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Fall 2008

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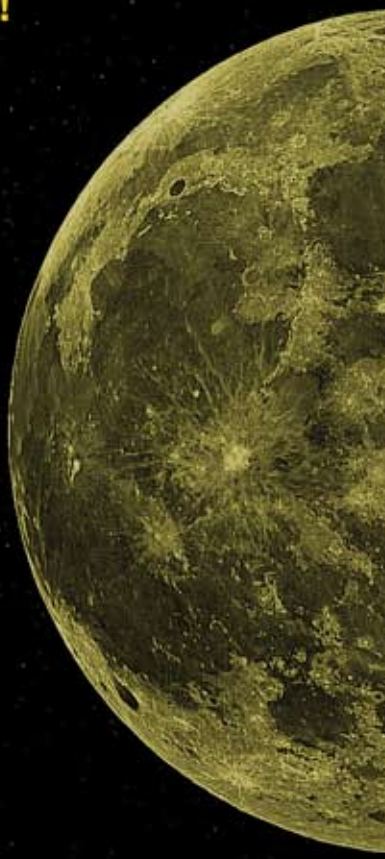

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This digital painting "The View West Above Vallis Marineris" illustrates an equatorial orbital view of Mars. The Sun is the large star near the upper right hand corner. This illustration was created by Jim Plaxco whose art can be found online at http://www.artsnova.com and at http://artsnova.com/blog.

editor's letter

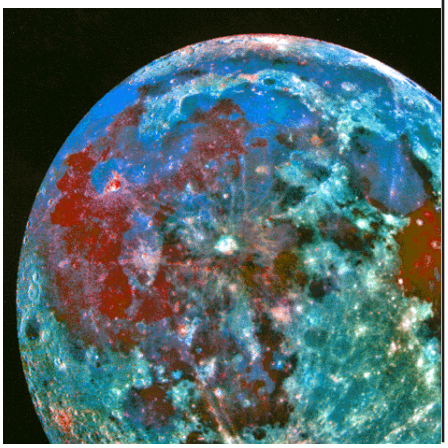
Welcome to the fifth issue of Space Lifestyle Magazine. Thanks for taking the time to enjoy the wide array of articles in this issue – from profiles of various people in the space industry, to an inside look at SpaceX's recent successful launch to orbit, to a reports from the latest space-related conferences. As always, you'll find the latest events in space and astronomy in the New and Notable section.

Publisher David Bullock and I had the opportunity to attend this year's International Symposium on Personal and Commercial Spaceflight in Las Cruces, New Mexico, held Oct. 22-23. This was my first time attending this conference and it was exciting to hear everyone talk about commercial spaceflight in such concrete terms. What I found most energizing was the spirit of cooperation displayed by commercial space companies, governmental entities and private citizens. Everyone attending the symposium has a common goal of making commercial spaceflight a viable industry.

Perhaps Will Pomerantz of the X PRIZE Foundation said it best. In describing the teams competing for the Google Lunar X PRIZE, he said, "They are in competition here, but it's a friendly competition. They would have every reason to be jealous of each other, but they are all interested in creating a rising tide that will float all boats."

These competitors are not only entrepreneurs, but also enthusiasts who want to see the success of commercial spaceflight. What "NewSpace" introduces is novel ways of looking at things and new ways of doing business. We at Space Lifestyle Magazine will try to help you keep up and stay abreast of this 'rising' industry.

Best Always,
Nancy Atkinson
Editor-in-Chief
Space Lifestyle Magazine



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In the Next Issue...

Representatives from commercial space companies, government and academia, as well as interested citizens gathered at the 2008 International Symposium for Personal and Commercial Spaceflight (ISPCS) at the New Mexico Farm and Ranch Heritage Museum in Las Cruces, New Mexico. With the theme of "Positioning For Profit," the goal of the symposium was to share pertinent information of recent advances and to build public support for the nascent commercial space industry. Another topic widely discussed was the creation of suitable government and public policies to adequately maintain the needs of the industry.

240 people attended the symposium, which included 23 exhibitors from business and government. ISPCS was supported by 29 different sponsors, including Space Lifestyle Magazine. Various topics were discussed in panel sessions that covered key issues related to the evolution human-rated orbital vehicles, how NewSpace can use university research capabilities, personal spaceflight indicators, the astronaut training experience, and much more.

Panelists represented the technical, business, regulatory, and customer sides of the suborbital space enterprise. Look for complete coverage and more images from 2008 ISPCS in our next issue.

SLM also had the opportunity to attend the X-PRIZE's Northrop Grumman Lunar Lander Challenge for 2008. Armadillo Aerospace clinched the first place prize for completing the first level of the challenge, winning $350,000 for their accomplishment. One other team, TrueZer0, competed in this year's event. They are the only other team besides Armadillo to have a launch in the competition.

Team Leader and famed video game software creator John Carmack spoke to the media and those attending the VIP event throughout the competition and after the victory celebration.

Find out more about the Challenge, the teams competing, and other tidbits from the competition in the next issue of Space Lifestyle Magazine.

XCOR Hires New Chief Operating Officer

XCOR Aerospace, a NewSpace company that develops rocket engines, propulsion systems and rocket powered vehicles, hired former banker Andrew Nelson as Chief Operating Officer. A former aerospace consultant and banker for such institutions as Lehman Brothers and Morgan Stanley, Nelson said he is excited to join an entrepreneurial enterprise that not only promises to play a major role in the space flight market, but it also provides all of its employees an opportunity to ride into space.

"In banking, people liked to say, 'The sky's the limit for our careers,'" Nelson said. "With XCOR, we're aiming even higher than that." For more information on XCOR see http://www.xcor.com/

Credit: XCOR Aerospace
Photo Caption: XCOR COO Andrew Nelson

Astronaut's Diary Survives Columbia Accident

Page from Ilan Ramon's diary. Credit: Israel Museum

37 pages from the on-orbit diary of Israeli astronaut Ilan Ramon survived the explosion of the space shuttle Columbia in 2003, and selected pages went on display at a museum in Jerusalem in October. The pages were found about two months after Columbia broke apart on February 1, 2003 while returning to Earth following the STS-107 mission. Museum officials restored the diary in a process that took four years, but most of the restored contents contained personal information the family of Ramon does not want to make public. The diary provides no indication Ramon knew anything about potential problems on the shuttle. Columbia's wing was gashed by a chunk of fuel tank foam insulation at liftoff and broke up just 16 minutes before it was scheduled to land at the Kennedy Space Center in Florida. All seven astronauts on board were killed. Visit http://www.nasa.gov/columbia/home/ to remember and to honor the STS-107 crew.

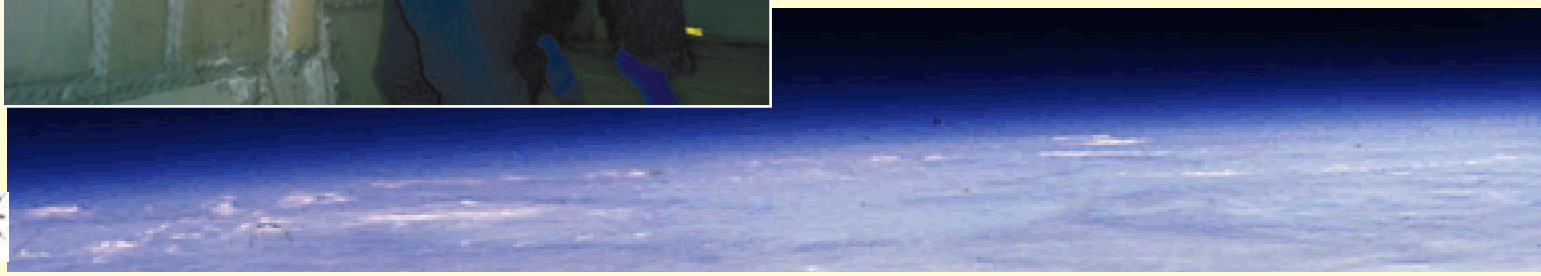
From the left (bottom row), wearing red shirts to signify their shift's color, are astronauts Kalpana Chawla, mission specialist; Rick D. Husband, mission commander; Laurel B. Clark, mission specialist; and Ilan Ramon, payload specialist. From the left (top row), wearing blue shirts, are astronauts David M. Brown, mission specialist; William C. McCool, pilot; and Michael P. Anderson, payload commander.

Garriott Visits ISS; Dyson Backup for Simonyi

Richard Garriott, videogame programmer and son of NASA astronaut Owen Garriott, flew to space and visited the ISS in October to become Space Adventures' sixth orbital spaceflight client and the first second-generation astronaut. While staying with the Expedition 18 crew, Garriott participated in a variety of studies including a NASA-arranged experiment to measure the effects of space travel on eye pressure. Space Adventures Ltd., currently the only company offering commercial human space missions, also has arranged for Esther Dyson, chairman of EDventure Holdings and established Space Adventures investor, to travel as back-up for Charles Simonyi in a spring 2009 flight. For more about Space Adventures visit http://www.spaceadventures.com/

Richard Garriott on board the ISS.
Credit: www.richardinspace.com

Esther Dyson enjoys zero gravity
Credit: James Hong via Esther Dyson's Flickr account at http://www.flickr.com/photos/edyson/



SpaceDev Founder Jim Benson Dies at 63

Credit: California Space Authority
Caption: Jim Benson speaking at the 2005 CSA Annual Conference

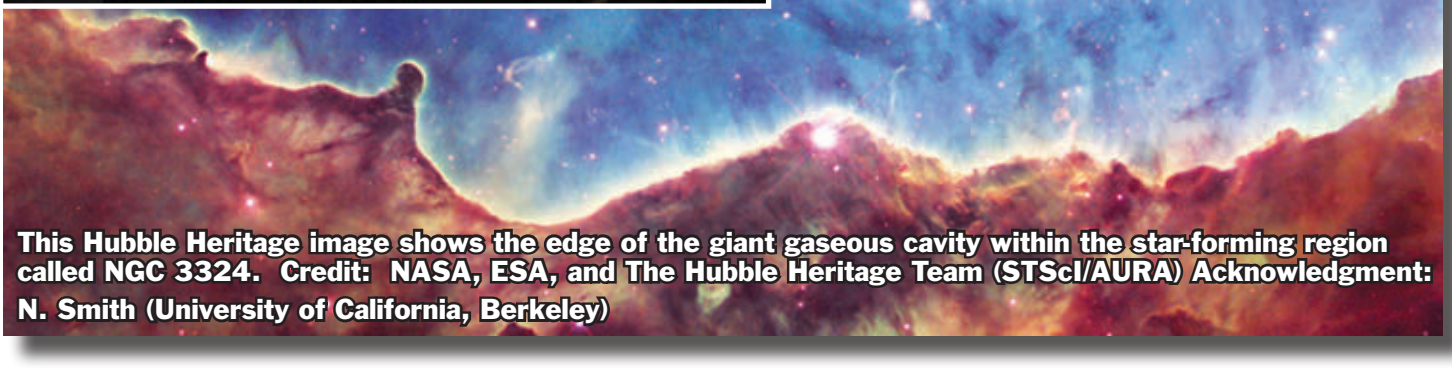
Jim Benson, SpaceDev founder and former member of the California Space Authority Board of Directors, passed away peacefully on October 10 from a previously diagnosed brain tumor. Known for his advancements in the field of computer science, Jim Benson used his knowledge of technology and his interest in astronomy to enhance the Space community's efforts. His contributions and insight will be sorely missed. For more information on Jim Benson's accomplishments, visit http://spacedev.com/press_more_info.php?id=285.

