasa) to conduct climate research over Thailand, Science and Technology Minister Plodprasob Surassawadee has told Voice of America (VOA).

Plodprasob visited Washington DC recently and was interviewed by VOA's Thai-language service. He said officials at the US space agency understood the situation and told him that if Thailand gave the green light, about 100 NASA staff were ready to go to Thailand to conduct research.

"This is about science," Plodprasob was quoted as saying on VOA's website on July 7. "But the opposition cried out and newspapers fanned [the issue] and there were threats that the matter would be brought to court."

Plodprasob said the matter would be discussed in Parliament as per Article 179 of the charter. Article 179 allows the government to bring an important issue up for discussion but there would be no voting on the issue.

The minister also insisted that the majority of Thai people were well aware that Nasa wanted only to carry out scientific research that would benefit Thailand and nothing more. "Only a minority are misled," he said.

The government was accused by the opposition and other groups of wanting to help America carry out military reconnaissance that would upset China. But the minister reiterated that in the end, scientific "cooperation" was fine but Thailand must stand on her own feet.

Flaring Black Holes May Solve Cosmic Ray Puzzle (NEWSCIENTIST)

New Scientist, July 30, 2012

WHERE do ultra high-energy cosmic rays come from? These charged particles zoom to Earth from outer space, but why is a mystery. Now a possible source - gamma-ray bursts, which seemed to have been ruled out - have received a new lease of life.

Gamma-ray bursts are usually created by exploding stars, which produce neutrinos. So last April, when the IceCube neutrino detector in Antarctica saw no neutrinos accompanying high-energy cosmic rays, astronomers favoured galaxies with active supermassive black holes at their cores as the source of the rays.

But a more recent study found that only one galaxy was powerful enough to have produced cosmic rays with such high energies. The rest appear to come from galaxies that seem too weak.

This posed a "perplexing problem", says Glennys Farrar of New York University, one of the study authors. Then they found a clue: gamma-ray burst GRB110328A, which happened in March 2011. Its afterglow persisted for over a week, instead of a few hours like normal ones. The culprit was most likely a star falling into a galaxy's central black hole. This would make a weak black hole flare up, producing a burst of gamma rays that in turn spits out cosmic rays, suggests Farrar (arxiv.org/abs/1207.3186v1).

The trouble is testing the hypothesis. Gamma rays travel at the speed of light, so would arrive millennia ahead of any cosmic rays. Farrar hopes to strengthen the idea by matching more cosmic ray emissions with weak active galaxies.

BLOGS

NASA Still Not Worried About Sequestration (SPACEPOL)

By Jeff Foust

[Space Politics](#), July 30, 2012

A top NASA official said Thursday that the agency remained confident that budget sequestration could be avoided, even though they were starting to think about the potential effects should those automatic budget cuts take effect. "If you talk to the leadership in the administration or Congress, most people believe it's not going to happen," said NASA chief of staff David Radzanowski in response to a question on the subject after his keynote address at the NewSpace 2012 Conference in Santa Clara, California, Thursday morning. "They're confident because the alternative is not good policy."

He did say, though, that the agency was starting to examine what might happen if those across-the-board cuts did take effect in January. "We've started thinking about what it would mean, in general," he said, adding that he expected at some point there would be some guidance from the Office of Management and Budget (OMB) on planning for sequestration. "A lot of the significant planning is going to be happening in maybe September or October."

On one other NASA hot topic, the impending awards for the agency's Commercial Crew Integrated Capability (CCiCap) program, Radzanowski said that announcement would come "real soon" but didn't offer more specifics. "I'm not going to make any news by saying when," he said. The announcement is widely expected for any time between now and the end of August.

Neil DeGrasse Tyson Isn't Mad At You, America -- But He **Is** Disappointed (ATLANTIC)

By Megan Garber

[Atlantic](#), July 30, 2012

Since the Apollo era of the 60s, NASA's budget has been steadily shrinking. And our national fascination with space has been declining along with it.

Neil deGrasse Tyson wants to turn things around. As does Bill Nye. As does astronaut Leroy Chiao. As does Paul Hildebrandt.

Hildebrandt is the director of a proposed documentary: *Fight for Space*, a feature-length film exploring the future of the space program. Proposed on Kickstarter, the project -- with 22 days left -- is less than \$10,000 away from its \$65,000 funding goal. It has, so far, more than 1,400 funders.

And that's due, in large part, to the trailer Hildebrandt created for the film, above -- a powerful video in itself, and one that manages to walk that fine between indignation and inspiration.

The economics of space are much more complicated, obviously, than the trailer makes clear. The film is a political play, blatantly and self-consciously. It wants a government-funded space program. But what the video also makes clear -- what the video, in fact, is fighting for -- is the culture of space. The desire of space, the symbol of space. That wild, whirling sense of all that can be achieved when we cast our gaze outside ourselves to the great beyond.

Neil DeGrasse Tyson And Bill Nye In Fight For Space Kickstarter (WIRED)

By Nicole Wakelin

Wired, July 30, 2012

I cried on July 8, 2011, when the Space Shuttle *Atlantis* launched as the final mission of the Space Shuttle Program. I kept wondering why it had to come to an end and how things had gotten to a point where funding missions to space just wasn't that important. What happened? How can we change it?

Paul Hildebrandt has just launched a Kickstarter campaign to fund his documentary, *Fight For Space: Exploring the Future of Manned Spaceflight*, which will answer those questions. It will look at how the United States space program lost its edge and why it's so very important that we get it back.

Hildebrandt has already spent time travelling the country to meet with some notable advocates of space exploration. Neil deGrasse Tyson, Bill Nye, astronaut Leroy Chiao, as well as astronomers, congressmen, engineers, and authors will all be included in the final documentary. They appear in the trailer and it's hard not to get all fired up listening to them speak.

The goal here is not to solve the problem, but to start a discussion. There are complex social, political, and economic factors that each play a role in where our space program is today, and only by understanding them can we hope to have the program rebound and inspire future generations. It's a difficult but not impossible task to excite children about the possibilities of space exploration as the whole nation was when Neil Armstrong first set foot on the moon.

If you're passionate about space exploration and long for the day when we travel beyond the moon to Mars, then head over to the *Fight For Space* Kickstarter page to learn more, donate, and make this valuable documentary a reality.

Defending The Interstellar Vision (CENTDREAMS)

By Paul Gilster

Centauri Dreams, July 30, 2012

An interstellar movement has been brewing for the past sixty or so years among physicists and engineers who have taken a serious look at what it would take to get to the stars. Their work is not based on wishes but on physics, and while they are aware of the intractable distances to reach even the nearest star (4.2 years at the speed of light itself), they have continued to study how to send spacecraft on such epic journeys. Organizations have emerged — DARPA's 100 Year Starship, Icarus Interstellar, the Tau Zero Foundation — whose members call to mind physicist Robert Forward's injunction: "Travel to the stars is difficult but not impossible."

Centauri Dreams readers know all this, but at least on the basis of Adam Frank's op-ed *Alone in the Void*, many readers of *The New York Times* do not. A professor of physics and astronomy himself (University of Rochester), Frank is

well versed in the problems of distance and time and understands how difficult it will be to send humans to the stars any time soon. But while acknowledging the 'exciting theoretical research' on unmanned vehicles currently underway (Project Icarus is an ongoing design study for such an unmanned probe), he leaves the implication that rapid interstellar travel is nothing more than a Hollywood fantasy.

Interstellar Concepts Emerge

Yet ever since the first serious studies of interstellar propulsion began in the 1950's, numerous concepts for crossing the starry gulf have been examined that violate no laws of physics and could well be achieved by a civilization with the technology our grandchildren — or their children — may have at their disposal. We can't get a huge space sail to ten percent of lightspeed by beaming a powerful laser at it, but our descendants may have the energy resources to do just that. We've been looking in these pages at ramjet concepts that in some cases use interstellar hydrogen and in others tap energy from X-ray lasers, while others examine the potential of nuclear fusion. A century from now we may have learned how to use antimatter in rockets.

Image: The Andromeda galaxy reminds us how vast cities of stars like the Milky Way really are. Will humans ever be able to leave our Solar System and reach even the closest stars? Credit: Bill Saxton, AUI, NRAO, NSF.

History reminds us that while progress is not inevitable, it can move quickly once unleashed, as the digital revolution of the last few decades attests. Our advances in computers may be complemented by a nanotechnology that will allow us to lower payload mass and make the propulsion problem a little less intractable. These concepts aren't yet focused on human interstellar flight but there is no reason why taking the first steps in examining them couldn't eventually lead to that outcome. But what Frank is saying is that going to the stars is such a long-term prospect that we might as well consign the idea to the realm of magic.

For the concepts I've cited simply don't appear in Frank's essay, nor does he mention the work of NASA's Breakthrough Propulsion Physics project, or the recently published *Frontiers of Propulsion Science*, which collects essays from leading theorists on the latest research and how it might be applied. Instead, he focuses on Hollywood:

From "Star Trek" to "Star Wars," from warp drive to hyperdrive — the idea of rapid interstellar space travel is such a deep meme for cultural visions of space and our future that Hollywood films don't even have to waste time introducing them to the audience. You pull a lever and zap — you are in a new star system. How many people would be surprised to know that warp drive isn't even a coherent concept, let alone a near-future technology?

Starflight and the Human Lifetime

Does warp-drive — if it ever becomes possible — have to be a near-future technology for us to study it? Here I question Frank's assumptions, because the curse of our times is our focus on short-term results, and our unwillingness to look beyond our own lifetimes. The warp drive under question would not violate Einstein's Special Relativity because rather than moving an object through spacetime, it would manipulate spacetime itself, an operation requiring vast amounts of energy but one on which there is no such speed limit. No one knows whether these investigations — or those into 'wormholes' that could be traversed to connect remote parts of the universe — will ever bear fruit. It is safe to say, however, that if we dismiss any study of these concepts we have guaranteed a negative result, and why do so?

Frank goes on to describe what he calls 'an inconvenient truth':

While our children's children's great-grandchildren will live with ever more powerful technology, they will also live ever more intimately with ever more billions of others in this, our corner of the cosmos. Looking back and forward, my bets are now on that same human genius, ambition and hope to rise to the occasion. We will have no other choice. There will be nowhere else to go for a very long time.

Who could doubt that this vision, of humans living on an ever more crowded Earth, is likely to come to pass whether or not we develop human interstellar flight? And yes, learning how to live with each other is not a matter of choice as our technology and our weaponry become ever more advanced. But the interstellar movement notes several other key points, and I bet on its genius, ambition and hope. Even as our species nurtures the home world, we live in a dangerous environment whose history has been punctuated by mass extinctions, some of them caused by impacts from space debris.

Getting representatives of humanity off this planet is an insurance policy that guarantees our survival. Let's forget fast travel for the moment and take an evolutionary view of what could occur. Human expansion into the Solar System involves developing new propulsion technologies to help us change the trajectory of potentially dangerous impactors like asteroids. In doing this, we master techniques for living in space that result in large habitats off-planet. None of this violates any laws of physics and invokes no magic, but it potentially leads to self-sustaining colonies, born and bred in space, spreading out on millennia-long interstellar journeys.

Of Vision and Commitment

Focused attention can be disruptive, as physicists and engineers go to work on problems that seem intractable, and we cannot know what might rapidly accelerate the time-frame for interstellar flight. But a commitment of a small part of our resources to studying how we might one day move out into the stars is a long-term investment whose outcome may surprise us. History shows that humans are a visionary and exploring species. We will move into the cosmos if we can because it is in our nature, and it is the nature of researchers in today's interstellar movement to take the small steps of foundation-building that may lead to a grand structure in the future.

Frank is certainly correct that the time-scale is long and the result unsure, and he's also right that Hollywood versions of star travel have simplified it to the point of absurdity. No one can guarantee that humans will ever travel to the stars, but it is a dead certainty that giving up in despair will leave the outcome in no doubt whatsoever. Meanwhile, interstellar theorists learn patience. They have to, for they understand that the first interstellar probes, even the unmanned ones, surely won't fly in their lifetime. Why should this be so hard to explain to the readers of a great newspaper? Since when did we lose the ability to see beyond our own mortality, building a vision that someone we'll never know in a century we'll never see can finally make real?

Alone In The Void (NYT)

By Adam Frank

New York Times, July 25, 2012

Rochester

SOMETIME this year Voyager 1, a probe sent from Earth 35 years ago, will cross a threshold no human-fashioned object has reached before. Passing through a sun-driven shock wave at the edge of the solar system, it will reach the icy dominions of interstellar space. Voyager is one of the fastest vessels we've ever blown out of Earth's gravity well. Still, after three and a half decades of hyper-velocity spaceflight, it will take another 700 centuries for the craft to cross the distance to the nearest star.

Short of a scientific miracle of the kind that has never occurred, our future history for millennia will be played out on Earth and in the "near space" environment of the other seven planets, their moons and the asteroids in between. For all our flights of imagination, we have yet to absorb this reality. Like it or not, we are probably trapped in our solar system for a long, long time. We had better start coming to terms with what that means for the human future.

Of course, we know this, on some level. But in a culture saturated with inbred notions of “progress” and an obsession with worlds seemingly just beyond our grasp, there is an expectation that sooner rather than later, we will be building an interstellar culture. In a kind of cosmic version of Manifest Destiny we assume that, unless something terrible happens, our science will be taking us to the stars sometime in the next few hundred years. Simply say “warp drive” to just about anyone and see if they know what you mean.

From “Star Trek” to “Star Wars,” from warp drive to hyperdrive — the idea of rapid interstellar space travel is such a deep meme for cultural visions of space and our future that Hollywood films don’t even have to waste time introducing them to the audience. You pull a lever and zap — you are in a new star system. How many people would be surprised to know that warp drive isn’t even a coherent concept, let alone a near-future technology?

The truth is we propel ourselves into space using much the same physics as the Chinese played with when they discovered what we came to call gunpowder more than 1,400 years ago. Blowing stuff up under us is just about the only way we know how to travel through the void.

But for the distances between the stars, that method simply won’t cut it. Even if we could find a way to increase the speed of our spacecraft a hundredfold — about the same ratio of speeds between a horse-drawn cart and a 747 jet plane — they would still take almost a thousand years to reach nearby stars, and as long to return. And while exciting theoretical research is under way into pilotless probes to the stars, the real possibility of large-scale human interstellar culture is considerably less thrilling.

Think about it. No salvation from population pressure on the shores of alien worlds. No release from the threats of biosphere degradation in the promise of new biospheres. No escape from our own destructive tendencies by spreading out among the stars like seedpods in the wind. For as many epochs in the future as there are epochs of human history in the past, we may simply have to make do, get by with what we have and, in the end, learn to get along.

I was just 15 when Voyager 1 left on its long journey. At that age I already knew I wanted nothing more than to be an astronomer. I was also sure that humanity’s future, even on the time scale of centuries, would be played out in the theater of the stars. Voyager’s departure on its interstellar mission convinced me we were well on our way toward that grand future where anything would be possible.

Today I am still in awe of that tiny box of electronics as it sails to the edge of the solar wind. I still believe it represents the best of human genius, ambition and hope. It is through these qualities that, I believe, we have taken the full measure of the stars.