Hubble Recovering After Major Failure

A major failure on the Hubble Space Telescope shut down science operations for most of the month of October as the spacecraft was unable process and send data to Earth. Hubble's Science Instrument Control and Data Handling (SIC&DH) system is a redundant system with two sides. Side A had been used exclusively since HST launched in 1991, but failed in late September. While engineers believed the redundant Side B – which hadn't been turned on for over 18 years – would work, nothing was certain. Engineers performed "neurosurgery" from the telescope's operations center at Goddard Space Flight Center in Maryland to switch the system to Side B. After a few glitches and false starts, HST appears to be on its way to recovery and normal operations. The failure forced NASA to delay the STS-125 space shuttle mission to upgrade the observatory, scheduled to launch on Oct. 14, until at least February 2009. That will allow NASA to test and prepare a replacement part, and the astronauts, for the mission. For current information about Hubble and the servicing mission visit http://www.nasa.gov/mission_pages/hubble/main/index.html

Engineers work in the Space Telescope Operations Center to fix Hubble's data handling system. Credit: NASA

The Hubble Space Telescope. Credit: NASA



This Hubble Heritage image shows the edge of the giant gaseous cavity within the star-forming region called NGC 3324. Credit: NASA, ESA, and The Hubble Heritage Team (STScI/AURA) Acknowledgment: N. Smith (University of California, Berkeley)

Internet Mogul Sues Space Adventures for Lost Flight

Internet mogul Daisuke Enomoto, known as Dice-K in his home country of Japan, is suing Space Adventures for $21 million after his trip was canceled due to health concerns. According to Space.com, Enomoto, who suffered a reoccurrence of kidney stones, paid an extra $7 million to participate in the first ever spacewalk of a tourist aboard the ISS, an offer that he claims misled him into making early payments. In his place, Anousheh Ansari flew with the Expedition 14 crew as the first woman tourist to pay to visit space. Enomoto's hearing is set to take place on November 21 in Alexandria, Va. For a report on the lawsuit, visit http://www.space.com/news/081001-spacetourist-lawsuit.html

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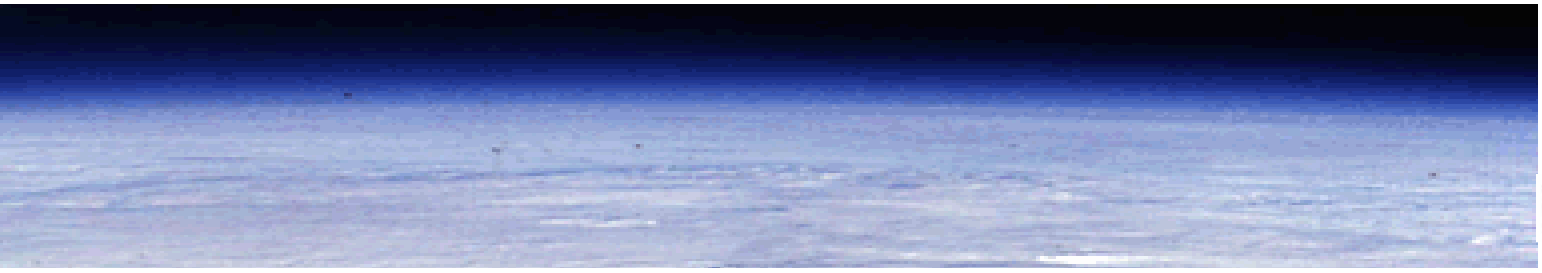
Credit: NASA
Caption: Daisuke Enomoto and Expedition 14 crewmembers at a press conference at Johnson Space Center



Chandrayaan-1 launches on Oct. 22. Credit: ISRO

India Launches Lunar Orbiter, China Takes a Spacewalk

On Oct. 22 the Indian Space Research Organization (ISRO) launched Chandrayaan-1, (which means "Moon Craft" in Sanskrit) as the country's first lunar mission. The unmanned craft will map the surface and interior of the moon using high resolution, 3D images. Its successful launch adds India to the list of Asian countries that also have recently launched lunar missions—Japan (SELENE) and China (Chang'e I) launched lunar probes in 2007.

China also launched three taikonauts into Earth orbit in September, and two performed the country's first spacewalk. They tested new spacesuits and retrieved test samples loaded on the outside of the spacecraft. For more information about the spacewalk see http://www.universetoday.com/2008/09/27/chinas-first-spacewalk-a-success-video/

For more information on the ISRO, visit their website at http://www.isro.org/Chandrayaan/htmls/home.htm.

China's first spacewalk. Credit: Xinhua

Google Lunar X PRIZE Announces New Partner and Teams

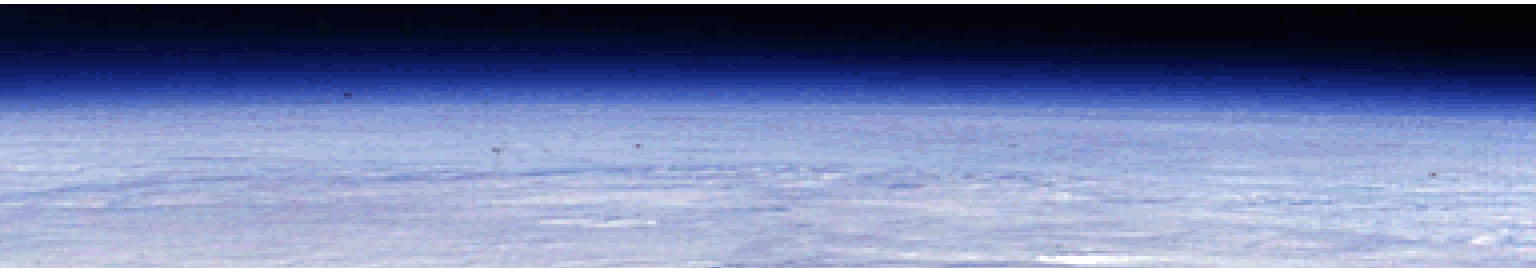
Google Lunar X PRIZE (http://www.googlelunarxprize.org/) announced a partnership with Analytical Graphics, Inc. (AGI), producer of analysis software for land, sea, air, and space. As a "preferred partner" AGI will provide each Google Lunar X PRIZE team with nearly $200,000 worth of complimentary software and engineering services. "AGI's software is unsurpassed and will bring critical new capabilities to the competing teams," said Dr. Peter H. Diamandis, Chairman and CEO of the X PRIZE Foundation. "This modeling and visualization software will be a great asset for the teams."

Members from the two new Lunar XPRIZE teams pose with Will Pomerantz from the XPRIZE Foundation. Credit: XPRIZE Foundation.

Logo courtesy Google Lunar XPRIZE.

Will Pomerantz, Senior Director for Space Projects at the X PRIZE Foundation, also announced two new teams competing for the $30 million prize. Omega Envoy from Florida and Independence-X Aerospace. "We are thrilled to add our first team from Florida and our second team from Malaysia to the roster of competitors. Both these teams will add an exciting element to the competition," said Pomerantz.

The Google Lunar XPRIZE is an international competition to safely land a robot on the surface of the Moon, travel 500 meters over the lunar surface, and send images and data back to the Earth.



US Government has No Plans to Limit Rocket Fuel in Drinking Water

High levels of perchlorate, a chemical in rocket fuel that is known to affect thyroid function and cause developmental disabilities in humans, have been found in water sources at 395 sites in 35 states around the country, the Associated Press reported in September. In a draft report, the EPA concluded that there was no need to impose a clean-up effort or to put a cap on perchlorate levels. While the contamination is mostly due to aerospace and Defense Department activities, the ingredient can also be found in fireworks, road flares and fertilizers. For more information, visit http://www.cnn.com/2008/HEALTH/09/22/rocket.fuel.epa.ap/index.html.

Perchlorate, a common contaminant of drinking water that can pose serious health risks (especially to pregnant women and newborns) is the primary ingredient of solid rocket fuels. Perchlorate molecules, shown in the models, are made up one chlorine atom (green) and four atoms of oxygen (red). Credit: Berkeley University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The Space Fou
Strategic Space a

Focus on Space and Global Security

Students from local area middle schools and high schools attended the educational outreach portion of the event. The educational portion featured both government and commercial opportunities available as careers, as well as a session in which the students were able to learn about Science, Technology Engineering and Math (STEM) subjects and their relation to space.

Strategic Space and Defense 2008 was held at the Quest Center Omaha in Omaha, Nebraska. (Background)

By David Bullock

Approximately 2,000 military personnel, business leaders and media representatives attended Strategic Space and Defense 2008, October 6-8 in Omaha, Nebraska. The event was sponsored by the non-profit organization, The Space Foundation.

The defense industry was the primary focus, as speakers talked about the role of the U.S. government as a consumer of satellites and their usage and the importance of that role. Speakers included David McGlade, CEO of INTELSAT, Gen. Bernard Molard, FAF, who is security and defense advisor to Europe's EADS ASTRIUM, and Lt. Gen William L. Shelton, USAF. Also speaking at the conference was the Honorable David Heineman, Governor of the State of Nebraska.

The issues discussed were numerous and included how to deal with current broadband limitations, how and where to dump data after it is obtained at a teleport, and Space Situational Awareness (SSA). SSA, which is the need for tracking of orbital space debris and monitoring radiation and additional space hazards (including those hazards introduced by other nations) has been an issue for most of the space age. Many of the vendors in attendance also focused on SSA, offering products that could better fit the needs of the problem.