But what we’ve learned in doing so brings me, as an adult and as an astrophysicist, to the hardest and most inconvenient truth of all. While our children’s children’s great-grandchildren will live with ever more powerful technology, they will also live ever more intimately with ever more billions of others in this, our corner of the cosmos. Looking back and forward, my bets are now on that same human genius, ambition and hope to rise to the occasion. We will have no other choice. There will be nowhere else to go for a very long time.

Adam Frank, a professor of physics and astronomy at the University of Rochester, is the author of “About Time: Cosmology and Culture at the Twilight of the Big Bang” and a co-founder of NPR’s “13.7 Cosmos and Culture” blog.

Successful Launch Of NASA's Degradation Free Spectrometers (GIZMAG)

By David Szondy

Gizmag, July 30, 2012

On July 24, 2012, NASA successfully launched a pair of newly developed spectrometers aboard a sounding rocket from the White Sands Missile Range, New Mexico to an altitude of 323.8 km (201.2 mi). This may not seem to have much to do with extending the life of a satellite floating between the Sun and Earth about 1.5 million kilometers (932,000 mi) away, but it does. That's because the tests' purpose was both to test new instruments for a potential future replacement of the SOHO solar observatory satellite and to recalibrate SOHO's existing instruments.

It's great when a space mission lasts longer than expected. Though the history of space exploration has been punctuated by failure and even tragedy, some missions shine out, such as the Viking and Opportunity Mars Landers, which operated years beyond their very short mission objectives and, of course, Voyager, a craft that is still working a generation after its launch. However, success can bring its own problems. One of these is that a still-functioning craft may have to work with instruments never meant to last so long and are now showing their age.

A case in point is the Solar and Heliospheric Observatory (SOHO). This joint project between the European Space Agency (ESA) and NASA was launched on December 2, 1995 and is currently parked at the Lagrange point between the Earth and the Sun where gravitational forces balance, leaving it forever in the one spot. Since its launch, it's been studying the Sun and has discovered over 2,200 comets. Originally planned as a two-year mission, SOHO continues to send back data. It's done a great job and, more importantly, is the main source of near-real time data that helps look out for solar flares. Trouble is, the instruments weren't designed to run for 18 years and they show it. Filters degrade, surfaces become contaminated, telescope mirrors dim... In other words, it's going slowly blind.

There isn't much that can be done to repair SOHO, but future missions will benefit from more durable instruments. That is the purpose of the sounding rocket test. Among its payload were two Degradation Free Spectrometers (DFS). These are similar to the spectrometers used by SOHO, but where the satellite's are gradually failing, these are designed to avoid that fate on a future mission. Instead of conventional optics, they use a rare gas photoionization-based Optics-Free Spectrometer (OFS) and a Dual Grating Spectrometer (DGS). These are made filter-free and optics-free by using rare-gas chambers, photoelectron focusing techniques, gratings and light baffles to exclude unwanted light without filters.

The mission was mainly to test the spectrometers, which are capable of, in the words of NASA's press release, "high cadence measurements of the highly variable Extreme Ultraviolet (EUV) solar flux and have minimal degradation over multi-year time scales while observing the sun 24/7." What that means is that the spectrometers can make precise observations of the Sun at the extreme end of the ultraviolet spectrum for years on end without the mechanism wearing out.

The other purpose was to help calibrate SOHO. In addition to the new spectrometers, the sounding rocket also carried a clone of SOHO's Solar Extreme Ultraviolet Monitor (SEM). This was calibrated at the National Institute of Standards and Technology both before and after flight to provide a calibration check for SOHO, so observations from the satellite can be corrected. If all goes well, it may give SOHO a little more life and its successor a lot more time.

AEROSPACE NEWS

Boeing Ships Third GPS (GPS)

GPS World, July 30, 2012

The third GPS IIF satellite is scheduled for launch in the fourth quarter.

On July 9, Boeing shipped the third of 12 GPS IIF satellites for the U.S. Air Force from the company's Satellite Development Center in El Segundo to Cape Canaveral Air Force Station, Florida, aboard a Boeing-built C-17 Globemaster III airlifter.

SVN-65 is scheduled to be launched in the fourth quarter of this year aboard a United Launch Alliance Delta IV rocket. It will join the first and second Boeing-built GPS IIF satellites, launched May 27, 2010, and July 16, 2011, to continue the sustainment and modernization of the GPS network.

"As each IIF satellite becomes operational, we continue the seamless transformation of the GPS constellation into an even more accurate, reliable and durable navigation resource for the U.S. military and the global civilian user community," said Craig Cooning, vice president and general manager of Boeing Space & Intelligence Systems. "Our efficient pulse-line manufacturing process, adapted from Boeing's commercial airplane production lines, also ensures that we deliver each spacecraft on time and on cost."

SVN-65 will now undergo preflight checkout, fueling, and integration to prepare for the early October launch. When on orbit, it will be controlled by the Operational Control Segment, the GPS network's ground control system. Developed by a Boeing-led team, the OCS entered service in 2007 and was turned over to the Air Force 50th Space Wing in April 2011.

GPS IIF features greater navigational accuracy through improvements in atomic clock technology, a more secure and jam-resistant signal for the military, and a protected, more precise, and interference-free civilian L5 signal for commercial aviation and search-and-rescue operations. Other enhancements to the IIF include an extended 12-year design life and a re-programmable on-orbit processor that can receive software uploads for improved system operation.

Of the remaining nine IIFs that Boeing is building for the Air Force, three are complete and in storage, and six are being assembled and tested.

MDA Expects Space Systems/Loral Deal To Close This Fall (SPCENWS)

By Peter B. De Selding

Space News, July 27, 2012

Canada's MDA Corp., which expects its purchase U.S. satellite builder Space Systems/Loral to be completed by this fall, on July 26 said it has booked "several 10s of millions of dollars" in orders from the U.S. Defense Advanced Research Projects Agency (DARPA) for robotic elements of a satellite-salvage program.

Several companies, including Space Systems/Loral (SS/L), have won contracts as part of DARPA's Phoenix program, whose goal is to launch small "satlets" to attach to dead in-orbit satellites, remove usable components and reuse them in orbit.

Palo Alto, Calif.-based SS/L and MDA are not comparing notes on Phoenix or anything else while they await regulatory approval of MDA's \$875 million purchase.

In a July 26 conference call with investors, MDA Chief Executive Daniel E. Friedmann said MDA continues to see growth in the global satellite communications market on its own.

Richmond, British Columbia-based MDA recently booked a \$90 million order with Israel Aerospace Industries to provide the payload for the Amos-6 telecommunications satellite, for which the Israeli customer will provide the platform. MDA also won a \$35 million order from Avanti Communications of London to provide the Ka-band payload for Avanti's Hylas 3 telecommunications satellite.

Neither of these orders figures in MDA's financial results. The Israeli order is still limited to an authorization to proceed, with a final contract expected in the coming weeks. The Avanti contract was booked after the June 30 close of the second quarter.

MDA is more than 90 percent finished with its work on the AM-5 telecommunications satellite for the Russian Satellite Communications Co. of Moscow, and about 80 percent finished with the AM-6 satellite.

A telecommunications satellite for Ukraine, which was delayed while Ukrainian authorities sorted out orbital-slot and broadcast-frequency rights, is about one-third complete, Friedmann said.

MDA is eyeing a future order from Israel for an Amos-7 satellite that could be ordered in 2013, and from a Brazilian customer as that nation expands its satellite telecommunications business.

Friedmann said a \$12 million order from the Canadian Space Agency for the Radarsat Constellation Mission (RCM) does not mean this on-again, off-again program is now back on track.

MDA, which is the presumptive prime contractor for the program, is still planning to shut down its work on this program in October absent a concrete decision on funding for the construction phase. "RCM goes to zero in October," Friedmann said. "It's about half of where it was a year ago. It's winding down very quickly."

MDA said it booked about \$1.9 million in legal and other costs related to the SS/L purchase, meaning MDA's successful bid apparently cost less than an aborted effort by Orbital Sciences of Dulles, Va.

Orbital has not confirmed that the \$2.1 million in costs related to an unidentified, and subsequently withdrawn, acquisition attempt was related to SS/L, but industry officials said Orbital was in the hunt for SS/L before determining that it would not match the MDA bid.

For the six months ending June 30, MDA reported revenue of 336 million Canadian dollars (\$328 million), down 16 percent from the same period a year ago.

MDA Chief Financial Officer Anil Wirasekara said the decrease was due in part to a lower level of pass-through revenue, meaning work performed by other companies but under an MDA contract. Pass-through revenue usually carries a lower profit margin than value-added work MDA does on its own, which helps explain why operating earnings before interest, taxes, depreciation and amortization, or EBITDA, at 95.8 million, was up from a year ago at 29 percent of revenue versus 24 percent.

Similarly, operating earnings, at 58.1 million Canadian dollars, was up about 4.5 percent from last year.

Inmarsat, Israeli Group Spar Over Iranian Oil Tanker Links (SPCENWS)

By Peter B. De Selding

Space News, July 27, 2012

Allegations by an Israeli legal group that mobile satellite services provider Inmarsat is selling prohibited communications to Iranian government-controlled oil tankers and other ships has once again raised the issue of the liability limits of a satellite operator with a global customer base whose identity is often not disclosed.

In a July 25 letter to London-based Inmarsat, Tel Aviv-based Shurat HaDin-Israel Law Center said Inmarsat is continuing to provide mobile satellite links to vessels that have been identified by the U.S. Treasury Department as owned or controlled by Iranian interests.

The U.S. government has imposed a series of sanctions against commercial dealings with Iran, but has not been able to win United Nations support for the policy.

Instead, the U.S. government is attempting to widen the circle of nations applying the sanctions to individuals or companies within their borders. That includes most of Western Europe.

The Treasury Department's Office of Foreign Assets Control (OFAC) on July 12 added a list of vessels it said are acting directly or indirectly on behalf of Iranian government and commercial interests, in violation of the U.S. sanctions.

On July 19, OFAC issued a specific "global advisory" to the maritime industry, saying the Islamic Republic of Iran Shipping Lines is continuing to operate vessels whose flags have been removed as the sanctions grip has tightened.

Many of the vessels listed on OFAC's July 12 list are registered not in Iran but in Malta, Sierra Leone and elsewhere. The U.S. government then applies pressure to these administrations. For example, on June 25, Sierra Leone agreed to remove its flag — equivalent to revoking its regulatory protection — from the Irano-Hind Shipping Co. vessel Amin, OFAC said in its July 19 advisory.

Some 28 vessels carry Inmarsat communications gear figure on the OFAC list.

In a July 26 interview, Israel Law Center Director Nitsana Darshan-Leitner said it appears that some of these vessels are using state-of-the-art communications gear, facilitating their attempts to slip through the embargo's net to deliver Iranian oil to customers, or to purchase goods.

"The evidence is very clear," Darshan-Leitner said. "Despite the sanctions, Inmarsat continues to provide satcom services. They are not supposed to deliver any service at all under the sanctions — not even emergency services."

In a July 26 interview, Inmarsat spokesman Christopher McLaughlin said the company had performed a thorough analysis of the ships listed in the Treasury Department's update and determined that none of them is using Inmarsat's broadband service.

These newer services, including Fleet BroadBand, permit Inmarsat to identify users by their subscriber identity module (SIM) card numbers, giving Inmarsat a more direct insight into their customer base even as Inmarsat remains a wholesale provider.

McLaughlin said some of these ships nonetheless appear to be using older Inmarsat gear, but that Inmarsat — by virtue of its history as an international treaty organization — is not informed as to the identity of the customers.

Inmarsat is bound by its convention to provide, without discrimination, the Global Maritime Distress and Safety System (GMDSS) service to vessels worldwide. These are low-throughput signals designed to provide ship-to-shore emergency calls, a service that Inmarsat inherited a decade ago when it transitioned from an intergovernmental organization into the current private-sector corporation.

In the interview, Darshan-Leitner appeared to agree that GMDSS service falls into a special category, especially given the United Nations' refusal, up to now, to endorse the current suite of sanctions promoted by the United States and its allies.

But Inmarsat mini-M and Fleet communications are among the communications assets on board the OFAC list — a clear transgression of the sanctions effort, Darshan-Leitner said.

McLaughlin said these "heritage services" were contracted and installed at a time when Inmarsat did not order its distribution partners to identify each and every customer. Inmarsat has been modifying its business model in recent years, notably by purchasing one of its largest distributors, but is still unable to identify with precision, ship by ship, what SIM card is activated where.

"For mini-M, Fleet, Inmarsat B and our other older services, we cannot get that far down into the service provider structure," McLaughlin said. "But I can tell you we have been through the whole list of ships and none of them are carrying our broadband services."

In a July 26 written response to Space News inquiries, Inmarsat said: "Inmarsat (Inmarsat plc, Inmarsat Global Ltd. and Inmarsat Inc.) seeks to comply with all applicable sanctions laws and regulations. Inmarsat does not sell telecommunications services to any Iranian entity, or to any entity on the U.S. Office of Foreign Assets Control list of Specially Designated Nationals.

"Inmarsat was founded in 1979 as the International Maritime Satellite Organization, a non-profit, intergovernmental organization established by United Nations Convention to provide maritime communications for distress and safety of life at sea communications. The Convention required Inmarsat to make its services available for the 'benefit of ships of all nations.'

"In 1999, the intergovernmental organization was privatized, creating Inmarsat plc. As a condition to its privatization, Inmarsat was required to continue its 'public service obligations' to 'ensure the continuity of maritime satellite distress and safety communications services' for the Global Maritime Distress and Safety System ... established by the U.N. Inmarsat was again required to provide safety communications services for all ships 'without discrimination on the basis of nationality.' In turn, all cargo and passenger ships above a certain tonnage must carry a terminal for GMDSS. Inmarsat is the sole satellite provider of GMDSS."

Russia Launches Cluster Of Four Satellites (RIAN)

RIA Novosti, July 30, 2012

Russia's Space Forces launched early on Saturday a Rokot carrier rocket with a Cosmos class military satellite and three civilian satellites on board, spokesman Col. Alexey Zolotukhin said.

The Rokot blasted off from the Plesetsk space center in northern Russia at 05.35 a.m. Moscow time (01:35 GMT).

The civilian payload includes two Gonets-M telecoms satellites and a MiR scientific microsatellite.

The satellites were put into designated orbits at 07.21 a.m Moscow time (03:21 GMT), as scheduled.

The classified military satellite received designation Cosmos 2841 after reaching the orbit. It will join a Russian network of about 70 military reconnaissance satellites.

The light-class Rokot launch vehicle is a modified version of the Russian RS-18 (SS-19 Stiletto) intercontinental ballistic missile. It uses the two original lower stages of the ICBM, in conjunction with a Breeze-KM upper-stage for commercial payloads.

According to the Russian Defense Ministry, a total of 16 Rokot launches have been carried out from the Plesetsk site since the first launch on May 16, 2000.

However, Rokot launches have been suspended for about 18 months after a Rokot launched on February 1, 2011 failed to put the Geo-IK-2 military satellite into the designated orbit.

Russian Rocket Puts Four Satellites Into Space (XIN)

Xinhua, July 30, 2012

A Russian carrier rocket with one military and three civilian satellites on board blasted off from the Plesetsk space center in northern Russia, the Aerospace Defence Force (ADF) said Saturday.

ADF spokesman Col. Alexey Zolotukhin told local media the Rokot rocket was launched at 5:35 a.m. Moscow time (0135 GMT). One military satellite, two Gonets-M telecoms satellites and a Yubileiny-2 scientific microsatellite successfully reached the designated orbit at 7:21 a.m. (0321 GMT).

Zolotukhin said the military spacecraft would join a network of 70 Russian military reconnaissance satellites after reaching the orbit.

The 107-ton light Rokot launcher is a derivative of the Russian RS-18 (SS-19 Stiletto) intercontinental ballistic missile (ICBM). It contains two original lower stages of the ICBM and an upper stage for commercial payloads.

Russia suspended the launch of Rokot carrier rockets after a failed launch in February 2011, when the rocket sent a Geo-IK-2 satellite into an incorrect orbit.

China's Long March-5 Carrier Rocket Engine Undergoes Testing (XIN)

Xinhua, July 30, 2012

China on Sunday successfully conducted tests on its new 120-tonne-thrust liquid oxygen (LOX) and kerosene engine for its new generation carrier rocket, the Long March-5, according to the China Aerospace Science and Technology Corporation (CASC).

The test was conducted in Xi'an, capital city of northwest China's Shaanxi province, according to the CASC's sixth research institute.

The LOX/kerosene engine underwent a test of a high rotational speed of nearly 20,000 revolutions per minute and a high temperature test of 3,000 degrees Celsius that lasted for 200 seconds, the China Central Television reported.

The high-performance engine, which is the first kind of high-pressure staged combustion cycle engine for which China has proprietary intellectual property rights, is non-toxic, pollution-free and highly reliable, according to the report.

The engine is much more powerful than the 75-tonne-thrust engines of the launch vehicles used in the already-launched Shenzhou spacecraft, the institute said.

It also makes China the second country in the world, after Russia, to grasp the core technologies for an LOX/kerosene high-pressure staged combustion cycle rocket engine.

The large-thrust carrier rocket under development, the Long March-5, is hoped to make its maiden voyage in 2014. Ahead of that, several limit-determining tests will be conducted to ensure the engine's stability and reliability, according to the statement.

New Engine Passes Test And Revs Up Space Hopes (CHINADAY)

Lunar mission will explore moon's surface and bring back samples

By Xin Dingding

China Daily, July 30, 2012

A next-generation engine, that will pave the way for lunar exploration, was successfully tested on Sunday.

The engine, with a 120-ton-thrust using liquid oxygen (LOX) and kerosene, will enable the Long March 5 carrier rocket — which is expected to make its maiden voyage in 2014 — to place a 25-ton payload into near-Earth orbit, or place a 14-ton payload into geostationary orbit, experts said.

The tests, which included seeing how the engine would respond to rotational speeds of nearly 20,000 revolutions per minute and temperatures of 3,000 C for

200 seconds, were held in Xi'an, capital of Shaanxi province.

"The successful tests confirm the reliability of China's LOX/kerosene engine," said Lai Daichu, test commander.

Tan Yonghua, head of Xi'an Aerospace Propulsion Institute under the China Aerospace Science and

Technology Corp, which developed the engine, said that the single engine currently used by Long March carrier rockets only has a 75-ton thrust, much less than the 120-ton thrust of the new engine.

Luan Xiting, deputy head of the institute, said that the new engine's extra thrust will enable China to assemble a space station and also help with the third stage of the lunar exploration program.

The three stages involve orbit, landing and return.

Earlier reports said that the Chang'e-5 lunar explorer will bring about 2 kg of lunar samples to Earth.

Ouyang Ziyuan, a senior consultant in the lunar exploration program and a member of the Chinese Academy of Sciences, said that Chang'e-5 will be launched atop the Long March 5 carrier rocket from the new space launch center in Wenchang, Hainan province, which is under construction.

The space program is in the second stage, with three lunar exploration spacecraft, Chang'e 2, Chang'e 3 and Chang'e 4.

Ouyang said in a recent e-mail reply to China Daily that China will launch its third lunar explorer, Chang'e 3, next year to land on the moon.

A rover will explore its surroundings.

The landing is expected to be the most challenging part of the mission, he said.

Chang'e 3 will hover about 4 meters above the lunar surface.

Then the engine will cut out, and the Chang'e 3 will drop onto the surface.

Space: Rover can see under the surface

As for the rover, the leading scientist in lunar exploration said it is "China's most advanced robot".

The rover carries a lunar "radar" and while it is operating on the surface it can scan several hundred meters under the surface.

The rover also carries instruments that can detect minerals.

To combat nighttime temperatures, -180 C, scientists have developed nuclear-powered batteries that can help the lander and rover function.

They will conserve energy by "hibernating" and when the sun rises the solar energy will "wake" the lander and the rover, he said.

Ouyang said the second lunar orbiter, Chang'e 2, has traveled to explore an asteroid.

The asteroid, 4179 Toutatis, is listed as a potentially hazardous object by scientists because it makes frequent Earth fly pasts.

Prior to traveling into deep space, Chang'e 2, launched in October 2010, completed its six-month mission and spent 235 days some 1.5 million km from Earth, where it gathered a large amount of scientific data about solar activity, he said.

It started its quest for the asteroid on April 15, and is expected to observe the asteroid close up, he said.

Hu Meets Astronauts, Scientists Of Manned Space Docking (XIN)

Xinhua, July 30, 2012

Chinese President Hu Jintao met Friday morning with astronauts, space scientists and engineers of the manned space docking mission, in the Great Hall of the People in Beijing.

Shenzhou-9 spacecraft, with three astronauts aboard, returned from a 13-day mission on June 29, after the crew succeeded in manually docking the spacecraft with a space lab module Tiangong-1, paving the way for building a possible space station.

Namibia Leads The Way In Space Observation (NAM)

By Tanja Bause

The Namibian, July 30, 2012

The HESS II telescope with its 28-metre mirror is the largest Cherenkov telescope ever built. It has a mass of 600 tons and take up an area of about two tennis courts.

Together with the four smaller 12-metre telescopes already in operation since 2004, the HESS Observatory outside Windhoek will continue to define the forefront of ground-based gamma ray astronomy and will allow deeper understanding of known high-energy cosmic sources such as supermassive black holes, pulsars and supernovae and the search for new classes of high-energy cosmic sources.

"This new telescope not only provides the largest mirror area among instruments of this type worldwide, but also resolves the cascade images at unprecedented detail, with four times more pixels per sky area compared to the smaller telescopes," said Pascal Vincent of the French team responsible for the photo sensor package of the mirror.

The telescope structure and its drive system were designed by engineers in Germany and South Africa, and produced in Namibia and Germany. The 875 hexagonal mirror facets which make up the huge reflector were manufactured in Armenia, and individually characterised in Germany. The mirror alignment system results from cooperation between German and Polish institutes. The camera, with its integrated electronics, was designed in France.

The construction of the new telescope was driven and financed by German and French institutions, with significant contributions from Austria, Poland, South Africa and Sweden.

The HESS II camera, with an area of the size of a garage door and weight of almost three tons, is 36 metres above the primary mirror in the focal plane at a height of a 20-storey building when pointing up.

The HESS Observatory has been in operation for almost a decade now with the collaboration of more than 170 scientists from 32 scientific institutions and 12 different countries. To date, this collaboration has published over 100 articles in scientific journals.

In a survey in 2006 HESS was ranked the 10th most influential observatory worldwide, joining the ranks with the Hubble Space telescope and the telescopes of the European Southern Observatory (ESO) in Chile.

Danish Space Travel Team Launches Private Rocket Test (SPACE)

By Tariq Malik

SPACE.com, July 30, 2012

A Danish group of amateur spaceflight enthusiasts launched a homemade rocket Friday (July 27) on a trial flight to test vital technologies for a private manned spacecraft.

The team Copenhagen Suborbitals launched its two-stage unmanned rocket SMARAGD-1 from a floating platform in the Baltic Sea to test long-range communications gear, rocket stage separation systems and other equipment needed for its planned larger crewed spaceship. The rocket was expected to reach an altitude of about 12 miles (20 kilometers) during the test flight, according to a mission description.

The launch marked the first mission for the non-profit Copenhagen Suborbitals since a 2011 test flight of its HEAT-1X rocket and a space capsule prototype. The group is now developing a small, one-person space capsule (called Tycho Deep Space) that resembles a miniature Apollo spacecraft.

"What a fantastic day!" Copenhagen Suborbitals co-founder Kristian von Bengtson wrote in a post-launch message on Wired magazine's Rocket Shop blog, where he has been chronicling the spaceflight project. "Thanks for all the support, viewers and donors."

About 50 Copenhagen Suborbitals team members watched over the launch from a mission control ship on loan from the Danish National Guard. [Private Space Travel by Copenhagen Suborbitals (Photos)]

Photos released by Copenhagen Suborbitals show the rail-launched SMARAGD-1 rocket soaring into the sky from the group's Sputnik sea-based launch platform off the coast of Bornholm, Denmark. The black-and-white rocket, tipped with a bright orange nose cone, launched into a blue sky in what appeared to be calm sea conditions.

"This SMARAGD-1 launch will be short fueled deliberately to have a controlled test and stability verification before going all the way," project officials wrote.

Copenhagen Suborbitals formed in 2008 with the goal of launching a person into space on a completely privately built spacecraft using a non-profit, open-source project. In 2010, the group's launch attempt failed to fly due to a malfunction. The 2011 test flight reached an altitude of 2 miles (3.2 km).

The SMARAGD-1 launch is the highest launch yet for Copenhagen Suborbitals. It is one of several missions planned by the private spaceflight group for this year. However, another major test flight — a launch escape system demonstration for the Tycho Deep Space capsule — has been delayed, von Bengtson wrote.

The escape system test, which would launch a space capsule prototype equipped with a rocket-powered escape tower, was delayed when a fuel tank for the capsule's launch escape system failed a pressure test, von Bengtson explained in an earlier Rocket Shop post.

Copenhagen Suborbitals officials plan to launch three other unmanned rockets, including another SMARAGD rocket flight (SMARAGD-2) and two flights of an active guided rocket called Sapphire.

Futuristic Space Plane Concept Moves Closer To Reality (SPACE)

By Rob Copping

[SPACE.com](#), July 30, 2012

A giant space plane that doubles as a supersonic jet is closer than ever to becoming a reality.

Skylon is a privately funded, single-stage-to-orbit vehicle designed to take off and land from a runway, delivering up to 33,000-pounds (15,000 kilograms) into orbit. That payload could be a satellite or crew module, its makers say. Under development by Abingdon, England-based aerospace company Reaction Engines Ltd., Skylon's progress has interested the European Space Agency, and the small U.K. firm has revealed to SPACE.com its latest progress.

"We are now planning the next phase of development and raising the financing for it," Mark Hempsell, the company's future programs director, told SPACE.com.

Progress on the Skylon space plane's heat shield, superstructure, aerodynamics, avionics and critical rocket engine technologies is expected to help the European Space Agency compare the unpiloted reusable spacecraft's business case with expendable launch vehicles next year. [Gallery: Concept Images of the Skylon Space Plane]

The next phase

Skylon is a space plane concept with a slender fuselage that has delta wings attached midway. On the wings' tips is the Synthetic Air Breathing Engine, or SABRE.

The "next phase" Hempsell refers to will involve building a SABRE engine and test-flying it. But building an engine will require a consortium, and Reaction Engines is now looking for partners. The firm has successfully tested a SABRE engine rocket nozzle, called Expansion/Deflection, to improve thrust, with the help of University of Bristol engineers. Its results have now been independently verified by the ESA.

Another key SABRE technology is the heat exchanger, which cools the incoming air to feed it to the engine that burns it with onboard hydrogen. In the thicker lower atmosphere the air entering the engine will be hotter than 1,830 degrees Fahrenheit (1,000 degrees Celsius). This air needs to be cooled or the engine overheats.

The air will be cooled to a cryogenic minus 238 degrees Fahrenheit (minus 150 degrees Celsius) in one one-hundredth of a second. However, once the space plane enters rocket mode above the useful atmosphere, the hydrogen will be burned with onboard liquid oxygen.

Future tests

Tested at Reaction Engine's B9 facility with a Viper jet engine from March to April this year, a flight-weight heat exchanger ran for the full ascent duration, six to eight minutes, cooling the viper's exhaust to around 14 degrees Fahrenheit (minus 10 degrees Celsius). The next tests, starting in August, will aim for the cryogenic temperatures.

For the exchanger work, the ESA and the U.K. government provided about 1 million Euros (\$1.2 million) in 2009. Early work is also under way on the engine's circulators, to circulate the medium SABRE uses to transfer the incoming air's heat, which is helium.

As well as building the SABRE engine, the next phase will see the current Skylon design, called C1, progressed toward the D1 configuration. Flying the space plane in the atmosphere faster than five times the speed of sound requires good aerodynamics. The D1 design is expected to help solve outstanding issues such as how to trim Skylon in flight. Aircraft use trim, meaning flight control surface adjustment, to adapt to changes in aerodynamic lift that occur as the aircraft flies faster and higher. [Video: Skylon Space Plane Delivery]

To control this supersonic space plane in the atmosphere, Reaction Engine's avionics development has reached a stage where hardware standards are being identified. Strategies such as adopting military standards or converting qualified satellite or aviation hardware for the reusable space plane were all considered. But Spacewire, a European standard that originated at Scotland's University of Dundee, is now to be used for the Skylon flight computer databus.

Withstanding the heat

When re-entering, like the space shuttle, Skylon will experience extreme temperatures. However, its heat shield will not have to be developed from scratch; the material already exists. The heat-shield material is a fiber-reinforced ceramic that can withstand temperatures up to 2,060 degrees Fahrenheit (1,127 degrees Celsius). It has already been tested in a plasma chamber by Reaction Engines.

The challenge is that the company behind it is no longer in business. Reaction Engines plans to re-create the material, but also has the option of buying from a French company, which has a similar product.

Under the heat shield is the superstructure of the space plane, which is to be made of titanium-silicon struts. The technicalities of this alloy have been overcome and now the work is focusing on reducing the strut's manufacturing cost, officials say.

Titanium is known to be an expensive metal to process. Reaction Engines is also planning for a shaker table that would shake a scale-model of a portion of the superstructure and its struts, to demonstrate the vehicle can cope with the forces it will experience during the rapid ascent into orbit.

Making progress

Such progress is enough that Hempzell is expecting in a year's time "to give ESA Skylon as a comparable [vehicle], they will be able to do an apples-for-apples comparison, I hope," he said.

That apples-to-apples comparison with expendable launchers will be more than a technical comparison. On July 18, Reaction Engines had a meeting with the ESA's launcher directorate, which oversees European rocket development. Also present were the U.K. Space Agency and representatives from the ESA's European Space Research and Technology Centre.