Mr. A Thomas Young, Chairman of an Independent Assessment Panel & Former Executive Vice President of Lockheed Martin presented a talk about national security and the future of space in regards to the Vision for Space Exploration. He is advocating his proposal that "a strategy" be used to enforce the Vision, as well as other U.S. space interests, including those

ndation Holds and Defense 2008

of national security. The proposal idea came after an Institute for Defense Analysis report to Congress, entitled, "Leadership, Management, and Organization for National Security Space." Details on what the strategy would be, or how it will be taken into effect, have neither been developed nor implemented.

About 300 Nebraska and Iowa students and teachers attended the event, as both industry and government tried to demonstrate to them the importance the space sector as a whole. Iain Probert, Vice President of Education, along with the Space Foundation's Educational Department organized the educational outreach for the local students and teachers. Tim Foster, a senior from Glenwood High School in Iowa enjoyed the Space Foundation's presentation. He told Space Lifestyle Magazine he was both interested in aerospace engineering and had a passion for flying. Foster was amazed at the presentation of the space opportunities available and said there were "lots of neat technology and advancements." His classmate Jessica Isadore didn't want to take to the air, nor be involved with the nuts and bolts of space quite as much, and she admitted that when she goes to college, she will probably major in psychology. What did appeal to her was the need for marketing for both the new and the old space companies. She felt that fit her interests better.

Apart from the time set aside for high school and middle school students, Capt. Michael W. Nicholson of the U.S. Air Force attended the three-day event for his career advancement and for the advancement of his university Air Force Reserve Officer Training Corps students at the University of Nebraska at Lincoln, where he is an Assistant Professor. He enjoyed "having vendors available to talk to and being able to talk about space systems." He added, "I think it's great to interface with counterparts. It's great to see all of the players in the space industry and you get to talk to them." By exposing his students to the variety of vendors, such as the Missile Defense Agency, The Boeing Corporation and Lockheed Martin at the conference, he felt they were able to "find out what space was about," as he seeks to "expose them to the real side of the military."

Amy Butler of Aviation Week talks with former Lockheed Martin VP, Mr. A. Thomas Young, after a Media Roundtable discussing Young's ideas implementing "a strategy" for U.S. space interests and improving space leadership for national security.

Frank Taylor of the NewSpace company Space Dev, also attended the conference. He is the Program Manager for Space Technology for the company located in Poway, California. "[The conference] gave us a lot of access to key industry leaders of the space community," he explained. "The panels were insightful for both the long term needs and short term needs of the space community."

For more information about the conference, you can go to the conference website: http://www.stratspace.org/

Space Vote 2008
The Candidates, The Issues, The Election

By Nancy Atkinson

Seemingly, the United States is at a pivotal point in history. With the current unprecedented economic crisis, ongoing concerns about healthcare, and lingering problematic issue in foreign affairs, the upcoming presidential election looms as an important crossroads for the nation. Presidential hopefuls, Republican John McCain and Democrat Barack Obama with their respective vice presidential candidates Sarah Palin and Joe Biden, have covered a wide assortment of issues in debates and on the campaign trail. And surprisingly, space exploration stands out as one issue both sides have deemed worthy of serious consideration, with each laying out official space policy platforms and conducting repeated visits to Florida, Colorado, Ohio, and Virginia; states affected by space programs and priorities.

The election also comes at a crucial time for NASA. With the space shuttle program slated to end in 2010 and its successor, Constellation, not scheduled to be operational until 2015 at the earliest, this creates a multi-year gap in government sponsored human space access. Aging Earth-orbiting satellites that monitor weather and climate need to be updated with new and better systems to adequately deal with environmental issues and research, while planetary scientists are scrambling for funds to maintain the current line-up of missions to explore our solar system and beyond.

Senator Barack Obama

Additionally, emerging commercial space companies are looking for reduced governmental restrictions and increased opportunities to make it easier for this nascent industry to flourish.

Regardless of who is elected, people with an interest in space will be looking to the next president to provide leadership and resources for all of these issues.

According to Dr. Scott Pace, Director of the Space Policy Institute at George Washington University in Washington, D.C., all of the space issues can be boiled down to one subject: money.

"The overall problem is not enough discretionary spending," he said. "NASA has a lot on its plate right now, simply with the transition from the shuttle to whatever comes next. They need an administration that will give them priorities, a stable budget, and allow them to move on. But this is also about creating a new generation of human spaceflight capabilities, whether in the public or private sectors – preferably both."

So, what do the candidates bring to the space policy table?

"The two candidates are not that far apart on space issues," said Dr. Jeff Foust, an aerospace analyst with the Futron Corporation in Maryland, and a journalist who publishes such websites as Space Politics [http://www.spacepolitics.com/] and The Space Review [http://www.thespacereview.com/]. "Both have professed their support for NASA and desire to continue the current human spaceflight effort, including the development of the Ares 1 and Orion vehicles and, later, other elements needed for NASA to return humans to the Moon."

Foust said of the two presidential candidates, Obama has made the biggest change in his stance, since initially he supported a five-year delay in Constellation to help fund his early education proposals, but now he endorses efforts to

close the Shuttle-Constellation gap.

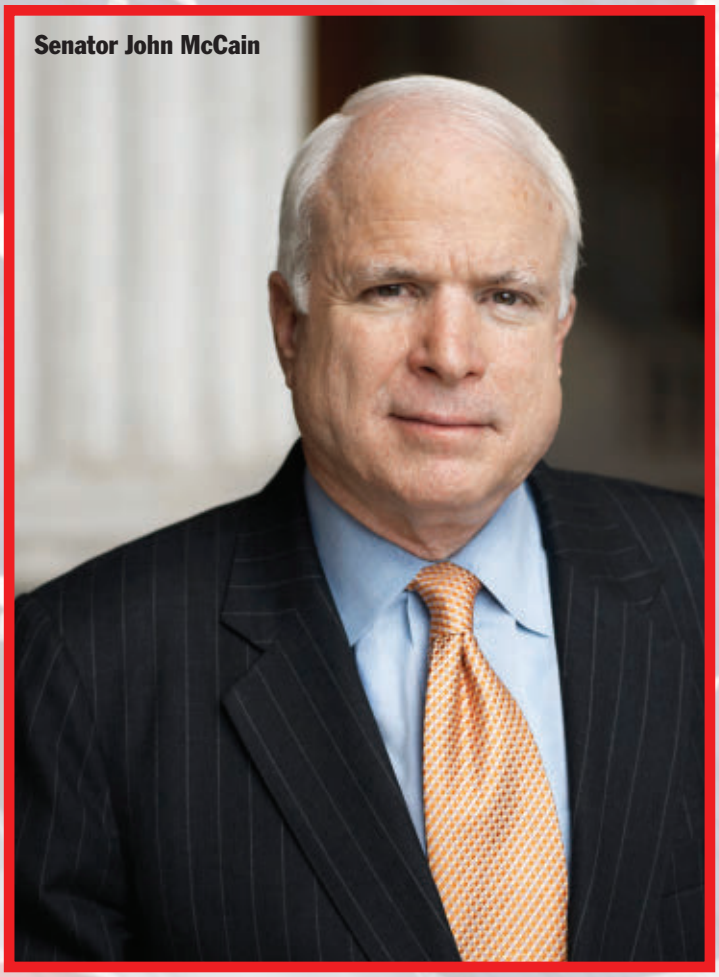
"Obama also now has the more detailed space policy statements of the two," continued Foust, "one that now includes provisions such as re-creation of the National Space Council and studies of the effects of export control restrictions on the US aerospace industry's competitiveness. Besides their stances on human spaceflight, the two both endorse continued or enhanced commercialization efforts and increased support for aeronautics and earth sciences."

Foust believes when it comes to space, in most areas it would be difficult to tell the two campaigns apart.

Keith Cowing, publisher of the watchdog website NASA Watch (http://www.nasawatch.com/), agrees. "If you talk to the space policy people here in Washington, the Obama and McCain people all know each other, and they slightly overlap on policies," said Cowing. "Both sides agree on the problems that NASA faces and the solutions are virtually the same when you get down to the nuts and bolts of it. They both want to keep the shuttle flying until the Orion program is on track, they both think the project should be funded more, and there needs to be more focus on cost accountability, education, and Earth science. Quite frankly, this is one of those cases where you could switch the two positions between the two candidates when they weren't looking and I don't think they would notice."

Pace, however, does see minor differences between McCain and Obama. "While McCain is very supportive of Constellation and space exploration policy and direction that the current administration and Congress have agreed upon, the main challenge for him is his view on non-defense discretionary spending. Whether NASA would even get inflationary growth would be a question for a McCain administration."

Pace said the main challenge with Obama is his desire to connect space with other issues he supports, such as environment, education, rebuilding infrastructure and American's role in the world. "So the challenge for an Obama administration is, what are the connecting links and how does space contribute to the positive



Senator John McCain

image of America abroad," said Pace.

Both candidates appear to be quite interested in space policy, more so than in any previous election. Could this be a harbinger of good things to come for NASA? Pace, Foust and Cowing all agreed the candidates have figured out that the Florida vote is important. The "gap" between the shuttle and Constellation is "of particular concern in Florida," said Foust, "where that gap could cause thousands of Kennedy Space Center workers to lose their jobs; that, plus the fact that Florida is a 'swing state' in the election, is one of the reasons why the candidates have said as much as they have about space in the election to date."

"All of this is before the election and during the campaign season, so how much one takes seriously any specific proposal is certainly up for question," said Pace. "You have to look at the general priorities that each candidate is bringing in."

Cowing believes how the candidates campaign could be vastly different than how they govern. "It's a three-step process," he said, "the cam-

paign, the transition, and then governing. Sometimes whoever is on the transition team can have a lot to say on different issues."

"I'd say McCain's space program would look a lot like Bush's," Cowing continued, "and an Obama one would look a lot different. If McCain gets in, having seen him with my own eyes over the years, he really does believe in pork-busting, so I think he'll approach Orion and Ares as making sure it is the best value for the taxpayer, and not looking for other ways this could be done better. The Obama people, while they want to keep the shuttle flying until we get Orion going, I don't see them jumping up and down about the moon and Mars. They might want to chart their own path."