"We showed them the [Skylon development] program," Hempzell said. "The launcher directorate was less concerned by the technical details, I think because ESTEC are already monitoring that. The launcher directorate felt they didn't need to do a technical job because ESTEC and Mark Ford's chemical propulsion department are already doing a technical job on us."

The launcher directorate's confidence in Skylon follows a technical assessment of the space plane by the agency that concluded in May 2011 that there were no issues that would prevent successful continued development of the space plane.

Instead, Hempzell explained, Reaction Engines' approach was "trying out a standard business model. We're treating them like our first customer, such as an airline's got a requirement, we might not have exactly what they have in mind, but we turn up with the product we've got." [Pictures: Breaking the Sound Barrier]

Business model

The business model for Skylon is a plan to offer the vehicle as a transportation system like a railway, a shipping company or an airline. Those are similarly large-scale investments in the million- and billion-dollar range, with a return that is spread over many years.

These various technical assessments and oversights led ESA Director-General Jean-Jacques Dordain to speak of his agency's increasing interest in Skylon and the planned July 18 meeting at an impromptu media briefing a week before, on July 10 at the Farnborough International Airshow in Hampshire, England. "I think there is a genuine interest there in terms of what we can do for [ESA]," Hempzell said. "We mostly concentrated on what Skylon would look like in a European context. How it would be marketed and funded."

Another reason for Dordain's interest in Reaction Engines is its application to the launcher directorate's New European Launch Service (NELS) program.

Unsuccessful in its initial bid, Reaction Engines will continue to inform the directorate of its progress while two companies, Germany's OHB System and EADS Astrium, maker of ESA's workhorse rocket, Ariane 5, have been funded with up to 2 million euros (\$2.5 million) for the one-year NELS program.

In Hempzell's view, the launcher directorate was surprised that Reaction Engines met NELS technical requirements but without the directorate's assumed model about how the requirements would be met.

On the same day Dordain spoke of his agency's interest in Skylon, Reaction Engines announced at its air show exhibit that its March and April heat exchanger tests had been successful. The U.K. government space minister, David Willetts MP, was present and endorsed the space plane. "The technology has been appraised by ESA and our [UK] space agency, and their assessments have always been very positive," Willetts said. "I've been very impressed with the technical assessments so far."

Willetts added that his government was considering how it can support Reaction Engines further. This could include resolving regulatory issues, because there are no European rules about operating reusable space planes. The ESA's head of chemical propulsion, Mark Ford, was also present and said, "We've been impressed with what has happened so far. ESA expects a successful outcome by the end of the year. For the heat exchangers there are spinoffs for aviation and other industries."

Deal Gives Aerojet A Big Boost (SACBIZ)

By Mark Anderson

Sacramento (CA) Business Journal, July 30, 2012

By acquiring Southern California-based Rocketdyne, GenCorp Inc. is poised to become the Sacramento region's largest public company — and to better compete for business in the rapidly evolving aerospace industry.

The Rancho Cordova-based parent of Aerojet on Monday announced it would spend \$550 million for Pratt & Whitney Rocketdyne of Canoga Park. If the deal is consummated as envisioned next year, GenCorp (NYSE: GY) would have combined revenue estimated at nearly \$1.7 billion. That would far surpass the region's current top public company, newspaper publisher The McClatchy Co. (NYSE:MNI).

"This is a transformative event for the company," said Kathy Redd, ...

DigitalGlobe, GeoEye Deal Could Protect Colorado Jobs (DENBIZ)

By Greg Avery

Denver Business Journal, July 30, 2012

Longmont-based DigitalGlobe's \$900 million victory in the buyout deal between the nation's only commercial satellite imagery companies is expected to preserve a lot of aerospace jobs in the Denver area.

DigitalGlobe (NYSE: DGI) is acquiring its rival, GeoEye, based in Herndon, Va., in a deal announced July 23. The merger is expected to lead to some layoffs, because reduced government spending on imagery contracts drove the consolidation.

But the deal is likely to preserve Denver-area jobs that might have been lost had GeoEye been the acquirer or began struggling to maintain its business.

DigitalGlobe will keep its headquarters in Longmont, ...

SpaceX CEO No. 4 On Fortune's Executive Dream Team (ORLBIZ)

By Megan Anderson

Orlando (FL) Business Journal, July 30, 2012

CNNMoney and Fortune Magazine compiled their 2012 Executive Dream Team of nine all-star execs, including SpaceX founder, CEO and chief designer Elon Musk who ranked No.4.

SpaceX has launched several satellites from Cape Canaveral. The company has also successfully launched its Falcon 9 rocket with the unmanned Dragon capsule from the Space Coast in May, becoming the first private company to send a rocket to the International Space Station.

SpaceX plans to perfect the Dragon capsule's cargo delivery system and then turn to transporting U.S. astronauts.

Here's what Fortune had to say about Musk:

"Apple industrial design chief Jony Ive may be the best-known designer in the world, but Musk brings a more diverse background. He's a CEO with design skills and an entrepreneurial mindset that any corporation would covet. The PayPal co-founder, only 41 years old, went on to create SpaceX, which aims, with NASA's blessing, to revolutionize space travel, and Tesla Motors, which offers its own electric-car models (like the gorgeous Roadster) but also sells technology to other auto giants. As a designer, he appreciates the importance of good user experiences and interfaces; as an executive, he's driven, passionate, and well-connected. Musk is a true innovator."

SES Profit Buoyed By HD, Emerging Market Demand (SPCENWS)

By Peter B. De Selding

Space News, July 27, 2012

Satellite fleet operator SES on July 27 reported a 4.8 percent increase in revenue and a 5.3 percent increase in gross profit for the six months ending June 30, saying emerging-market demand and Europe's appetite for high-definition (HD) television remained strong.

The North American market, as expected, showed almost no growth, but SES said it has been able to redeploy satellite assets over the North American arc to Latin America to capture the growth there.

In conference calls with journalists and financial analysts, SES Chief Executive Romain Bausch said SES's push into the emerging markets of Latin America, Africa, the Middle East and Asia delivered the expected results in the first six months of 2012.

Revenue from these markets, which Luxembourg-based SES does not break down into specific regions, increased by 8 percent over the first half of 2011, to 232 million euros (\$292 million) after adjusting for foreign-exchange fluctuations.

SES is in the middle of a large expansion program that is deploying new satellite capacity worldwide, but with a special focus on the markets outside Europe and North America.

Bausch said per-transponder revenue, meaning the average annual pricing of leasing 36 megahertz of bandwidth over the emerging markets, remained stable despite patches of weakness in Africa.

He reiterated SES's view that African pricing would remain soft, and may decline slightly, in the next several years as the continent absorbs new satellite capacity coming into the market. After that, he said, pricing and satellite fill rates will increase.

The average fill rate of satellites pointed toward the emerging markets was 74.2 percent as of June 30, lower than in Europe (81.4 percent) and North America (74.2 percent) mainly because SES is busy launching new satellites there.

In Europe, the demand for high-definition television, which broadcasters often must simulcast with standard-definition television for viewers that have not yet switched to HD, remained so strong that Europe-based revenue growth compensated for the loss, on April 30, of 29 transponders following the switch-off of analog television in Germany.

The loss of the analog business, long planned under German government order, will deprive SES of 107 million euros in 2012 when compared to 2011, and of 150 million euros in 2013, the first full year without the analog business.

SES said it has already resold 13 of these transponders, including 10 that are already generating revenue from new customers, with the remaining three set to re-enter commercial service by January 2014.

Longer term, Bausch said the position of satellite television worldwide looks promising as the same broadcasters that now simulcast programs in both standard-digital and high-definition format in the coming years will move to simulcasts in high-definition and a new standard called ultrahigh-definition.

Compression technologies will advance as well, but with networks broadcasting in HD and ultra-HD, satellite fill rates should remain high, Bausch said.

SES reported revenue of 891.9 million euros for the first six months of 2012, up 4.8 percent, or 1.4 percent at constant exchange rates. EBITDA, or earnings before interest, taxes, depreciation and amortization, was up 5.3 percent and was equivalent to 74.6 percent of revenue, compared to 74.2 percent a year ago.

Winning Spaceport Poster May Mean Career Lift-off For Emirati (NAT)

By Melanie Swan

The National, July 30, 2012

Mariam Al Hammadi is set to become the first of many Emirati students to benefit from the upcoming Virgin Galactic spaceport in the capital.

Ms Al Hammadi, a third year graphic design student at Zayed University, won a competition earlier this year to design a poster telling the story of Abu Dhabi becoming the second spaceport, following on from the New Mexico base that opened last year.

The poster was used to promote the Abu Dhabi spaceport project at the Farnborough Air Show in England earlier this month.

It is the first of many planned educational collaborations for the company.

Accompanied by her brother, Yousif, Ms Al Hammadi, 22, will spend six weeks as an intern at Virgin Galactic's London headquarters later this year.

Stephen Attenborough, the commercial director at Virgin Atlantic, hopes the relationship with Zayed University and possibly other institutions will grow.

"The new private space industry that Virgin Galactic is spearheading will create hundreds of thousands of new jobs in many fields," he said. He added that among the high calibre entries, Ms Al Hammadi's work, Taking you out of this world ... , stood out for its "creativity, vision and sense of fun".

Ms Al Hammadi said: "The space-port is a big thing for Abu Dhabi. It's opening a new door for people to go to space, not just astronauts but many people. It's such an exciting project and I wanted to convey that in my design, which was meant to attract people to space travel."

She said being in Britain for the air show last month made her realise just how little people know about Abu Dhabi, and she was proud to be able to tell them about her home.

David Howarth, Ms Al Hammadi's teacher, was not surprised by her win. "She's very outgoing and we knew when we were looking at the finalists that she'd be the strongest candidate. It was her personality as much as her design."

Representatives from Virgin had come to brief the students on the project. "We wanted the students to depict the story that within the next five or 10 years, we'll be able to sit in a plane and go to outer space," Mr Howarth said. "They [Virgin] wanted someone to help promote the air show and the collaboration with the UAE and Abu Dhabi."

In April, Virgin Galactic announced Abu Dhabi would be the location for its second spaceport.

The service will let six passengers at a time ride into a low Earth orbit aboard Space Ship Two, which will be carried by one of the company's White Knight Two launcher vehicles. Tickets will cost US\$200,000 (Dh730,000) per passenger.

The Abu Dhabi spaceport, a partnership with Aabar Investments, will include a long runway and a nearby zone of airspace for the ascent. It is hoped it could become a space and science centre with activities for families on holiday as well as for regional students.

There may be links to local university programmes with the possibility of integrating space flight experiences with university degree programmes.

IN THIS WEEK'S WEEKLIES

Mitt Romney: Too Wimpy For The White House? (NWK)

By Michael Tomasky

Newsweek, July 29, 2012

It should be the easiest thing in the world for a presidential nominee: a trip to England. The mother country, the shared tongue, our firmest ally. And it should have been easiest of all last week, happening as it did on the eve of the Olympics. Just praise everything you see. Limn London as one of the world's great cities, invoke the spirit of the British

people that lives on from the glorious days of the blitz. Praise the bangers and mash and the pasties if you have to. Nothing to it.

And yet, Mitt Romney managed to alienate just about every living Briton. He didn't merely criticize the organizers or bureaucrats—he questioned the people of Britain themselves: “Do [the people] come together and celebrate the Olympic moment?” He wasn't sure. The Sun even went so far as to dub him “Mitt the Twit.”

It was an astonishing faux pas—one of many packed into his brief visit. And it makes one wonder: if elected, Romney is going to have to work hand-in-glove with Prime Minister David Cameron and other world leaders on the ongoing global financial crisis and other issues. What unintended offenses are going to tumble out of his mouth then, when he's representing our nation on the world stage?

The episode highlights what's really wrong with Romney. He's kind of lame, and he's really ... annoying. He keeps saying these ... things, these incredibly off-key things. Then he apologizes immediately—with all the sincerity of a hostage. Or maybe he doesn't: sometimes he whines about the subsequent attacks on him. But the one thing he never does? Man up, double down, take his lumps.

In 1987, this magazine created a famous hubbub by labeling George H.W. Bush a “wimp” on its cover. “The Wimp Factor.” Huge stir. And not entirely fair—the guy had been an aviator in the war, the big war, the good war, and he was even shot down out over the Pacific, cockpit drenched in smoke and fumes, at an age (20) when in most states he couldn't even legally drink a beer. In hindsight, Poppy looks like Dirty Harry Callahan compared with Romney, who spent his war (Vietnam) in—ready?—Paris. Where he learned ... French. Up to his eyeballs in deferments. Where Reagan saddled up a horse with the masculine name of El Alamein, Mitt saddles up something called Rafalca—except that he doesn't even really do that, his wife does (dressage). And speaking of Ann—did you notice that she was the one driving the Jet Ski on their recent vacation, while Mitt rode on the back, hanging on, as Paul Begala put it to me last week, “like a helpless papoose”?

Another point of comparison with Bush Sr. is instructive. Newsweek identified Bush's wimp problem as being laced into his adherence to an old, upper-class, WASP civic code: the idea that one does not put oneself inordinately forward. At his boarding school, students literally received grades in a category titled “Claims no more than his fair share of time and attention.” Somehow, in 1987, this magazine decided that high marks in that realm constituted a demerit. But a quarter century, one global financial meltdown, several concentrations of wealth, and many magnitudes of culture-coarsening later, that sounds like a real plus. He was magnanimous, and his magnanimity was grounded in a code of honor.

Romney was raised in that same code—his father was the epitome of the civic-minded millionaire (except, of course, the Romneys were not WASPs). But as Mitt was making his fortune, those old values were being ground to dust by new Gordon Gekko values. The clash between those competing value systems exists inside him. There's some of the old—he gives away plenty of money and so on. But the new values surface often enough—his fondness for firing people, the way he made fun of NASCAR fans' ponchos, his reminders to us that his friends are the people who own the teams, and now his putdown of an entire nation, which happens to be our closest ally—to suggest that they won the argument.

A good-looking guy doesn't have to walk around saying, “Hey, look at me!” He knows everyone's looking. And a rich guy doesn't have to remind us he's rich. When he does, something's off. It looks insecure.

Romney is the genuine article: a true wimp. Oh, there are some ways in which he's not—a wimp lets himself get kicked around, and Romney doesn't exactly do that. He sure didn't during the primaries, when he strafed Rick Perry and carpet-bombed Rick Santorum (but note that they were both weaker than he).

In some respects, he's more weenie than wimp—socially inept; at times awkwardly ingratiating, at other times mocking those "below" him, but almost always getting the situation a little wrong, and never in a sympathetic way. The evidence resonates across too many years to deny. What kind of teenager beats up on the misfit, sissy kid, pinning him down and violently cutting his hair with a pair of school scissors—the incident from Romney's youth that *The Washington Post* famously reported (and Romney famously didn't really deny) back in May? The behavior extends, through more sedate means, into adulthood. The Salt Lake Olympics remains his greatest triumph, for which he wins deserved praise. But to many of those in the know, Romney placed a heavy asterisk next to his name by attacking the men he replaced on the Olympic Committee, smearing them in his book, even after a court threw out all the corruption charges against them.

And what kind of presidential candidate whines about a few attacks and demands an apology when the going starts to get rough? And tries to sound tough by accusing the president who killed the world's most-wanted villain of appeasement? That's what they call overcompensation, and it's a dead giveaway; it's the "tell." This guy is nervous—terrified—about looking weak. And ironically, being terrified of looking weak makes him look weaker still.

Harvey Mansfield, the Harvard political philosopher, is a godhead to conservatives. He wrote a book while Bush was president called *Manliness*. It was a self-parodic volume, but conservatives loved it. In 2006 an interviewer asked Mansfield his definition of manliness, and he said: "confidence in a situation of risk."

By this definition, the conservative definition, Romney is a total bust. He's the most risk-averse major politician to come along in ages. He accepted the job at Bain Capital only after wringing out of Bill Bain a promise that, if the venture failed, Mitt would be welcomed back to Bain & Co.—at his old levels of compensation and seniority—and that the press and public would be fed some happy talk about how it had all gone as intended. And why didn't he leave Bain in 1999 to go run the Olympics, as he always said he had, but instead take his now-famous "leave of absence"? To have the option of coming back; to minimize the risk. Even his flip-flopping, his taking of positions all over the map, is a form of risk aversion, being all things to all people, able to placate any audience, never stuck out on a limb unable to satisfy.

There's another conservative yardstick on which Romney comes up short: he's too smart, as in clever or book-smart, to be a real Republican candidate. All those stories about how intensely data-driven he was at Bain, or as governor? Weird. Liberals, men of caution and contemplation, are obsessed with data. Conservative men are supposed to be men of action—they have hunches and play them. In this one sense Romney is just like a Massachusetts liberal. When it's said that conservatives still don't trust the guy, it's not just his past moderate record they distrust, but also this sense of Romney as approaching issues intellectually instead of instinctively, producing the lurking unease that if he got into that Oval Office, Romney might one day look at the evidence and decide that, by *Jiminy Cricket*, global warming does exist!

Which ties directly to his biggest wimp problem. He still, after five years and two presidential campaigns, has yet to take one real stand on any issue; has yet to adopt one position that troubles his party's hard right. At least Obama praised Ronald Reagan. And he meant it. Romney has tried to praise Bill Clinton, but it was so obviously by way of denouncing Obama that it came off sounding hollow and too clever by half.

The catalog of Romney flip-flops is lengthy and by now famous: abortion rights; support for Planned Parenthood, to which he and his wife once wrote checks, now in his gun sights; Grover Norquist's "no tax increases" pledge, which he admirably refused to sign as a gubernatorial candidate but since 2007 has taken up with gusto; on immigration, where he once supported a path to citizenship; on guns (he supported the Brady Bill in the 1990s); on "don't ask, don't tell"; and, most famously of all, on health care.

These are conventionally explained by the obvious political dichotomy: the moderate positions were adopted when he was seeking votes in Massachusetts, the conservative ones when he went national. That's true as far as it goes.

But there's more going on in this case. All politicians undergo a tuck here and a trim there. Comparatively few turn outright somersaults on big issues, let alone half a dozen or more of them. What gives? Most pols in Romney's position would think: OK, I've got to change some stances, but I'd better keep one or two, just to show I stand for something, and accept the consequences. But not Romney.

Politicians change positions for three main reasons: financial ambition, political ruthlessness, and political cowardice. Romney already has the big money, so that's out. Ruthless? Not really—a ruthless change of position is one designed to please one group of people but equally to piss off another group. Romney's flip-flops are solely about making a group of highly suspicious voters like him. That, folks, is door No. 3.

The Presidential Studs: George W. Bush and Ronald Reagan set the modern standard for chief-executive manliness. (Pete Souza / AP (left); Charles Ommanney / Getty Images)

Compounding matters, when pressed to the slightest degree about his inconsistencies, he can get nasty and whiny. No one talks anymore about his encounter with Bret Baier of Fox News last December, but it was a Moment. When Baier had the nerve to challenge him on his health-care and immigration views, Romney complained—told Baier his questions were “uncalled for!” Of course it was Fox, which is supposed to be his on-air public-relations firm, so Romney was shocked. But even so, you don't say it. A politician complaining about a journalist just doing his job is ... weenie-ish.

In a similar vein, it was breathtaking, and a meaningful window into his thinking, that he thought denouncing “Obamacare” to the NAACP constituted courage. That was the opposite of courage—an easy shot aimed at people who aren't voting for him anyway. Going to the Southern Baptist Convention and telling them they're all wet about Mormonism? Now that would be courage. Can anyone picture Romney doing that in a million years? The Mormon God will come down from Kolob before that happens.

This is the first presidential campaign of the post-World War II era in which neither candidate is a veteran. With no one having that card to play, the candidates have to nudge the testosterone meter through other means.

Obama is not your stereotypical gunslinger, that's for sure. He came into office as the liberal beau ideal. His opposition to the Iraq War was his great calling card, along with his race. But now look: he's knocking off terrorists at a pace that Cheney would envy. Despite what conservatives believe—that liberals are silent about this because it's a Democratic president doing it—he takes a lot of whacks in the liberal press over this. But his mind is made up. For better or worse, he's not going to be a Jimmy Carter or a Mike Dukakis under any circumstances he can help.

In the Osama bin Laden raid, he made the toughest high-pressure decision a president has made since the Cuban missile crisis. Talk about risk! Harvey Mansfield must have swooned while watching that gripping 60 Minutes segment when Obama and others discussed how it all went down.

What a crazy, and crazily unseeable, irony that would be, if Barack Obama ended up being the guy who turned the Democrats into a tough-guy party again. They've been trying for years, since the post-Vietnam 1970s when these lines began to harden. Clinton was getting there in his second term with the Kosovo business and a wave of foreign-policy successes, but Monica got in the way. Even after that, Clinton came within a few hours of getting bin Laden in August 1998, although at that point, most Americans would have asked, “Who?”

Then came 9/11, and we know all that history. Bush on the pile of rubble with the megaphone—giving him enough tough-guy momentum to coast all the way through the 2004 election. But by 2008, the macho bank had been seriously depleted—starting and not being able to finish two wars will have that effect.

But even so, the Democrats remained totally emasculated. Didn't know what to do. The two other leading presidential contenders, Hillary Clinton and John Edwards, spent the pre-2008 years doing everything they could to shore up their macho cred. But it took the most unlikely one of them—antiwar, cerebral, urban, a community organizer; someone who, when he launched his quest for the presidency, may not even have known the difference between a brigade and a battalion—to bring the party back to the Truman-Acheson roots the Republicans tried so hard during the Bush years to replant in their own soil.

Romney will go at Obama hard until the election on Pentagon cuts and security leaks and Obama's alleged apologies for America. Here and there he'll score a point. But here, too, he's just trying too hard. You watch something like his recent VFW speech, and you see that he so desperately wants people to see him and think: "He's like Reagan." Please. You would no more cast Romney as Reagan than you would Pee-wee Herman as James Bond.

Republicans and conservatives seem to know all this: many of them wanted New Jersey Gov. Chris Christie to jump in. Now, there's a Republican man! Bellicose, sharp-tongued, a gleeful crusher of liberal pieties. Even his girth seems somehow manly. (Maybe it's the way he throws it around.) He's a smart choice to keynote the party's convention—he'll supply the tough-guy shtick the nominee can't.

Every once in a while, a George Will or Bill Kristol will fret in public that Romney just doesn't have the sauce. Donors and GOP honchos, while giving him their full backing because they despise Obama, are well aware that Romney was just the least bad of the party's available candidates—not the sort of man Republicans prefer carrying their standard into battle, and one whose defects, should he lose, could injure the party long into the future, especially on what used to be the GOP's "natural" foreign-policy advantage.

But if Romney is elected? Be nervous. A Republican president sure of his manhood had nothing to prove. Reagan was happy with a jolly little shoot-up in Grenada, and eventually he settled down to the serious work of arms control, consummating historic treaties with Mikhail Gorbachev. But a weenie Republican—look out. He has something to prove, needs to reassert that "natural" advantage. That spells trouble more often than not.

Still, there's a campaign to get through first. At some point, an unexpected event more serious than the Olympics—a scandal, a smear—will put Romney under the interrogation lamp, and he'll need to rise to the occasion. We'll see then if he has it in him. So far, he wants to sneak into the White House through a side door, without having to do any of the difficult and controversial things candidates have to do. Voters want candidates who are harshly tested and emerge from those tests stronger. Romney is desperate above all else to dodge them—and when they have come, he's failed.

Exclusive: John McCain Stages Romney Intervention (NWK)

By Howard Kurtz

Newsweek, July 29, 2012

When Mitt Romney declared, during a Republican primary debate in Tampa, that he would pressure illegal immigrants to "self-deport" back to their home countries, John McCain was downright disturbed. Worried that his former rival was grievously wounding himself with Hispanic voters, the Arizona senator staged an intervention. He and fellow senator Lindsey Graham placed a joint call to Romney in January, urging him to tone down his rhetoric. Romney listened politely, sources say, and did not use the phrase again.

Romney "has not got a lot of instincts on some of these national-security issues," McCain says. (Richard Ellis / Getty Images)

It was a rare instance of Romney taking counsel from the man who beat him in the last campaign—and who has been relegated to a behind-the-scenes role in this one. Four years after his own presidential bid, McCain's luster as a Republican Party spokesman appears to have dimmed: a number of proposed campaign trips on Romney's behalf have quietly evaporated, and there has been no offer of a speaking slot at the GOP convention. "He's chomping at the bit to do something," a McCain aide confides.

Romney, to be sure, has been willing to use McCain when it suits him. The candidate's strategists have asked him to do fundraising events in places like Annapolis, Md., and Pensacola, Fla., where he is popular among military families. But such events take place far from the television cameras. "If you're the Republican nominee, the campaign is about the future," says Steve Schmidt, who oversaw McCain's 2008 effort. "John McCain is very much a figure of the immediate past."

Right after losing to Barack Obama in 2008, McCain went to Tahiti, where he would hang around the hotel desk waiting for a one-page sheet of news to come in. "I almost went crazy," he recalls. "You're all geared up. You can't come to a full stop."

Having once delighted in working with Democrats, McCain might have emerged as a dealmaker during the Obama era. But there were two problems. First, McCain had to embrace a harder-edged conservatism to survive a primary challenge in Arizona. "He understood the party was in rebellion and he'd have to move substantially to the right," says a former lieutenant.

Watch: McCain on Romney

(/content/newsweek/2012/07/29/john-mccain-is-chomping-at-the-bit.img.jpg)

The other glitch was his strikingly antagonistic relationship with Obama. Despite a fence-mending meeting at the White House last year, the president never called again. McCain contrasts Obama's aloof approach to lawmakers with that of Bill Clinton, who "was remarkably good to me." In fact, McCain told me that he and Clinton chatted about policy in occasional phone calls during his 2008 campaign, even as the former president was backing Obama.

As for McCain's relationship with Romney, it seems to have improved—somewhat—since 2008. The wounds sustained during their primary battle had been unusually deep and personal: When Romney charged him with promoting amnesty for illegal immigrants, McCain accused his rival of "desperate, flailing, and false attacks." And at one point, Romney ripped McCain for "Nixon-era" tactics. But once the battle ended, says McCain, "nobody helped me more than Mitt Romney." The vanquished candidate visited McCain's retreat in Sedona "and we became friends. I wouldn't say close friends. Why look back in anger? It's not healthy for you mentally."

The Romney camp has made similarly conciliatory noises. Stuart Stevens, Romney's top strategist, told me that McCain is "a tremendous asset." But if that's the case, why has he been so underutilized on the campaign trail?

One reason may be McCain's tendency to commit candor. The senator caused a stir when he recently told reporters that his decision to bypass Romney as the VP pick in 2008 had nothing to do with his tax returns; it was, he said, that "Sarah Palin was the better candidate." (McCain told me that he didn't mean the remark as a dig at Romney—and added that complaining about out-of-context headlines "is just stupid and a waste of time.") Then, days after the Palin flap, McCain launched a stinging assault on GOP congress-woman Michele Bachmann for questioning whether Hillary Clinton aide Huma Abedin had ties through family members to the Muslim Brotherhood. Bachmann's accusations, McCain told me, are "just terribly wrong ... It's McCarthyism."

But the bigger problem may be that Romney—and the Republican Party -itself—has moved to a very different ideological place than McCain has. The senator is careful not to betray any hint of dissatisfaction with Romney. "He asks

me for advice and we have good conversations. He certainly listens to me," McCain says. Yet there is mounting evidence that his suggestions are incompatible with the image Romney is trying to project.

McCain says that Romney supports the Simpson-Bowles budget plan "as a blueprint"—but the proposal includes tax increases, and Romney is talking about slashing corporate tax rates instead. And, even though Romney took McCain's advice on the phrase "self-deport," he has remained further to the right on immigration than the senator would like. "He gets 24 percent of the Hispanic vote," McCain told me. "They need to do more outreach."

McCain's greatest strength is as a leader on foreign affairs, Schmidt says, but that is the issue on which his differences with Romney may be the starkest. "He has not got a lot of instincts on some of these -national-security issues, but he has the right instincts," McCain says. Yet the candidate rarely brings up the muddled mess in Afghanistan; nor has he embraced McCain's call for U.S. airstrikes to support the rebels in Syria. "We all know it's not popular, including with the Ron Paul wing of our party," McCain admits.

It's little surprise, then, that Team Romney doesn't want to give McCain a high-profile surrogate role—and be stuck defending his pronouncements on military intervention. "Do they want to own McCain on foreign policy?" one of the senator's confidants asks. "McCain is never a talking-points guy, and for a cautious campaign, that can be kind of a nightmare."

There may be one more reason for Romney's reluctance to involve McCain: both politicians are, at heart, men of moderation who had to suppress those instincts to appease the party's conservative power brokers. McCain's presence on the trail might serve as a nagging reminder that neither candidate was the right wing's choice for the nomination.

For the moment, McCain is something of a caged lion, circling his circumscribed world, using vacation breaks to jet off to foreign-policy hotspots. Early this month, McCain was in Tripoli, where he watched 200,000 flag-waving people pour into the streets to cheer Libya's first democratic election in four decades. Many approached him, some wearing T-shirts bearing pictures of slain relatives, to thank him for his push for U.S. airstrikes against Muammar Gaddafi's regime. "John likes a good fight," says his Senate pal Joe Lieberman. "He likes being in the arena."

But the domestic arena has drastically changed, and McCain bears part of the responsibility. It was his gamble with Palin—they still stay in touch—that helped unleash the hard-right tide that swept moderates and traditional conservatives from Capitol Hill, and turned the Republican primaries into a pandemonium.

McCain resists the notion that the GOP has been captured by Tea Party types who have little use for him. "If the party had been taken over by that, Mitt wouldn't be the nominee," he says. Yet he also points out that, with the Supreme Court unraveling his beloved campaign-finance reform, the party is today "less relevant," much of its power having been lost to super PACs. "Now that we have Citizens United," he says, "nobody has to go to the Republican Party for money. You go to Sheldon Adelson, you go to Karl Rove." Which may help explain why John McCain is looking on from the shadows.