Dr. Scott Pace, Director of the Space Policy Institute. Image Courtesy Dr. Pace

But according to Obama's official website, he supports returning to the moon and traveling to Mars, as well as promoting commercial space ventures. Obama lists the following priorities for his space policy:

- **Re-establishing the National Aeronautics and Space Council.**
- **Minimizing the gap between the retirement of the current shuttle and the Constellation program.**
- **Supporting Congressional efforts to add an additional shuttle mission before retirement.**
- **Completing the International Space Station and using it for scientific and technological research.**
- **Supporting human space flight, including a mission to the Moon by 2020 and missions to further destinations such as Mars.**
- **Exploring the role of the private sector in fulfilling some of NASA's lower orbit cargo transportation needs and encouraging commercial access to space.**

McCain's website lists these issues as space policy priorities for his administration:

*** Ensure that space exploration is top priority and that the U.S. remains a leader;**

*** Commit to funding the NASA Constellation program to ensure it has the resources it needs to begin a new era of human space exploration.**

*** Review and explore all options to ensure U.S. access to space by minimizing the gap between the termination of the Space Shuttle and the availability of its replacement vehicle;**

*** Ensure the national space workforce is maintained and fully utilized; Complete construction of the ISS National Laboratory;**

*** Seek to maximize the research capability and commercialization possibilities of the ISS National Laboratory;**

*** Maintain infrastructure investments in Earth-monitoring satellites and support systems;**

*** Seek to maintain the nation's space infrastructure;**

*** Prevent wasteful earmarks from diverting precious resources from critical scientific research.**

While McCain lists scientific research as "critical" he certainly didn't endear himself to scientists – especially astronomers – when during his campaign, he accused Obama of seeking funds for "planetariums and other foolishness."

What fate will sciences like astronomy and physics have under either candidate's administration? "I don't really see astronomy benefitting or hurting from either candidate," said Pace. "The bigger question is what happens to Earth science spending. Part of the debate there, is that science has a long list of things they would like to do, but it's not clear that spending more money on satellites is the most cost effective way to deal with something like climate change."

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Cowing believes both candidates would keep a focus on space science, Earth science and global warming. "I don't think there's much difference there. But with Obama it's about education and social relevancy," he said. "And for McCain, I'm sure NASA is one of those things that will be asked to explain their relevancy to why we should be giving them money."

A broader issue just now emerging, however, is what effect the current financial crisis will have on NASA budgets and the space industry in general. "While candidates can promise to put more resources towards NASA, it's not clear those resources will be available, particularly given all the spending that's going towards the Wall Street bailout," said Foust. "In fact, it's not far-fetched to imagine scenarios where spending is reigned in as a result of the bailout, resulting in across-the-board cuts of federal programs, including NASA. It's very easy to promise many things to the space industry and its supporters during a campaign, but I think it may be much harder to follow through on them in the next couple of years, regardless of who wins in November."

Pace said NASA receives less than 0.6% of the federal budget so a small increase or decrease would not affect the overall budget very much. But given the current financial climate, even small increases are likely to be very difficult for any new administration.

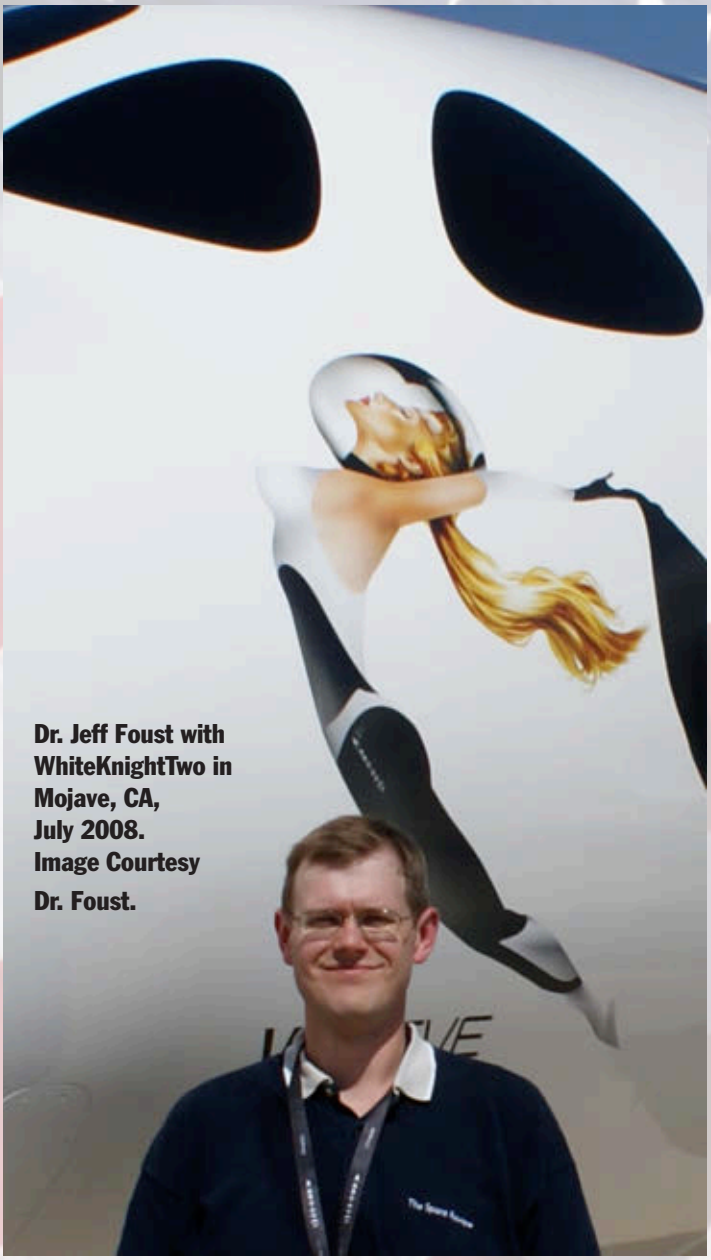
"NASA will always respond to the priorities of the president, whatever they are," said Pace. "The main thing I would hope for is that the new administration doesn't come in and reorganize NASA. It's been through so many reorganizations. NASA will do whatever it is told to do, but given they've reached a point of stability internally and organizationally, I would hate to see a year or two wasted by yet another reorganizational exercise."

Cowing agrees. "Reorganization is a transient fix that doesn't really do anything. I think people get distracted by reorganization when you could really list NASA's problems on a single sheet of paper. I think with Obama, NASA's organization would get looked at from a more philosophical point of view. With McCain, things might change only because he's going to hammer them on costs. Again, you may see the results being similar but the motivation will be different."

As for the vice presidential candidates, Pace, Foust and Cowing agreed that neither of the candidates have a track record on space issues.

"The two vice-presidential candidates have had little to do with space in their current positions," said Foust. "Senator Biden does not get involved in space issues much, and Governor Palin has had little opportunity to do so at a state level. If Obama does win and reconstitutes the National Space Council, though, Biden would presumably have a greater role in space, since traditionally the Vice President has chaired the council."

Cowing noted that while Biden is a blank slate on space issues, Palin's state of Alaska has a



Dr. Jeff Foust with WhiteKnightTwo in Mojave, CA, July 2008. Image Courtesy Dr. Foust.

Keith Cowing at the Haughton Mars Research Station, Devon Island July 2007. Image courtesy Keith Cowing.

launch center on Kodiak Island, and she appears to have an interest in space education since she visited a Challenger Learning Center in her state at least five times.

Whichever team ends up in the White House, certainly challenging times lay ahead for NASA. "They need to stay focused over the next couple of years on completing their flights safely," said Pace. "Remember, the space station will be completed in the first few years of a new administration, and the shuttle flights will be completed. So the most important things for a new administration is going to be flight safety and handling the transition from the shuttle to whatever space flight system comes next. So they should focus on that and not reorganization."

Cowing feels NASA's challenges go much deeper, with an aging workforce and an agency mired in middle age, along with needing to contend – as well as cooperate – with upstart commercial space companies. "I think NASA needs to fix what's broken before they can get back to where they need to be," he said. "Whatever happens it is going to take pretty much the entire first term of the next president to get NASA out of its rut and back on stable footing. Even if you can toss money at it today, it takes awhile to get things restored. If you're a scientist, like in life sciences which was decimated under Bush, it takes a few years to get programs going again, and it may be a decade before a new mission or spacecraft flies. A lot of people feel they were burned by NASA. And NASA is now going to have to convince people to trust them again. That's going to be NASA's biggest challenge."

For more information on the candidates:

McCain: http://www.johnmccain.com/

Obama: http://www.barackobama.com/index.php

Rocketplane Rolls Out A Wedding Plan

NewSpace Company Offers Engaging Opportunity

By David Bullock

A digital image of a Rocketplane in flight. (Right) Misuzu Oniki Rocketplane's Director of Asian Business Development's theme for a space wedding. Credit: Rocketplane.

On July 1, 2008, Oklahoma-based Rocketplane Global announced a partnership with Japanese IT and Media company First Advantage (http://www.1st-advantage.com/). Together, the two companies began offering a suborbital wedding package for engaged couples. The package advertised on a Japanese-hosted website (http://www.spacewedding.jp) includes a charter flight, flown in one of Rocketplane's six-seat suborbital spacecraft, taking a pilot, a justice of the peace, the engaged couple and two other guests, such as a best man and a maid-of-honor, for a marriage ceremony that would be truly stellar. The price tag depends on a variety of factors, as First Advantage has the ability to coordinate the wedding reception, a honeymoon and any other needs on the ground. But estimates run between $2 million and $3 million dollars for the wedding package.

"There has never been in all of history where a bonding couple was both off planet," says Chuch Lauer, Vice-President of Business Development for Rocketplane. There was a space marriage in 2003, where one member of the couple was on the International Space

Station and the other was on Earth in Texas.

The plans for this new space wedding venture comes on the heels of several changes at Rocketplane, including the loss of the NASA COTS agreement and a group of new appointments after former test pilot John Herrington left the company.

The idea for an astral wedding, however, has come from Misuzu Oniki, Rocketplane's Director of Asian Business Development who is based out of Japan. She has been involved with the development of NewSpace and Rocketplane for some time, with interests in aspects somewhat outside of science and engineering including space fashion. Lauer explained that she has been able to get magazines, television and other media from all over the world to cover the space wedding venture, which Rocketplane hopes to make a reality in 2011.

After the Scaled Composites' successful suborbital launch in 2004 and Space X's successful orbital flight this year, people are interested to see if another NewSpace company, such as Rocketplane can achieve similar results. Rocketplane has not achieved a successful suborbital flight, yet, but has been aggressively marketing its company. Lauer explained they have worked with the J. Walter Thompson Advertising Agency to create, "The Ultimate Break"—a partnership with Nestle in France in which two winners, one of them an instant winner, receive a pre-printed ticket for a $200,000 spaceflight. (http://www.kitkat.fr)

With the concept of a space wedding, Rocketplane is breaking new boundaries. "From the commercial standpoint, it has not been possible before. So from a technical standpoint, a marketing stand point, and a legal stand point this all unexplored territory." The issue has proven to have many interesting legal considerations.

According to Lauer, he is aware of an agreement that one of his company's former clients made for a wedding in space, in which that couple's marriage would have been recognized in a western Oklahoma county due to the fact the spacecraft would be flying over the county's airspace. But that airspace is in federal airspace, not Oklahoma airspace, and a variety of legal questions regarding the actual jurisdiction for a space wedding come into to play. Many of these legal questions will not be answered until someone actually completes a suborbital wedding. Questions include: Can a non-U.S. couple have a suborbital marriage recognized in the U.S. if they fly over U.S. soil? Will the marriage be recognized in their home country? Do international laws, federal laws, or Oklahoma laws or some combination of laws find jurisdiction for a marriage takes place in space?

Many non-U.S. couples have their ceremony in places all across the United States and

Digital image of a Rocketplane space-port attraction. Credit: Rocketplane

Rocketplane's concept of a spaceport in Hawaii. Credit: Rocketplane

then have their marriage recognized abroad, so this might not bring a paperwork headache to the couple who decide to get married above the Earth, but the answer to the last question is a little different.

Couples have been married on ships before—sea ships—and the marriage that take place in a ship's international waters is recognized under the laws of the country in which the ship's business is headquartered. For example, any marriage that takes place on The Pacific Princess – also known as "The Love Boat," from which the popular television show in the 1970s and 80s was based—would be recognized in Liberia, where the company that owns the ship is located. If the scenario taken from the Pacific Princess was attributed to a Rocketplane spacecraft, flying over Oklahoma airspace in this new case, then it would be Oklahoma law that would be taken into effect. The couple would be married in Oklahoma as a result.

While speculation of the various scenarios can be all very interesting, according to Elliot T. Everett, a representative from Spratt and Everett law firm in Oklahoma City, Oklahoma, "No one really disputes marriages." That is good news for Rocketplane and the potential couples that would be interested in space weddings. Moreover, as Everett continued, "Oklahoma has common law marriage. Common law marriage is a marriage that occurs as long as [the couple] spend a night under the same roof as man and wife and then present themselves or 'hold themselves out' as husband and wife [afterwards]."

Again, this is all good news. And all should remain well unless the marriage leads to divorce. If this occurs, how and where the couple was married can become significant in obtaining legal understanding and resolution.

Moreover, Joanne Irene Gabrynowicz, a space law professor at the University of Mississippi, brought up an aspect that reminds people that much of the NewSpace efforts are, well, new. "A more interesting and compelling legal aspect of the idea of a suborbital wedding is whether or not the couple understands the inherent risk involved in the flight. Under current U.S. regulations, the bride and groom will be 'space flight participants' and will have to be fully informed by the company of the risks involved in the flight. They will have to waive their rights to recovery in the event of their own death or injury and could even be potentially liable for harm caused to innocent third parties," she said referring to current FAA regulations. "It's an interesting way to start a marriage."

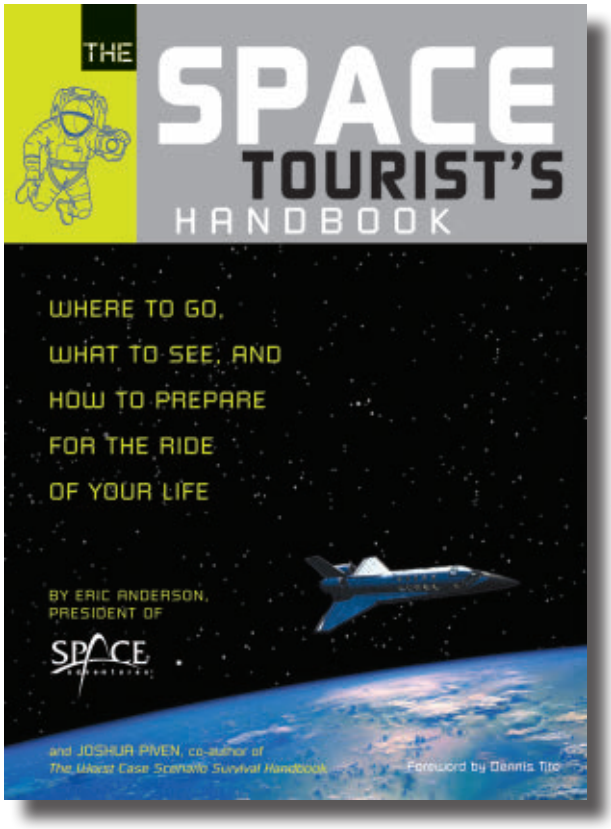
So far, nothing has stopped Rocketplane, and they plan on continuing their NewSpace business, including the space wedding package. Lauer further stated, "We have been working with Hawaii for a year and a half now to develop a second site for suborbital spaceflight. Hawaii has been looking at starting the process of beginning their own spaceport. We think that there are spaceports all over the world for their own regional market. We are looking at Asia, Europe and all over the world. People would then get a chance to see their home from space, from all over the world instead of New Mexico solely."

So, ring out the bells. After 2011, Rocketplane seeks to take a chance and bring us a possible union amongst the stars.

The Space Tourist's Handbook

by Eric Anderson and Joshua Piven
Quirk Books, 2005
Reviewed by Katie Kline

Combining the literary influence of Joshua Piven, co-author of The Worst-Case Scenario series, and the space knowledge and wealth of Eric Anderson, president of Space Adventures, *The Space Tourist's Handbook* initially presents itself in an amusing, "in the unlikely event you are ever stranded in the Everglades" sort of way. Yet somewhere in between the sections entitled "How to Survive if your Vehicle Detonates on the Launch Pad" and "Space Food and Drink: What To Expect," the reader may come to realize that this truly is the go-to manual for aspiring, or at least curious, space travelers.



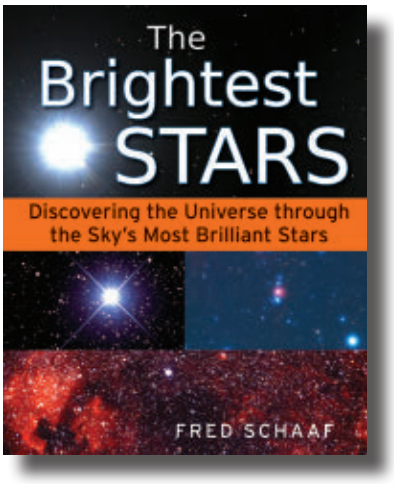
Cover art Courtesy Quirk Books

For serious space enthusiasts or just avid readers, the travel experiences offered through Space Adventures are described in detail so as to quench everyone's thirst for the unknown. And Anderson and Piven certainly cover all the details of this endeavor. The "Language Training" section, for example, which includes Russian phonetic translations of such phrases as "What does this button do?" and "When will this spinning stop?" prepares a potential space vacationer traveling aboard a Soyuz taxi.

But do not be fooled by the often humorous take on space tourism as this book also provides some of the more technical, yet essential, information on engineering, training and even the lifestyle of ISS crew members. For those who can afford to vacation in space, *The Space Tourist's Handbook* is a treasure trove of helpful tips and hints that NASA and other space flight companies just might fail to mention in training. How else would you know that playing chess in the ISS will likely provoke conflict and should always be avoided?

The Brightest Stars: Discovering the Universe through the Sky's Most Brilliant Stars

by Fred Schaaf
Reviewed by David Bullock



Taking the reader on a tour of the night sky, Schaaf writes an engaging and highly informative book about the brightest stars as we see their brightness here on Earth. Besides giving a chapter to each of the most brightest stars in both the Northern and Southern hemispheres, Schaaf includes historical accounts of the evolution of the names of each of the stars and, when known, the mythology and the discoveries behind them. Each of the stars are described at length, as the author explains each ones location, its path in the sky and what type of star it is in relation to others.

Before going into the details of the night's brightest stars, Schaaf gives much basic background information on how to watch the night sky with either a telescope or the unaided eye. He gives information on how to find stars, light pollution, and the spectral classes of stars. Other information includes how to avoid the moon when watching the night sky and the rotation of the early and the movement of the solar system in relation to the stars of our skies.

Besides the work put into accurately giving the scientific data of the sky's brightest stars, Schaaf put in a lot of effort collecting the stories behind the science, and also the mythology that came even before that. He explores Arabic lore, ancient Greece, and Native American culture, among others.

Overall, the book is a good one and it inspires. While Schaaf tries to do this a bit himself, the amazing story of the night sky speaks for itself, and it is as captivating, as it is real. If the names Regulus, Alpha Centauri, Rigel, and Sirius were words you've heard before but didn't know much about, by reading *The Brightest Stars* you become more familiar with these luminous objects—most of them neighbors to our own star, the Sun.

The New Face of SPA

Space X Changes the NewSpace Game

You know when you pull off the highway onto a street named "Rocket Road" that you're somewhere very special. In a converted hangar on the edge of Hawthorne Municipal Airport, a small airstrip ten minutes east of Los Angeles International Airport (LAX), the dream of affordable commercial space flight is closer to reality. If it wasn't for the understated "SpaceX" sign at the entrance, you might mistake the Space Exploration Technologies Corporation headquarters for a refurbished office building. However, once you step inside, you realize this isn't any ordinary corporation.

The 550,000 sq ft interior of 1 Rocket Road once constructed Boeing 747's, but is now completely redesigned. From the décor, to the open plan offices and glass-walled meeting rooms, the working conditions seem to blend comfortably with recreational and social areas. Think "Google" meets "NASA mission control" and you should have an accurate image of what working at SpaceX is like. It's a combination Elon Musk, CEO and Founder of SpaceX, has used to ensure his comfortable and happy employees. And when speaking to these workers, their relaxed enthusiasm for SpaceX is apparently abundant.

After meeting the receptionist (who gives the impression of being rather "space-age" herself with striking red hair and Bluetooth headpiece in ear) all visitors are then photographed and issued a digital pass before being accompanied into the heart of SpaceX operations.

Stimulating Commercial Space Flight

Established in June 2002 Space Exploration Technologies had been started by PayPal co-founder Elon Musk after the online payment company had been brought by the online auction site eBay. The $1.5 billion acquisition

By Ian O'Neill

CETRAVEL

from Musk, the largest shareholder in PayPal, began his space commercialization corporation. By 2006, Musk invested $100 million into the company, and it seems the space start-up went from strength to greater strength ever since. SpaceX has been cash-positive for the last two years.