Failure To Launch (TIME)

By Fareed Zakaria

Time, July 27, 2012

Mitt Romney picked a bad day to launch a blistering attack on Barack Obama's foreign policy. As Romney was speaking to the annual gathering of the Veterans of Foreign Wars, charging Obama with weakness, betrayal and mendacity, NBC News and the Wall Street Journal released a new poll. It turns out that on "handling of foreign policy," Americans prefer Obama to Romney by 15 points.

Romney's principal charge against Obama is that he has angered America's allies and emboldened its enemies. Again, it turns out that some recently released data contradict the claim. The Pew Foundation released one of its global surveys in June, soliciting opinions from several countries around the world. When asked if they have "some" or a "great deal of" trust in President Obama, the numbers are overwhelmingly positive. In Britain, for example, which is Romney's first stop on his foreign tour, 80% of people trust Obama, compared with 16% who trusted George W. Bush. All countries surveyed have much higher approval ratings of America in 2012 than they did in 2008, when Bush was President. (It's fair to note that the numbers have come down from their 2009 highs, just after Obama's Inauguration, when expectations were soaring.)

In order to give substance to his claim that Obama has let down our allies, Romney dwells at length on a minor issue: the supposed humiliation of the Poles and Czechs over the building of an antimissile system. That is presumably why Romney chose to visit Poland, a country where he thinks attitudes toward Obama will be distinctly cool. That narrative is often repeated on the right. On July 23 the conservative commentator George Weigel of National Review argued that the Poles are extremely nervous about this election, worried that Obama might remain in the White House and continue his allegedly anti-Polish policies.

The Pew survey, however, gives us the numbers. Poles think Obama deserves a second term by a ratio of nearly 5 to 3. In the Czech Republic, the ratio is more than 6 to 1. It was so much easier to characterize whole countries' attitudes in the old days, when nobody did polls in them!

There are parts of the world where approval rates for Obama have dropped significantly and where America is viewed with suspicion. They include Russia, China and the countries of the Arab world. This would suggest that Obama has not given these countries what they want, thus earning their disfavor. That is precisely what Romney seems to want in his speech--approval from allies and disapproval from adversaries.

And consider the reasons Obama's ratings are low in the Arab world. The two strongest justifications given by people in every Arab country that was surveyed are, first, that he has not been fair in dealing with the Israeli-Palestinian issue, and second, that he has used drone attacks in Afghanistan and Pakistan to go after terrorists. In other words, the reason Obama has lost some of his global popularity is that he is perceived as too pro-Israeli and too hawkish.

Romney has tried to dredge up the standard-issue Cold War Republican attack on Democrats: the world is dangerous, our enemies are growing strong, and Obama is weak. The problem is, most Americans recognize that none of this is true. The world is actually quite peaceful right now; our adversaries--like Iran--are weak and isolated. China is growing strong but has not used its power to contest America in national-security terms. The one enemy Americans recognize and worry about remains al-Qaeda and its affiliated Islamic terrorist groups, and Obama has been relentless in attacking them.

Mitt Romney is a smart man who has had much professional success. But even Republican insiders have admitted to me that he has been strangely amateurish on foreign policy. His campaign, they note, is not staffed by the obvious Republican foreign policy heavyweights--people like Robert Zoellick, Richard Armitage, Richard Haass and Stephen Hadley. As a result, he has blustered about Russia's being our greatest geopolitical adversary (actually it is a second-rate power), seems willing to start a trade war with China, is vague yet belligerent about Syria and Iran and has gone back and forth on the timetable for withdrawal from Afghanistan.

Romney faces a tough problem. President Obama is the first Democrat in nearly 50 years to enter an election with a dramatic advantage in foreign policy. (The last time was Lyndon Johnson vs. Barry Goldwater in 1964.) Unless Romney can craft a smart, strategic alternative, that gap will only get wider.

Between The Lines: By Mark Halperin (TIME)

By Mark Halperin

Time, July 27, 2012

With about 100 days to go until Nov. 6, campaign veterans spy a rarity in presidential politics: both the Obama and Romney operations like their chances of winning ... The phrase used consistently by each side: "I would rather be us than them" ... That is a shift from the recent past, when the McCain, Kerry, Gore and Dole camps all projected the air of fretful underdogs at this stage ... Two seminal new television commercials from the President's team perfectly capture both the incumbent's expectation of victory and his awareness of his vulnerabilities ... In one 60-second ad, "The Choice," President Obama speaks directly to the camera, making the case he thinks will win him the election: contrasting his plans on the big issues with Mitt Romney's agenda, which he links to the George W. Bush years ... "The Choice" is free of ominous music and ghoulish Romney photos, instead highlighting what the Obama campaign considers its greatest asset: the President himself ... Many observers have called the spot the best of the election cycle so far ... A companion ad, which came out one day later, shows the re-election team on the defensive, with Obama responding to the Republican charge that he doesn't understand how the free market works ... Sustained weakness in the economy remains the President's biggest vulnerability, and his recent remark that "if you've got a business, you didn't build that"—taken out of context and exploited by the GOP as purported proof that Obama neither understands nor respects the private sector—is resonating across much of the country with CEOs and pizza-parlor owners alike ... Meanwhile, the President's foes at the Republican National Committee have put out a television ad in which a mournful and sympathetic narrator seeks to soothe guilty Obama '08 voters with the words "He tried. You tried. It's O.K. to make a change" ... Its obvious intent: to give wavering voters permission to fire a well-liked incumbent ... The political truce following the Aurora, Colo., shooting tragedy lasted all of 96 hours, just enough time to circuit-break the Democrats' long-running, rather successful attack on Romney's unwillingness to release additional years of tax returns and on the details of his record at Bain Capital ... Still, Democrats plan to revive the charge, spearheaded by Obama and Vice President Joe Biden, both of whom have demonstrated granular familiarity with their opponent's record, more than any ticket mates in recent memory Meanwhile, Obama headquarters in Chicago dismissed the criticism (rattled derision from Republicans and nervous anxiety from Democrats) over its hefty summertime budgets for TV ads and personnel: spending now, Obama aides say, will have a big impact in their efforts to define Romney, while attempts to reach voters in the fall through paid messaging may not work ... Romney's performance on the campaign trail in the past month has reinforced Democrats' confidence that their caricature of the GOP nominee will stick ... Republicans, wary over Romney's failure to overtake Obama despite the torpid economy, are looking to the model of 1988, when George H.W. Bush used a revelatory convention speech, withering advertising to key voter groups on radio and television, and strong debate performances to pull ahead in the final weeks of the race.

When The Rains Stop (TIME)

By Bryan Walsh

Time, July 27, 2012

Meteorologists call drought the "creeping disaster" because, unlike hurricanes and tornadoes, droughts normally unfold in slow motion, day after dry day. The "flash drought" of 2012, though, is proving to be anything but a slow burn. From the middle of June to the middle of July, drought gobbled up cropland at an alarming rate, pushing the amount of

land under severe drought from 17% to 39% of the continental U.S. Bone-dry weather combined with high temperatures—2012 is on track to become the hottest year on record—sucked the moisture from the air and the soil, toasting America's breadbasket. More than half the continental U.S. is parched—the largest swath of the country that has been this dry since 1956.

Crops are wilting in Corn Belt states like Illinois and Indiana, where some farmers have already given up on a harvest. Only 26% of the corn crop is currently rated good or excellent, according to the U.S. Department of Agriculture (USDA), whereas 45% is rated as poor or very poor. What was expected to be a record harvest—farmers planted more corn this spring than in any year since 1937—is sure to disappoint; the USDA has already cut the projected corn yield by 12%. That's caused prices to rise, with corn hitting a record \$8.24 a bushel on the Chicago commodities exchange. Last year at this time it was less than \$7 a bushel.

The torrid weather is hitting at a time when grain stockpiles are unusually low, increasing pressure on prices. If the drought lingers—and weather forecasts offer neither rain nor hope—we can expect to see more-costly food across the board this fall in the U.S. and, even worse, in developing nations where hundreds of millions already go hungry.

We've seen this before. Sharp spikes in the price of food in 2007 and 2010 helped lead to riots and may have been one of the sparks for the Arab Spring. It's no wonder that USDA Secretary Tom Vilsack's drought response apparently includes appeals to a higher weatherman. "I get on my knees every day," Vilsack told reporters in Washington recently. "If I had a rain prayer or a rain dance I could do, I would do it."

The secretary's rain dance is most needed in the heart of America's Corn Belt, where the drought is reviving memories of the Dust Bowl in the 1930s. But while farmers are the first victims of drought, a lot has changed since dispossessed Okies fled parched Midwestern farms for California during the Great Depression. For one thing, today's farmers had been doing pretty well: high crop prices, fed in part by growing incomes in overseas markets like China and by mandates for corn ethanol, helped U.S. farm income reach a record \$98.1 billion last year. Farmland in the Midwest was going for some 10 times as much per acre at the start of the 2012 growing season as it was a decade ago. There are fewer farmers now—just 1.2 million in the U.S., compared with 6.8 million in 1935—but they tend to be better off than the average American. While the financial hit from the drought of 2012 will almost certainly eclipse the \$78 billion in inflation-adjusted losses recorded during the great drought of 1988, the agricultural sector is in much better shape to absorb the damage.

In fact, some farmers may end up benefiting. Growers in the northern reaches of the Corn Belt have been spared the worst, which means they should be able to take advantage of record prices. But even farmers who have all but given up on their fields won't go under, thanks to subsidized crop insurance. This year, 85% of all planted acres in the U.S.—up from 75% a decade ago—are covered by some form of crop disaster insurance. If those farmers took out insurance plans with a harvest-price option, they'll be paid for crops destroyed by drought at the market price—a price, of course, that has increased thanks to that same drought.

Taxpayers can expect to foot a good deal of the bill, because the government now subsidizes much of the cost of private insurance. "Taxpayers are going to be the ones who will come to the rescue of Midwestern farmers," says Bruce Babcock, an agricultural economist at Iowa State University. "Crop-insurance companies are not going to be able to take on these losses."

How big will the bill be? Agriculture's indemnities losses last year reached \$10.7 billion thanks to a devastating drought in Texas and the Southwest, so this year's even drier weather will surely cost more.

While corn farmers smart enough to buy subsidized insurance will weather the weather, everyone else in the food chain will be worse off. First in line are livestock farmers, who will have to buy high-priced corn to feed their animals because pastures have been charred. Hog farmers, who depend on cheap corn, are hurting badly. Some ranchers are selling their cattle early out of desperation; the national cattle inventory is at its lowest level since the USDA began keeping track in 1973. The drought will actually lead to lower beef prices in the short term as a glut of cattle reach markets, but prices will rise as the industry struggles to rebuild itself after two crippling droughts in a row.

The cost of everything from hamburgers to cereals to Gatorade could go higher, since corn is the base of the U.S. food pyramid. For every 50% increase in corn prices--and corn has already jumped by more than half since the spring--retail food prices usually rise by 0.5% to 1%. It will take several months for the full effects to be felt in the processed-and-packaged-food industry, but drought will eventually deliver an unwelcome jolt to the struggling economy as it kicks inflation up a notch.

The drought's biggest victims may be people who work in the restaurant industry, where more-expensive food will raise operating costs and might discourage potential customers from stopping in if menu prices rise as a result. There's no subsidized insurance program for servers laid off because of the weather.

Still, Americans are comparatively well insulated from the increase in crop prices, largely because our diets are so full of processed goods that only about 15 of every dollar we spend on food actually goes to food. (Most of the remainder goes to packaging and advertising.)

That's not the case in developing nations, where hundreds of millions live on plain tortillas or bread and the cost of commodities really is the cost of food. A reduction in the American harvest translates to higher prices overseas. Global food prices have slowly but steadily increased since 2004, with sharp spikes in 2007 and 2010. It's likely not a coincidence that social unrest in places like Latin America and the Middle East followed those spikes. Global stocks of corn and soybeans were tight even before the drought. "We're on the verge of another crisis, the third one in five years, and likely to be the worst yet," says Yaneer Bar-Yam, a researcher at the New England Complex Systems Institute and the co-author of a new paper on the 2012 drought.

Much depends on whether the drought of 2012 really is just a flash. Though some much needed rain fell on the Midwest toward the end of July, forecasters are predicting that the drought will last until at least October, if not longer. And then there are the years beyond. While climate change has had an uncertain effect on this year's drought--blame La Nia, the periodic ocean cooling that can wreak havoc with weather--there's general agreement that dry conditions will become ever more common in the Midwest as the world warms. The creeping disaster could be here to stay.

Obama's Smart Electrical Grid Plan (TIME)

By Michael Sivy

Time, July 27, 2012

Washington, America's power center, recently experienced life without power--the kind that gets generated, not the kind that gets wielded. After a nasty storm knocked out the Beltway's electricity for days during a heat wave, power brokers of the political type complained: Didn't President Obama promise a smarter, more reliable grid?

Yes, he did. And the blackout notwithstanding, the grid is slowly improving. In fact, its story is a nice parable about change in the Obama era. On the trail in 2008, Obama had big dreams for a digital smart grid that would self-monitor and self-heal, minimizing costly outages by diagnosing problems electronically and rerouting power around them. He envisioned a national network of high-voltage transmission lines that would connect windy and sunny areas to cities, as

well as smart meters and other high-tech gizmos that would give us real-time feedback and control over our energy use. He basically wanted to merge the grid with the Internet so we could adjust our air conditioners with our iPhones when we were out of the house, program our appliances to save us energy and money and sell power from solar panels and electric cars back to our utilities.

After the election, Obama wanted his economic stimulus package to include some iconic, futuristic legacy projects to advance his long-term agenda. The smart grid seemed perfect, a modern moon mission, a 21st century version of the interstates. He suggested pouring in \$100 billion. "Let's just build it!" he told his transition team. His aides explained that that wasn't possible or even desirable. Utilities own the grid, and they could pay to upgrade it themselves. But it would take decades to convert an analog grid to digital and string high-voltage wires nationwide. Ultimately, Obama settled for \$11 billion in seed money. "There was this sense of frustration," his former budget director Peter Orszag recalled when I interviewed him for my forthcoming book on the -stimulus, *The New New Deal: The Hidden Story of Change in the Obama Era*. "Here's the first African-American President, the economy has fallen off a cliff, history is calling, and -really? I can't just do a smart grid?"

The frustration only mounted after the stimulus passed. The grid money got snarled in bureaucratic morasses, and the initial investments in smart meters actually inspired a backlash—partly because of unfounded fears about radiation and partly because smart meters aren't that helpful when the grid remains dumb. And their main up-front benefit was their ability to replace human meter readers, an inconvenient stimulus message.

But behind the scenes, Obama's billions are gradually upgrading the grid. Utilities now receive updates on transmission lines 30 times a second instead of every two seconds. They are also expanding transmission, even though electricity use has yet to recover to prerecession levels. "You wouldn't expect the industry to be building new wires left and right, but there's a huge amount of activity," says Peter Fox-Penner of the Brattle Group. Meanwhile, stimulus investments in sensors, auto-mated substations, "synchrophasors" and other unsexy electrical equipment are helping diagnose, pinpoint and solve problems before we even notice them so utilities no longer have to deploy battalions of trucks to troubleshoot entire neighborhoods. "People don't see it, but it's happening," Fox-Penner says.