In August 2006, SpaceX had been co-awarded nearly $500 million from the NASA Commercial Orbital Transportation Services (COTS) Program. SpaceX had been allocated $278 million by COTS, while Rocketplane Kistler won $207 million. COTS does not release the money immediately, however. It is a "Space Act Agreement" providing funds when SpaceX completes certain milestones.

COTS is split into four goals: COTS A is to get into space, COTS B is a cargo delivery to the International Space Station (ISS), COTS C is the a safe return from the ISS and COTS D

is human-rated space flight. SpaceX is the only commercial spaceflight company that is currently developing a space transportation system that can deliver cargo as well as crew and then return them in a reusable vehicle (fulfilling all COTS goals). SpaceX's Dragon vehicle will be used in the first mission to deliver cargo to the ISS. However, the capsule truly was designed with astronauts in mind, therefore allowing it to be swapped between the two configurations. Dragon can either carry pressurized or unpressurized cargo into space, or can importantly transport astronauts to-and-from the ISS.

The COTS program, conceived by NASA Administrator Michael Griffin, is intended to stimulate the commercial space flight industry to ultimately provide US space flight options for the ISS. The goal of COTS is to do this after the Space Shuttle is decommissioned in 2010.

Although the US Government signed a waiver for the Iran-North Korea-Syria Nonproliferation Act (INKSNA) in October, which allowed NASA to use the Russian Progress cargo and manned Soyuz vehicles after the time when the previous waiver runs out in 2011, NASA flatly declined the Progress option and is more in favor of using US commercial space flight companies to get cargo to the ISS.

NASA still reserves the right to buy manned Soyuz flights to the station after 2010, but now there is an alternative to Progress, in the form of the SpaceX Falcon 9 rocket and Dragon vehicle.

"COTS was a brilliant move on Michael Griffin's part. It's never been done before. It's very much like how you would enrich and motivate the private sector – you're not back in the government contracting mode," said Diane Murphy, SpaceX Vice President of Marketing and Communications. "I think it's just new business, it's following the computer industry, following Silicon Valley. You don't need things to be in the government sector once [the technology] has been developed."

Although Soyuz could still be used to ferry astronauts to-and-from the space station, SpaceX intends to prove their human spaceflight capabilities sooner rather than later. "I think we will surprise them with how quickly we are moving so they can use us for crew as well. We'll be ready!" Murphy added.

COTS not only provides a viable answer to the political issues with spaceflight, the agreement also makes business sense. The strong overtones with the aerospace industry are evident. Once technology for commercial air flight had developed, corporations took over, for example. Aerospace, as we know it, quickly became a competitive sector, providing affordable transportation while motivating high standards in safety and reliability.

"Why should we have one space vehicle

Video: Elon Musk gives a tour of SpaceX
Website: http://www.spacex.com/multimedia/videos.php?id=27&cat=recent

http://www.youtube.com/watch?v=eGHWheEM-ww

that goes to one place? We need multiple vehicles, multiple destinations and regular launches," Murphy added. After all, if space commercialization follows the air commercialization route, it won't be long until multiple spacecraft manufacturers and multiple vendors (or "space liners") appear, with the intention of possibly taking us to various locations in the Solar System.

While the SpaceX mid-term plan is to supply goods and services to government and military departments, the long-term plan is to provide human-rated vehicles for travel around the Solar System.

"Elon's ultimate goal is human space travel; allowing mankind to travel to multiple planets. This is the whole reason why we are doing everything here," said Murphy. "Elon believes humans have the right to space travel." On looking around the SpaceX facility, there's a real feeling that anything is possible for Musk.

All Under One Roof

Walking through the comfortable and airy open-plan offices eventually leads to the main section of the building. This is the place where the rockets are physically built. It is hard to describe the SpaceX rocket workshop. You have your obligatory workbenches covered with electronics equipment, aluminum foil-wrapped tubing and rocket engine parts standing on their ends, but an overwhelming theme is cleanliness. In the section where the huge Falcon 9 rocket tanks are built (fabricated from an aluminum-lithium alloy, a material with the highest strength to weight ratio of any aluminum-based material), there is little dirt or clutter. Perhaps it was the fact that it was time for lunch in the adjacent canteen – where SpaceX provides food for all its 560 employees – but the rocket workshop is a surprisingly quiet place.

As you make way toward the end of the huge workshop, you can see the small "mission control" cabin where all communication to the launch pad in the South Pacific is made. But in keeping with the SpaceX work ethic, recreation is not far away. At the end of the walkway, four engineers are on a break, playing a foosball match.

The work environment is very different from a manufacturing facility or an office set-up, also. After all, it's rare you'll ever see four rockets being built, next to parts of Dragon—the former undergoing construction and the latter having its electronics installed.

By keeping 85% of SpaceX operations, from project design all the way through to physical completion, under the same roof, a high degree

The Dragon vehicle under construction, set for space tests in 2009. Credit: Ian O'Neill

Mock-up of the Dragon vehicle. When complete, it will be slightly larger than the Apollo command module. Credit: Ian O'Neill

of quality assurance is ensured. According to the staff at SpaceX, this "open door policy" encourages better communication and swift problem solving. The "flat" management structure departs from the traditional hierarchal system, allowing each member of staff to feel as if they make a difference to SpaceX operations. "Every SpaceX employee is an entrepreneur," remarks Murphy.

In six short years, SpaceX has developed their launch technology from the ground-up. They have designed everything from the rocket engines to the human-rated Dragon capsule. The Merlin rocket system is the first rocket system to be developed by the US in a decade and only the second in 25 years.

SpaceX has even has built a customized South Pacific launch pad located on Omelek Island at Kwajalein Atoll. The region is made up of equatorial islands about 2500 miles from Hawaii, and has a long history of rocket launches by the US military. The intent is to deliver fast, reliable and economical access to space from here, all while avoiding unnecessary bureaucracy.

"COTS is a Space Act Agreement [with NASA], not a contract, and it's a partnership collaboration so we go back and forth with them. If we need an expert in a certain area, they send the expert here to work with us," Murphy pointed out. "It is an absolutely fantastic model when going forward to develop any new system. It's very, very successful. A lot of that has to do with the people in that COTS office. Minimal oversight, a lot of help, without strangling us with oversight."

With the help of NASA expertise, SpaceX is quickly becoming the spearhead of commercial rocket launches. But COTS awards, NASA assistance and groundbreaking commercial rockets aside, SpaceX has had its fair share of set-backs. After all, who said rocket science was easy?

Video: Flight 3 failure (August 2nd)
Website: http://www.spacex.com/multimedia/videos.php?id=13
Youtube: http://www.youtube.com/watch?v=Dhci-93Xnxw

If at first you don't succeed...

The Falcon 1 rocket, SpaceX's smallest partially reusable satellite launch system, saw its first Pacific blast off on March 24th 2006 at 5:30pm EST. [http://www.space.com/missionlaunches/060324_spacex_failure.html) This was SpaceX's first launch. Alas, the inaugural flight of the two-stage-to-orbit rocket-grade kerosene/liquid oxygen (LOX) powered vehicle suffered a main engine fuel leak at T+25 seconds, and sparked a fire. Falcon 1 lost control, as a result, and crashed into a dead reef a little less than 300 feet from Omelek Island. While the loss of Falcon 1 was sad, the overriding attitude of Musk was that SpaceX was in it for the long haul and, "come hell or high water, we are going to make this work."

A Defense Advanced Research Projects Agency (DARPA) investigation followed. The agency determined a corroded fuel line nut caused the leak. SpaceX soon swapped all aluminum hardware with stainless steel replacements, as a result. Stainless steel is heavier, but cheaper than aluminum and does corrode. Pre-flight computer checks were also increased 30-fold, to avoid future problems.

In a statement he made soon after the 2006 launch failure, Musk emphasized how difficult it is to launch payloads into space:

"It is perhaps worth noting that those launch companies that succeeded also took their lumps along the way. A friend of mine wrote to remind me that only 5 of the first 9 Pegasus launches succeeded; 3 of 5 for Ariane; 9 of 20 for Atlas; 9 of 21 for Soyuz; and 9 of 18 for Proton. Having experienced firsthand how hard it is to reach orbit, I have a lot of respect for those that persevered to produce the vehicles that are mainstays of space launch today." [http://www.spacex.com/updates_archive.php?page=0106-0506)

So, the pressure was on SpaceX for their second test flight, the following year. On March 20th, 2007, a launch was attempted. This time, at T-0.5 seconds, the automated launch sequence software had detected the engine chamber pressure slightly under its designated value, and launch was aborted. During a Falcon 1 launch sequence, the final 30 minutes of the countdown is purely automated. This "hot launch abort" is a good test for Falcon 1 systems. Ground crew speedily carried out a partial de-tank and re-tank, in order to warm the fuel. Falcon 1 then prepared for a second attempt only 70 minutes later.

The second launch attempt had turned out far more successful. Falcon 1 blasted off from Omalek and appeared to carry out a flawless first-stage separation as it flew into space. However, the second stage engine switched off prematurely due to an unexpectedly large oscillation amplified by the sloshing of propellant in the LOX tank. When first stage separation occurred, it is believed the interstage hit the second stage Kestrel engine nozzle, thus forcing the second stage Thrust Vector Control (TVC) system to overcompensate for the oscillation. Falcon 1 did deploy its satellite mass simulator ring, but the rocket couldn't attain optimum speed and therefore had not make it into orbit on this second attempt.

Critically, Flight 2 had proven to the world that SpaceX was capable of actioning a very fast turnaround when faced with an automated hot launch abort. Falcon 1 had also proven that its

Panormaic view of inside the Space X Facility. Credit: Ian O'Neill

Video: Falcon 9 – Nine engine test (Texas Test Facility, McGregor, July 31st)
Website: http://www.spacex.com/multimedia/videos.php?id=19
Youtube: http://www.youtube.com/watch?v=rU8wu-gnf6M

technology was capable of getting into space, reaching a maximum (yet sub-orbital) altitude of 156 miles.

After the 2006 crash and 2007 failure to reach orbital altitude, SpaceX had addressed all the design flaws of the previous test flights and hopes were high for a successful Flight. Only this time, Falcon 1 would be carrying several commercial payloads. The August 3rd, 2008 launch carried the Trailblazer satellite for the US Air Force, the NanoSail-D and PREsat nanosatellites for NASA and a space burial payload for Space Services (Celestis).

"We were quite confident that Flight 3 was going to be a success, and a portion of it was," Diane Murphy said when asked how SpaceX felt about the third attempt. "We had a picture-perfect launch and, for the first time, we used our Merlin 1C engines which we developed here. This was very important for us to verify that this engine worked properly because it's going to be used in the Falcon 9."

The Merlin-1C Transient Thrust Problem

As with Flight 2, the August launch appeared to lift-off perfectly. However, an anomaly occurred immediately after first-stage separation at approximately T+170 seconds into the flight. Residual fuel vapor inside the Merlin-1C main engine ignited, providing some transient thrust. In the vacuum of space, the tiny boost had caused the first stage to push back into the second stage Kestrel engine. On viewing the video footage of the event, stage separation had appeared to be executed perfectly, only for the retreating main engine to rebound, colliding with the second stage. As the first and second stage collided, Falcon 1's fate was sealed. The second stage engine Kestrel engine ignited whilst the first stage was not clear, forcing the craft to tumble out of control. Although the fairing was successfully jettisoned (the protective shielding surrounding the payload), it was too late; the rocket exploded 200 miles over the Pacific Ocean.

The problem was quickly singled out as being an issue with the brand new Merlin 1C regeneratively cooled engine. The previous Merlin 1A engine (as used in Flight 1 and Flight 2) was ablatively cooled and would not have experienced this stage separation anomaly.

The interim Merlin-1B engine, an upgrade from the Merlin-1A, had been designed to provide 10% more thrust than its predecessor. However, as stated by Elon Musk during an interview on NASASpaceflight.com in August, 2006 (http://www.nasaspaceflight.com/2006/08/spacex-has-magical-goals-for-falcon-9/), "Merlin-1B was upgraded in thrust, and had an upgraded turbopump with upgraded main valve. This was a significant upgrade, but it was still an ablative chamber. As development of the more advanced regeneratively

SpaceX canteen, adjoining the rocket workshop. Credit: Ian O'Neill

Video: Compilation of the successful Flight 4 (September 28th)
Download hi-res: http://bitcast-a.bitgravity.com/spacex/2008/launches/falcon1_flight4_highroller_hd.mov
Website: http://spacex.com/multimedia/videos.php?id=31

Diane Murphy, Vice President of Marketing and Communication at SpaceX. Credit: Ian O'Neill

cooled Merlin-1C was progressing quickly, SpaceX decided to skip the use of the Merlin-1B all together. The Merlin-1C, one of the highest performing gas generator cycle kerosene engines ever designed, is on a par with the Apollo Program's Saturn V F-1 engine, and surpasses the specifications of any engine since. The poor cooling system eventually caused the craft to explode."

The biggest loss from Flight 3 came from the destruction of the NASA, Air Force and Celestis payloads. NASA's prototype NanoSail-D solar sail and PharmaSat Risk Evaluation (PRESat) nanosatellite were never able to prove themselves in orbit, but the scientists working on the projects remain upbeat that they were a success. As stated on the NASA website, "This mission provided an excellent opportunity for collaboration between two NASA centers, other government agencies, academia and the burgeoning space industry. Through the development of NanoSail-D and PRESat, NASA gained experience and knowledge it can apply to future small and nanosatellite missions." [http://www.nasa.gov/mission_pages/smallsats/index.html)

Although the Flight 3 loss was a devastating blow to SpaceX, they remained upbeat about what went right, rather than dwelling on the unforeseen stage separation anomaly. "We were very pleased in the fact that there were no production faults, it was in the design," Murphy said. "It was a matter of going back to the computer and fixing it."

The Pay-Off

Finally, after six years in the making, the first Falcon 1 rocket made it into Earth orbit on

Personal Loss:

The Dead's Remains Explode with Falcon 3

The Celestis payload onboard Flight 3 of the Falcon 1 was carrying the ashes of 208 people including Mercury Project astronaut Gordon Cooper and Star Trek actor James "Scottie" Doohan. In a recent statement to TrekMovie.com (http://trekmovie.com/2008/08/04/doohans-ashes-fail-to-make-orbit-statement-from-family/) Doohan's son Eric described the emotional turmoil after losing some of his father's ashes on the doomed Falcon 1 saying, "Every launch attempt is like reliving his funeral."

Although there has been some media coverage of the payload losses of Flight 3, there has been little mention about whose remains were flying on the Celestis Explorer Flight. Celestis Inc. is an affiliate company of Space Services Inc. which specializes in post-cremation memorial spaceflights. Using Celestis, families can have the opportunity to send a small portion of their loved-one's ashes on board a rocket flight. Space Services has a proud 30 year history of public participation space flight, and Celestis launched their first memorial space flight in 1997.

One of the participants on the Explorer Flight was Kit Cole who died in 2006 when he was 68. His wife Susan, and sons Bryan and Randall wanted to give Kit his second flight into space. Having previously sent a portion of Mr Cole's ashes with the April 2007 Legacy Flight (onboard a SpaceLoft XL sounding rocket, capable of reaching a sub-orbital altitude of 140 miles), the Cole family wanted to have a memorial flight for Kit that would take him into orbit. Unfortunately, this Celestis Explorer Flight was on board the failed Falcon 1 Flight 3.

Whilst no space launch company can give assurances that they will get a payload into orbit, the Celestis Explorer Flight is a poignant reminder that it wasn't only hardware lost on August 2nd.

Charles Chafer, CEO and Founder of Celestis, is acutely aware of the risks associated with getting his memorial flights into space. "We inform the potential customer that spaceflight is risky, that there is a good chance (even on proven vehicles) that the flight might fail, and that they should send sufficient cremated remains for a free re-flight," Mr. Chafer said. "This approach has worked well to date."

Although Celestis provides information on the launch company to their clients, Bryan Cole and his family were not aware of the previous SpaceX launch failures. "If I would have known that, I probably wouldn't have done it," Bryan pointed out. However, the Cole family are not critical of Celestis or SpaceX in any way, they are fully aware of the risks associated with space flight. In light of the recent SpaceX success and previous good experience with Celestis, Bryan Cole said, "Yes, I'd do it again."

Although Kit Cole was not a space enthusiast, he did enjoy watching shooting stars on a clear night at his Oregon coastal home, so his family thought it would be a fitting tribute to send some of his ashes into orbit. "You'd see a star and it would be Dad," Bryan said.

The interstage section of a Falcon 1 awaits assembly. Credit: Ian O'Neill

September 28th, 2008. SpaceX made history on that day, becoming the first privately-owned space transportation company to send a ground-launched payload into space. Only 58 days after the loss of Flight 3, SpaceX once again proved they could fulfill a fast turn-around and successfully get back into space.

This time the company launched a "dummy" satellite to simulate the insertion of a real satellite into orbit. The SpaceX simulated payload was dubbed "Ratsat", an acronym of the last names of the engineers who built it. The 165 kg Ratsat intentionally had not been ejected from the second stage of Falcon 1. Instead, it remained attached and will continue to orbit Earth for the next 5-10 years.

The live webcast of the event, presented by Diane Murphy and Senior Mission Manager Max Vozoff, was also shown on a huge wall by the SpaceX canteen so all the employees could watch. The atmosphere was elated, but the overriding feeling was of relief.

"It was a relief. Elon called it a 'monkey off his back'! It was a relief to see that it worked so well. Of course the separation worked well in Flight 2, so the total relief didn't come until the whole thing worked [and got into orbit]," Murphy said.

There was a moment of nervousness when streaming video was lost 60 seconds before the Kestrel engine shut-down, but the signal was quickly re-established. Then, 9 minutes and 30 seconds into the flight, the Kestrel engine shut down, signifying the second stage had reached orbital altitude.

"And that would be a nominal SECO!" Vozoff exclaimed as the second stage engine was turned off. "Which means that Falcon 1 has made history as the first privately developed launch vehicle to reach Earth orbit from the ground!" The spacecraft was traveling at a velocity of over 16,000 mph at an altitude of 206 miles.

Falcon 9 and the Future

Now that SpaceX has proven the Falcon 1 technology, what's next? As the larger Falcon 9 rocket will use the same technology as Falcon 1, SpaceX is perfecting the Merlin-1C technology before attempting Falcon 9 launches. Falcon 9 will use nine separate Merlin 1C engines to get it into orbit; should there be any design flaws in the system, at least Falcon 1 will identify them.

The single Merlin-1C provides the 21 meter-long Falcon 1 with 347,000 N of launch thrust. The 55 meter-long Falcon 9 (the rocket that will launch cargo and crew on board the Dragon space vehicle) will use nine of the Merlin-1C's, thereby delivering nine-times the thrust. So it is good that SpaceX is perfecting Falcon 1 before the maiden flight of Falcon 9, to be launched from the new SpaceX launch pad at Cape Canaveral, FL.

"We want to use Falcon 1 to verify all of the systems worked perfectly on this small rocket before we transfer things to the larger rocket. You increase the systems ten-fold on the larger rocket, so it's ten-times more expensive to make a mistake on," Murphy pointed out.

So, in 2009, SpaceX will fly the Dragon vehicle into space. "We'll definitely be ready with the cargo, we'll be flying next year with that capability," Murphy added. But it doesn't stop there, SpaceX is confident that they will have a manned spaceflight option for the US sooner rather than later. "We are estimating that will demonstrate our capabilities [for manned flight] by 2011."

Fast progress is also being made at Cape Canaveral, at the location where Titan IV launches were carried out. "It's almost completed down there," Murphy confirmed. "We're putting the hangars in now and the helium pipeline is going in. The Falcon 9 is going down to the Cape before the end of the year and have it upright on its stand."

"It's very symbolic because it's a transition from 'old space' to 'new space'; Titan IV to the Falcon 9."