What people see are blackouts, and they assume nothing has changed. Not even a smart grid can send power through a downed line. But over time it will be more reliable and user-friendly on a day-to-day basis. Nobody notices infrastructure investments when they work, but that's the point of infrastructure—and power.

One Washington resident whose lights stayed on was Rhone Resch, who has solar panels on his roof, perhaps because he's the solar industry's top lobbyist. His neighbors stopped by to charge their phones and enjoy his cold beer. "It was an Armageddon situation, and our house became the beacon of comfort," Resch says. The stimulus poured money into solar too, and installations have increased sixfold.

"That's right," Resch says. "That's change."

How The Gun Won (TIME)

By Joe Klein

Time, July 27, 2012

'We cannot and will not be passive in the face of such violence,' President Barack Obama said in January 2011, after a deranged gunman shot Congresswoman Gabrielle Giffords and 18 others, killing six. "We should be willing to challenge old assumptions in order to lessen the prospects of such violence in the future." He called for a "national

conversation" about "everything from the merits of gun-safety laws to the adequacy of our mental-health system," and he asked that it be conducted with civility. It was a terrific speech, perhaps the best of his presidency. And then ... nothing.

There has been no conversation about either gun control or the mental-health system—even though mass shootings have become a plague since the late 1970s, averaging nearly 20 per year according to James Alan Fox, a professor of criminology, law and public policy at Northeastern University. These rampages mean something, but the meaning is complicated and hard to untangle. The violence has a lot to do with the state of our mental health, the increased mobility and atomization of our society, the time young men in particular spend alone staring into television and computer screens, the comic-book depiction of brutality—and yes, the availability of ever more kinetic weaponry. It is a difficult topic, but as with the conversation we're having about the nature and equity of our economy in this election year, it is all about the transition from the industrial to the information age. The remedies, if any exist, are elusive. The President was right: this was, and is, a subject that needs to be addressed in a mature and subtle way.

And so it was striking, and disappointing, that both Obama and Mitt Romney—and most of a jaded mass media—scurried away from any substantive discussion after alleged gunman James Holmes went on a murderous spree in a Colorado movie theater, shooting 70 and killing 12. Holmes had amassed an arsenal that included a semiautomatic assault rifle and 6,000 rounds of ammunition. Sales of the gun that was originally identified as the shooter's weapon of choice were prohibited during the 10-year life of the 1994 federal assault-weapons ban; they were also prohibited in Massachusetts, after the federal ban expired, by the signature of none other than Governor Romney.

Romney's delinquency on the gun-control segment of this issue is understandable, part of the chameleon turn he's made to become the nominee of a political party that counts gun-rights advocates as an essential part of its base. But what about Obama? The Democratic Party has historically been the advocate of gun control. Bill Clinton signed into law both the assault-weapons ban, which George W. Bush allowed to lapse in 2004, and the Brady Law, which required background checks of those seeking to purchase handguns. Democratic-leaning constituencies—especially minorities and the poor—remain the primary victims of gun violence. And yet the party has abandoned the gun-control debate, leaving the field to an ever more fanatic National Rifle Association (NRA). It fell to poor Jay Carney, the White House press secretary, to deliver the President's views on the subject: "He believes we need to take steps that protect Second Amendment rights of the American people but that ensure that we are not allowing weapons into the hands of individuals who should not, by existing law, obtain those weapons."

As Obama seeks re-election, it is legitimate to ask why he and his party have accepted the Republican narrative on this issue—why he is standing "passive in the face of such violence."

The right to bear arms is famously enshrined in the U.S. Constitution. It is also enshrined in the American character, inherent in the chesty, libertarian Scots-Irish sensibility that populated the Appalachian backwoods and spread south and west from there. But no right is absolute. No American has the right to own a stealth bomber or a nuclear weapon. Armor-piercing bullets are forbidden. The question is where you draw a reasonable bright line.

In the early 1990s, after an astonishing rise in violent crime that started in the 1960s and peaked following drug-related gang violence during the 1980s, there seemed to be a critical mass for tighter gun laws. A Gallup poll found 78% in favor of more control. A good part of Bill Clinton's pitch—that he was a "different kind of Democrat"—was predicated on his being tough on crime, unlike previous Democrats who had tilted too far toward the "depraved because they're deprived" view of criminals. Clinton proposed to fund 100,000 new police officers during the 1992 campaign and made good on his pledge with the 1994 crime bill, which also included the assault-weapons ban. The bill was controversial because of the ban and some social-work add-ons like money for urban midnight-basketball leagues to keep kids out of

trouble. "I remember the President took a call from [House Speaker] Tom Foley and [majority leader] Dick Gephardt, who said that a lot of their members were scared to death of the gun-control portions of the bill," says William Galston, who served on Clinton's domestic-policy team. "But he stood firm on the ban."

The crime bill passed, 216-214, in the House, but only after Indiana Democrat Andrew Jacobs changed his vote. Jacobs was targeted by the NRA in the 1994 congressional elections but held onto his seat. Others weren't so lucky: 54 House Democrats were expunged that year; Republicans took control of the Senate as well. In the Sun Belt, Republicans routinely ran "3-G" campaigns emphasizing the social issues of God, guns and gays. Clinton attributed 20 of the Democrats' lost seats to NRA targeting. In his autobiography, Clinton wrote that the NRA "could rightly claim to have made Gingrich the House Speaker."

This was immediately accepted as political gospel, but the reality was a bit more complicated. Clinton's own failures, especially his attempt to push health care reform, had a lot to do with the result, as did several of his successes—like his budget plan that raised taxes on the wealthy. "My recollection is that the most important factor [in the rout] was the vote for higher taxes," says Stan Greenberg, who polled for Clinton in 1994. "But the gun issue was crucial in some districts, especially in the South and West."

Clinton had run as a moderate, but he spent his first two years governing like a liberal, or so it seemed in the South. A great many Sun Belt seats that had been redistricted to favor Republicans in 1990 but remained Democratic with Clinton's victory in 1992 were plucked by the GOP in 1994. In any case, it was less painful for Clinton to emphasize the role of the NRA in the election than to acknowledge his mistakes.

Even after the 1994 debacle, the Clinton Administration remained devoted to gun control. "The Clinton people didn't run away," recalls Jim Kessler, who served as legislative aide to Congressman (and later Senator) Chuck Schumer, who became the prime sponsor of most gun-control legislation. "We were able to add domestic violence to the list of criminal behaviors that were covered by the Brady Law. There were other small measures that passed with Administration support. And after the Columbine shootings in 1999, Schumer called the White House about pushing the abolition of the gun-show loophole"—which allowed arms to be sold at "private" events without background checks—"and was told, 'That'll be a great issue for Gore. Let's leave it for 2000.'"

Gore ran full bore on gun control after Columbine, even though he'd been pretty quiet about the issue as a Senator from Tennessee. His primary opponent, Bill Bradley, was a vehement gun-control supporter, "and Gore followed Bradley down that road," Kessler recalls. "They tried to outdo each other and both wound up way out in left field—in favor of licensing gun owners and registering guns, restricting purchases to one gun a month. Gore ran for President on the most radical gun-control platform in American history."

When Gore lost, Clinton was out again saying the NRA had beaten him, especially in Arkansas and Tennessee, and that if he, Clinton, had been allowed to campaign in those two states, Gore would have won. "The NRA was certainly a factor," says Elaine Kamarck, who was Gore's domestic-policy adviser during the campaign. "It was so close in so many states. There were a lot of factors. Ralph Nader was a factor. And a 7% drop in support among married women after the Lewinsky scandal didn't help either."

But after the 1994 and 2000 elections, very few Democrats were going to take any chances on gun control. "This is a classic example of the toughest vote any legislator has to make," says Ted Kaufman, who served as Senator Joe Biden's chief of staff and later as his replacement in the Senate. "You have a situation where, say, 60% of your constituents favor something like gun control, but 20% are so adamantly opposed that they won't vote for you even if they agree with you on other issues. Do you just slam the door on that 20%? That's a high-risk proposition."

Indeed, a vote for gun control became more and more difficult as the NRA gained strength over the past 30 years--from 2.4 million members in 1982 to 4.3 million now--and violent-crime rates dropped and guns were transformed into a libertarian-conservative symbol of American freedom by Republican messagemakers. Suddenly GOP candidates began to appear in television ads shooting or toting their weapons. It also didn't help that there was no clear evidence that the assault-weapons ban had accomplished anything. According to Fox's statistics, mass shootings continued, only slightly abated, during the 10 years of the ban. In 2003, the next-to-last year of the law, there were a record 30 shootings, with 135 victims. As support sagged and Democrats abandoned the field, the NRA felt free to become more and more extreme in its advocacy. "I resigned my membership," a Pennsylvania gun owner named Donald Dyke told me recently, "because of all this propaganda they were sending me about President Obama. They're saying that if he's re-elected, he's going to take away all our guns." (And indeed, sales of both handguns and sport rifles have spiked during the first half of 2012 in some regions of the country--Texas, for example--because of the belief that Obama would suddenly change course if re-elected.) But even though Obama has almost no chance to win over the NRA's supporters, he has remained silent on the issue, conforming to the political calculus Kaufman described. Every last vote is going to be crucial in swing states like Ohio, Pennsylvania and Virginia, where gun owners predominate.

By the time that Holmes allegedly opened fire in Aurora, Colo., stricter gun-control measures were opposed by a majority of Americans. And conservatives like George Will could argue, without a twinge of doubt, "The killer in Aurora, Colo., was very intelligent and farsighted and meticulous. I defy you to write a gun-control law that would prevent someone like this with a long time horizon and a great planning capability from getting the arms he wants. I just think that this is a mistake."

Will has a point. Holmes had no record of violence. It was impossible to pick him up with existing background checks. Even if there were an assault-weapons ban, he might have found a way to buy his weapon and perhaps even his 6,000 rounds of ammunition on the black market. There is no law that will prevent every crime. But an assault-weapons ban and a more advanced recording system for ammunition purchases (and perhaps, as Daniel Patrick Moynihan once proposed, a tax on ammunition) might prevent some of these crimes. Not every perpetrator is as smart or meticulous as Holmes allegedly was. Some act out of blind, immediate rage. If the shooter had gone into the theater without a semiautomatic weapon, how many fewer would have been wounded? If only one person had escaped injury, the law would be worth it--as would laws, opposed by civil libertarians, that would make it easier to treat and institutionalize violent paranoid-schizophrenics without their permission. (Such a law might have prevented the Giffords shooting.)

In the end, criminal laws have a dual function. They seek to prevent crime, but they also send a message: This is where we draw the line. We do not permit this in our society. We think it is excessive. In this case, there is absolutely no rational or sporting reason for an individual to have a semiautomatic weapon or a gun clip that can fire 50 to 100 rounds at a time. Recent polling by Frank Luntz indicates that despite the NRA's official positions, vast majorities of gun owners favor stricter background checks--including a ban on the sale of guns to persons on the government's terrorist watch list--and gun-safety training, especially for those seeking permits to carry concealed weapons.

As the President said, we need to have a conversation about these gun laws and the mental-health system--and a larger conversation as well about how we stay coherent as a society, how we establish our common bonds and maintain a sense of community in a time when all the technological signals are pointing us toward a relentless, unmitigated individualism that could slowly lapse into social anarchy. I suspect, though, that in the current atmosphere, any reasonable conversation about the logical limits of our freedoms, and where our civic responsibilities should begin, is well beyond the reach of these two candidates and these two parties.

The Ammo Economy (TIME)

By Nate Rawlings

Time, July 27, 2012

To many, a particularly startling element of alleged gunman James Holmes' planning was the size of his ammunition stockpile: he had purchased more than 6,000 rounds for his assault rifle, pistols and shotgun. Ammunition, it turns out, is a fast-growing business in the U.S. As of May, there were 1,996 licensed ammunition manufacturers—up 27% from 1,567 in January 2010, according a Bureau of Alcohol, Tobacco, Firearms and Explosives database.

Obtaining the amount of ammunition that Holmes had is relatively easy if you have the money. Depending on the brand, 3,000 handgun rounds cost \$630 to \$1,770; 3,000 rounds of .223-caliber bullets for an assault rifle cost \$1,100 to \$1,350; and 350 rounds for a tactical shotgun will set you back a little over \$300. In all, Holmes' ammo cache probably cost \$2,030 to \$3,420. Internet retailers—including prominent names like BulkAmmo.com and LuckyGunner.com—will ship cases of the rounds to purchasers via UPS or FedEx (mainly by ground, since shippers generally don't let live ammo on airplanes). All that is required is the proper hazardous-materials labeling as specified by the U.S. Department of Transportation.

Some companies manufacture ammo from scratch, but a substantial portion of the industry sells recycled rounds—known as reloaded or remanufactured ammunition—which can be as much as 50% cheaper. Getting started in the business requires a \$2,250 federal license, a reloading machine that costs \$500 to \$1,000 and a handy source of spent shells to be refilled. Sources of spent brass include local law-enforcement agencies and gun clubs, as well as the federal government, which uses a lot of ammunition and offers barrels of spent shells at surplus prices.

BULLET

Technically, bullet refers only to the projectile at the tip of a round. The most popular bullet for the .223-caliber assault-rifle round is the 55-grain Full Metal Jacket, priced at about \$40 for a set of 100.

SMOKELESS GUNPOWDER

A variation on black powder, smokeless powder contains different energetic components like a derivative of nitrocellulose (flash cotton). It can be shipped, with an extra fee for hazardous-materials handling.

CASING

Commonly referred to as brass, the shell casing houses the powder, primer and bullet and is ejected from the rifle once the bullet is fired. One hundred casings cost about \$16, and they can be reloaded five to 10 times.

GETTING STARTED

Ammunition manufacturers must obtain a Class 06 Federal Firearms License to manufacture ammunition as a business. A license costs \$2,250 to initiate and to renew annually from the Department of State's Directorate of Defense Trade Controls.

RECYCLING

To save money, gun owners can buy reloaded ammunition that consists of a fresh bullet and powder inserted into a previously fired shell made primarily of brass. Shells can be reused anywhere from five to 10 times, depending on the type of ammunition.

RAW MATERIALS

Ammunition remanufacturers buy spent brass from ranges, shooting schools and government agencies. Some reloads are bought by individuals; others are purchased by heavy ammo users such as gun-safety schools and police departments.

BULK VS. TRUE BULK

Online retailer LuckyGunner.com offers customers the option to purchase ammunition in "bulk" and "true bulk" orders. The latter—aimed at firearms dealers, sporting-goods stores and pawnshop owners—lets customers who buy 25,000 rounds per month, or \$5,000 worth of ammunition, get the best deals. (There are separate ordering avenues for law enforcement.)

Preventing Mass Murder (TIME)

By John Cloud

Time, July 27, 2012

James Holmes was meticulous in his preparations. He shopped at different gun stores and hid his online purchases from colleagues and neighbors. It may well be that no gun ban or background check could prevent such a determined man—one with no criminal record and with uncommon student achievement in neuroscience—from acquiring assault weapons. And so the Holmes case raises a crucial question: Is there a way to identify and stop mass killers before they unleash themselves?

The study of mass murderers is at once fascinating and frustrating. After Columbine, the Secret Service and the FBI undertook months-long projects that were designed to create methods to spot mass killers before they act. The Secret Service study, the more influential one, looked at 41 attackers in 37 school massacres. The data showed that mass shooters don't usually act impulsively and rarely make threats against enemies. But they do tend to have experience with firearms.

In short, mass murderers are a vexing and diverse lot. For instance, the typical mass killer said nothing suspicious to friends or family members but signaled his intent to third parties—especially, in the cases of the kids who shot up their schools, classmates they liked. On July 25, a report emerged, citing a law-enforcement source, that Holmes had taken the time to send a troubling package to a psychiatrist at the University of Colorado at Denver, where Holmes worked. He apparently sent drawings of his intended massacre.

In 2004 the journal *Behavioral Sciences & the Law* published an authoritative paper by a team of psychologists led by Reid Meloy, a professor at the University of California, San Diego. For the past decade, Meloy has been a consultant for the FBI's counterintelligence division.

In the paper, Meloy and his colleagues offered both sociological traits and behavioral clues that are associated with mass violence. Some of the factors they identified: A criminal history. The No. 1 predictor of violent crime is previous violent behavior. (For his part, Holmes had only a speeding ticket.)

A sense of victimization.

Most adolescents who shoot up their schools say they were bullied. Most adult mass murderers say girlfriends or relatives had recently rejected them or that they had been persecuted at work.

An age in the 20s.

According to the Meloy paper, the average age of mass killers is 27. (Holmes is 24.)

Other factors come up as well—for instance, preoccupation with fantasy is a common feature of mass killers, and Holmes is reported to have played video games ad libitum. But none of these facets can distinguish a burnout from a psychopath. "We can't pinpoint these people in the aggregate," says Stephen Holmes (no relation), a criminal-justice professor at the University of Central Florida. "And then the debate becomes a circular argument. If they weren't going to

use an AK-47, they would have found some other instrument ... The type of havoc is almost irrelevant. It's their will to do it."

For the record, police say James Holmes used an AR-15-type semiautomatic, not an AK-47. But Stephen Holmes is right: breaking any particular mass murder into its component parts and then reconstructing them into an explanation that makes any sense is folly. As Meloy wrote, turning "hot shame into cold anger" is a confusing process not just for us but for the murderer.

What's curious about this case is that we can't construct a narrative that bends to our first assumption--that mass killers are psychotic. At this point in previous investigations of gunmen like Cho Seung-Hui (who killed 32 at Virginia Tech), Jared Loughner (who shot Gabrielle Giffords and killed six) and the duo at Columbine--Eric Harris and Dylan Klebold--we knew far more about their mental states, their prescription-drug use and their behavior as kids.

According to Meloy's research, the average death count in a mass murder is 10.8--a brutally statistical way of referring to victims but one that helps put Holmes into perspective. (He is accused of murdering 12.) Holmes departed from the profile in many ways: the shooting took place at night, whereas the majority of mass killers strike in the morning; he didn't kill himself; and he gave himself up to police. In contrast, two-thirds of mass murderers die by their own hand or get shot by cops before they see a court. Before this year, when Holmes began buying guns and ammunition--he reportedly spent \$15,000, at least some of it federal grant money from the National Institutes of Health--he had no known history of accumulating weapons or enthraling himself to war. No friends have come forward to say he was troubled or sick.

In other words, there were few reasons to predict that Holmes was more dangerous than anybody else in Aurora. What law could account for such a person? Madmen will untie themselves from legal restrictions as easily as they depart from moral ones. But Holmes' case, like the others, will be endlessly scrutinized, all in the hopes of recognizing signs that could stop the next mass murderer.

Cable Wars (TIME)

By Eliana Dockterman

Time, July 27, 2012

On a recent Wednesday night, Annie Scalabrino, 20, flipped on MTV to watch one of her favorite shows, *The Real World*--only to find nonstop DirecTV ads. "I was really thrown off," she recalls. The reason: her satellite provider (DirecTV) and the media company it rents channels from (Viacom) couldn't agree on how much they should be paying each other, which meant that viewers of any Viacom channel--Nickelodeon, Comedy Central, MTV and others--were left in the dark. (The dispute has since been resolved.)

Sound familiar? It should. In the first 6 months of 2012, there have been 22 broadcast blackouts--up from 15 in all of 2011 and just four in 2010, according to the American Television Alliance. Meanwhile, fans are angry, cable and satellite prices are climbing, and Congress is debating cable-TV reforms. Here's why this is happening and why it's likely to get worse.

1. THE CABLE-TV BUSINESS IS TOUGHER THAN IT USED TO BE

According to the 1992 Cable Act, media companies like Disney can legally charge a fee to providers like Comcast for carrying their cable channels. In the past, Disney would forgive these retransmission fees if Comcast agreed to carry its new channels, like ESPN, since building an audience helps media companies attract advertising dollars. (That's a

major reason so many cable channels were launched in the '90s and '00s.) Now that the new-channel market is saturated, however, media companies are asking for "retrans" fees instead.

But most providers and customers aren't used to footing that bill. "That puts a whole new level of stress on the TV ecosystem," says Barton Crockett, a media analyst at Lazard Capital Markets. Media companies don't want to lose revenue; providers don't want to raise prices and lose customers. When neither side budes, viewers get blackouts. (TIME's parent company, Time Warner, operates some cable channels; provider Time Warner Cable spun off in 2009.)

2. CHANNELS ARE SOLD BY THE BUNDLE--WHETHER YOU LIKE IT OR NOT

Media companies have historically forced cable and satellite providers--and their customers--to accept channels in bundles; if they want to carry a popular network like MTV, they must also air less popular networks, like MTVU. To offset retrans-fee-related increases, providers are challenging media companies to offer an la carte option, allowing customers to pay for channels individually and saving themselves money. "Taking the movie channel Epix off the table [in the Viacom negotiations] saved us about \$500 million," says Derek Chang, DirecTV's executive vice president of content and strategy.

3. NO MATTER WHAT, AMERICANS WON'T STOP PAYING FOR CABLE TV

Despite the rise of Netflix, Hulu and other cable alternatives, "87% of people who have a TV set still subscribe to cable and satellite," even though fees have increased 60% over the past eight years, says media analyst Bruce Leichtman. In other words, Americans are a long way from cutting the cord, and media companies and providers know it. "You lose a few channels for a few days," says Lazard's Crockett. "That's not enough to stop the love affair Americans have with TV."

5 Ways Syria Can Get Even Worse (TIME)

By Karl Vick

Time, July 27, 2012

Israel has fighter-bombers in the air nearly around the clock these days, loitering at 16,000 feet in case a target appears on its northeastern border. What the pilots are waiting for is word that a line of trucks has been seen leaving one of the Syrian military bases known to be chemical- and biological-weapon storehouses for President Bashar Assad's regime. Having canisters of VX gas or ampules of anthrax fall into the hands of, say, Hizballah, is not the only dire possibility gripping the world's attention as the clock ticks down on the rapidly deteriorating Assad government. But of the potential consequences of his regime's demise, loose WMD stocks may be the only one the outside world has the ability to do something about. Israeli ground crews swap out underwing payloads, and U.S. commando teams study maps of known storage sites, most located in Syria's north and northwest. But what's the drill for holding a country together?

For most of the past 5,000 years, Syria was not a sovereign state but a general area on the map that spawned wars. It could well revert to malevolence. Or it could hold itself together by virtue of the past few decades of relative stability, unified by a sense of nationhood enforced by century-old borders and the politics of living memory. No one pretends to know. But after the example of Iraq, where a Baathist dictator was deposed by the world's most powerful military only to be followed by a decade of violent chaos, the assumption is no longer that things will take care of themselves. In Syria, the Baathist dictator, backed by Iran and coddled by Russia, teeters before an indigenous rebellion driven by both secular warriors and Sunni jihadists, arms from moneyed Gulf states and the shredding of a social fabric more intricate than nearly any other in the region. What could go wrong?

1. SYRIA BREAKS INTO WARRING STATES

The ruler-straight lines of the middle East describe a map drawn not by the aspirations of its residents but by colonial powers divvying the spoils of World War I. But even by that measure, Syria counts as a real jumble. In the 1920s, France assigned each population the cantons to which, some fear, they will return if Assad is swept away—Alawites in the mountains by the sea, the Druze in the mountains to the south, Maronite Christians on Mount Lebanon, Kurds making do on the northern periphery and the Sunni Arab majority, 60%, getting everything else. Indeed, the sorting has already begun, as families rush to the mutual protection of clan and sect.

The uprising has brought additional divisions. The rebel Free Syrian Army divides the country into 10 bureaus, nominally under a unified command. But commanders taking losses in Syria resent a few of those raising money from the safety of Turkey. "Where are they? In five-star hotels, drinking tea?" Abu Trad asks TIME's Rania Abouzeid, who spoke with him in Saraqeb, a town in northern Idlib province, as he sits at his battered desk decorated with photos of the seven men in his unit who died. He resents the local unit of fundamentalist Sunnis who enjoy funds from the Gulf. "We spilled our blood. It's a grave injustice."

Learning from post-Saddam Hussein Iraq, "free" Syria is avoiding a governance vacuum. Rebels left Saraqeb's local council standing while they destroyed the Baath Party headquarters. "We burned it because it didn't serve a purpose," says a Free Syrian Army fighter. "But we didn't burn the trees outside it." However, the local coordination committees that took up the slack double as battlefields for local rivalries. Efforts by Washington and Europe to form a government-in-exile have come to naught. The exiled Syrian opposition is distrusted back home, having produced no viable leaders or goals beyond toppling Assad.

"There is a real risk of a failed state here," says Jane Harman, a former House Intelligence Committee chair who now runs the Woodrow Wilson Center. "We don't do tribal societies well."

2. THE KILLINGS ESCALATE

The Syrian conflict has been defined by its brutality even at the remove of blurry cell-phone footage. That leaves to the imagination the depth of the anger felt by the tens of thousands who can count a family member lost to shelling, torture or house-to-house executions. The implications are amplified by differences in faith and privilege.

As a modern nation, Syria invested heavily in overcoming the entropic tendencies of diversity. At the peak of the Arab-nationalist movement, it even struck a brief union with Egypt, forming the United Arab Republic. But for all the emphasis on building a secular state, the Assads trusted their security services to members of their sect, the Alawites, a heterodox order that accounts for 12% of Syrians. They carry a historic outsider status suggested by their nickname from Ottoman times: redheads.

In the bloodletting of the past 16 months, the very worst incidents, like the massacre of children in Houla, have been attributed to an Alawite militia known as Shabiha, thugs who in calmer times were notorious mostly for economic crimes. The horrifying deaths by torture—a picture of the mutilated corpse of Hamza Ali al-Khateeb was posted online—were blamed on security services dominated by Assad's minority.

Few have a clear picture of the dynamics across such a varied country, but the fears of other minorities are credible if the brutal treatment of Christians and other "infidel" minorities in Iraq serves as a template. Speak, memory: in Moscow, a Syrian exile summons the 1982 leveling of the rebel town of Hama, where 16 members of his family were among at least 10,000 killed on the order of Assad's father. "Now is our chance for revenge," he says.

3. THE CONFLICT SPILLS OUT OF SYRIA

What happens in Syria doesn't necessarily stay in Syria. Too many populations overlap its borders.

In the northeast, Kurds have taken control on the ground since receiving training from Kurds on the Iraqi side of the border. The Syrian Kurds may well be taking a page from their cousins, not pressing for independence but contenting themselves for now with the considerable advantages of effective autonomy. But even that is unlikely to sit well with Turkey, which is heavily invested in deposing Assad as well as in containing Kurdish ambitions. Intensely nationalist Turkey is home to half the world's Kurds and shares borders with Syria and Iraq.

To the east lies Iraq, where the recent escalation of sectarian warfare is believed linked to the Syrian revolt: insurgents on both sides of the border, which doesn't follow tribal lines, are Sunni, and both Baghdad and Damascus are aligned with Tehran, though Assad's ties are closer.

The implications for Lebanon are almost dizzying. The militant Shi'ite organization Hizballah is deeply tied to the Assad regime, but Israeli officials question the notion that the two would fall together. A successor Syrian regime may still align with Iran, Hizballah's patron, if only to maintain its footing. Lebanon's spiral of political and ideological plotlines may find a way to take advantage of chaos.

Meanwhile, Israel frets about the Golan Heights, high ground seized in the Six-Day War of 1967. A change of government in Egypt forced the Jewish state to reinforce its frontier with a costly fence. The sound of mortar fire in the Golan in July (a shell landed 500 feet from the line of Israeli control) has officials concerned about more trouble and expense, including the possibility of Druze and Christian refugees arriving at the frontier.

4. CHEMICAL OR BIOLOGICAL WEAPONS ARE USED

As a practical matter, the weapons may be less of a threat than is widely feared. Chemical weapons require regular attention even in storage, careful mixing before use and sophisticated means of delivery. Syria keeps its stores, including nerve gas, in depots separate from the missile warheads that would deliver them. An Israeli intelligence official recently told Time that they had not been moved from a handful of known bases, which remain under constant surveillance by governments with the means to monitor them.

Biological weapons--Syria likely has anthrax, at least--are more problematic. And the international preoccupation with the WMD stocks has given Damascus a desperate leverage. On July 23, amid fighting in the capital and in Syria's largest city, Aleppo, a Syrian government spokesman confirmed for the first time that the weapons exist but vowed that they would be used only against foreign forces. In Israel, demand for gas masks spiked. The Jewish state has repeatedly warned that it will intercede at any sign that the weapons are making their way to Hizballah, which has an arsenal of 40,000 missiles capable of reaching Israel.

5. THE MILITANTS WAIT IN THE WINGS

There may be some consolation that most jihadists in Syria don't call themselves al-Qaeda; the brand has become a stinker. But it's really cosmetic. The banner over a rebel checkpoint in the countryside of Idlib looks very much like the flag of Osama bin Laden's army. The colors and logo are just different enough for a local to insist, "We don't have al-Qaeda here." Nevertheless, Syria's militants are steeped in the same Sunni fundamentalism and reinforced by volunteers from around the Muslim world. The ranks of one indigenous militant force with a presence in a half-dozen towns in Idlib and other areas of Syria include jihadists from Kuwait, Libya and Kazakhstan, according to a foot soldier named Ibrahim, who discounts any hint of bin Ladenism. "We are just people who follow our religion," he says. "I'm a mujahid but not al-Qaeda. Jihad is not al-Qaeda." It can be similarly lethal, however. His group's specialty "in the killing and chemical branch" is improvised explosive devices, including copper-lined shaped charges that penetrate armor.

As in Iraq, the Islamists face resistance from a local population resistant to their severe views. "There are some people who are afraid of us," says Abu Zayd, a fighter with another Islamist army. "We need to explain the reality of who

we are, that we are not scary." Scary is what's happening in Iraq, where al-Qaeda has found new energy in Syria's turmoil—which may yet make its name. If so, it will join the forces arrayed against Assad that will not disappear just because he does.