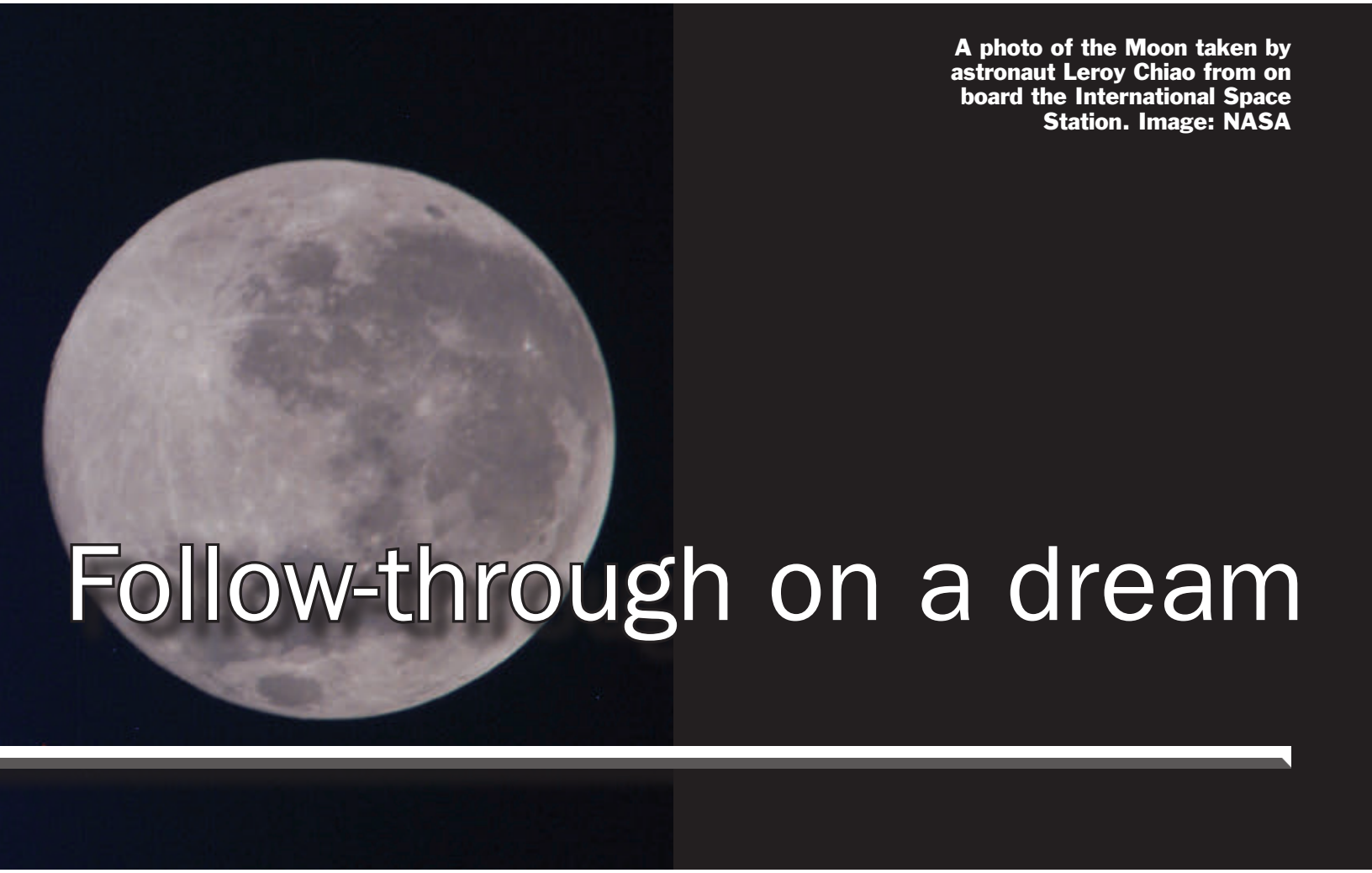
Main SpaceX manufacturing operations will remain at Hawthorn, but the inclusion of the Cape Canaveral launch site enriches the options for SpaceX. The company is even considering Falcon 9 launches from Omelek Island.

It seems that from a small converted hangar, on the edge of a small airstrip, deep inside Los Angeles, the dream of low-cost spaceflight is quickly becoming a reality. The spaceflight industry as a whole appears to be undergoing a transition from old government contract-driven spaceflight to new commercially motivated NASA partnerships. Perhaps the "5-year gap" after the Shuttle is decommissioned in 2010 won't be such a problem after all...

SPACE LEADERS

By Lois Elfman

There are tens of thousands of people involved in the business of space—from researchers to astronauts to engineers. Some of them were fascinated by space from a very early age and others found their way into the industry by chance. What is unquestionable is that the leaders in the space industry all have a passion for their work and for exploring what is yet to be discovered. In this feature we take a look at three people, each of whom have made and continue to make significant contributions to the ever-changing world of space exploration.



A photo of the Moon taken by astronaut Leroy Chiao from on board the International Space Station. Image: NASA

Follow-through on a dream

From Star Gazing to Inside the Space Shuttle

Roland M. Nedelkovich

Roland Nedelkovich helps prepare the Node 2 before the module is brought to the International Space Station. Image courtesy of Roland Nedelkovich.

"When I was a sixth grader for Christmas Mom and Dad bought me a 2" refracting telescope, which I would set up on the roof," said Roland M. Nedelkovich. "I grew up in Brooklyn (NY), and we lived in a brownstone. I would set up on the roof and just look at the stars, the Moon. Big thrill—I saw Saturn once. I was an amateur astronomer."

Nedelkovich, 49, did not grow up to be a professional astronomer as he'd dreamed, but he did forge himself a distinct career in the space industry. Since 1995, he's been working at United Space Alliance, where he is currently serving as the FCE/EVA Project Manager.

He remembers the first Moonwalk as if it was yesterday. "It was late at night and my dad said I could stay up," he recalled. "We're Europeans, so there were some lines we could not cross and one of them was bedtime. So it had to be a pretty big deal for us to be able to stay up. I pretty much stayed up all night watching that TV. It was amazing."

He attended Stevens Institute of Technology in

New Jersey to study engineering and joined the ROTC program with the hope of becoming a pilot. His eyesight was slightly imperfect, so he needed to get a waiver to do pilot training. When that didn't happen, he was directed to navigator school instead.

"I was never a back-seater," he said. Instead, he worked off the tuition reimbursement at Edwards Air Force Base in California.

His sights were set on the aerospace industry. When companies came to the college to recruit, Nedelkovich lined up interviews with Lockheed and Northrup. The latter was interested in hiring him and flew him out to the plant in Southern California for further interviews, which went well. Because his family had come to the United States as refugee immigrants (originally from Hungary), it was somewhat difficult to get him the security clearance required to work on the B-2 Bomber program, so the job offer didn't come through.

"I didn't have any other job prospects, so when I graduated college I took the first job that somebody locally offered, which was a steel mill in New Jersey," he said, adding it was just as awful as it sounds.

One day during lunch hour he saw an ad for Rockwell International. After a few phone calls, he was offered a job as soon as his Air Force service was fulfilled. He began working at Rockwell in 1985. While his bachelor of engineering degree with concentrations in mechanical and electrical engineering were crucial in landing that first aerospace job, he said the last 23 years have involved keeping his eyes open to opportunities, sensing forthcoming changes in the industry, making efforts to reinvent himself and, yes he admitted, being in the right place at the right time.

"Some of the jobs I selected put me in contact with people who could introduce me to the next great job," he said. For example, during his four years at Rockwell International in California, he did what he referred to as "hardcore engineering work." That brought him to the attention of Rockwell Space Operations in Houston, which was looking to take on staff.

"Literally just answering a phone call one day where the guy said, 'Would you like to come to Houston?' 'Sure, NASA sounds great,'" he said. "Leave California, spend a few years in the Shuttle Avionics Lab, which is our real high fidelity simulator for avionics, for software check out, for the flight hardware checkout.

"The neat part of that job is you actually learn how to fly the Shuttle. You become certified as a ground commander. You can pretty much execute any part of the mission. On top of which, you get to meet a lot of the astronauts who come through as part of their training flow." That led to the next job with United Space Alliance where he was the mission lead/orbiter lead in the Astronaut Office.

United Space Alliance (USA) was established in 1995 as a Limited Liability Company equally owned by The Boeing Company and Lockheed Martin Corporation. USA is a major NASA contractor and has been responsible for more than 40 Space Shuttle missions and 17 International Space Station (ISS) increments. Nedelkovich's offices have always been on the premises of NASA.

Nedelkovich in front of space shuttle Columbia in 2002 before it launched on the STS-109 mission, the fourth Hubble Space Telescope Servicing flight. Courtesy of Roland Nedelkovich.

One of his most prestigious and stressful assignments was a five-year stretch where he literally commuted between the U.S. and Europe to serve as integration lead for the Nodes program. This involved flight crew interface activities, which included EVA and IVA testing and hardware verification for the ISS Node 2 and Node 3. He mentioned as a standout accomplishment helping

to get Node 2 into orbit given the lack of funding and some huge technical problems that had to be overcome.

When you do something day-to-day, you can easily forget how unique a job can sound to others. Every now and then Nedelkovich catches a glimpse of one his job-related photos and remembers the historical connotations. For example, a photo holding the Olympic torch. When he was working the integration engineering job at the Astronaut Office, on his first flight at Kennedy Space Center, one day before lift-off he was handed a package and told to place the torch somewhere on the Shuttle, but before doing that make sure it's safe for flight. He found an x-ray lab on site and wrote a report certifying the torch as safe.

"Drove out to the pad with a roll of duct tape and literally taped it to the side of the mid-deck locker," he said. That torch is now at the Atlanta Convention Center with other artifacts of the 1996 Olympic Games.

Now is a time of change in the business of space. "With the Shuttle projected to end in about a year and a half and huge reductions in all the workforces, all the companies really have to fundamentally change the way they're doing business and sometimes the business they're in," he noted.

"I'm trying to take my part of the company from a one-contract big kid on the block to a multi-contract environment," he continued. "Try and go out and make money in the commercial sector."

New tasks may not be as exciting. There were times when Nedelkovich was the last person off the Space Shuttle before the flight crew boarded. At one point, one of the astronauts suggested Nedelkovich apply for the program. Unfortunately, an old back injury made it unlikely he could meet all the physical requirements.

There are downsides to his work. "I spent 10 years living out of a suitcase, because of all the travel that was required," he said. "The compensation is what it is. You're not going to get 15-20% annual raises or a bonus of 40% of your salary at Christmas. This is a different kind of world. That's not to say you cannot do well."

Constant travel led to the end of his marriage, but he's worked very hard at keeping a tight bond with his 12-year-old son, Otto. He said his son is a bit blasé about Dad's occupation, but sometimes he does acknowledge that the autographed astronaut photos and his solid gold EVA pin that has been in space are kind of cool. "He would like to see a launch. I have to work that out somehow," Nedelkovich said.

He strongly advises young engineers to look beyond engineering to program management or non-technical management. "If you are a nuts and bolts engineer, you need to move on," he said. "We have many people at NASA who are engineers for their whole lives. Good example is the flight controllers. They love what they do so much that they can't imagine ever going beyond that.

"I think part of the satisfaction is the stress of doing some new things. You need to replant yourself every once in a while." He came into his current position when he simply could not commit to the years of travel necessary for Node 3. "That was tough, because at my going away party, I realized that might be the coolest technical job I would ever have.... But I like what I'm doing now."

One of his current responsibilities is managing the little subcontracts, to see if USA can move from an environment of one big contract, NASA, worth $16 billion over the years, to multiple contracts, some as small as $500,000 to $1 million.

"The little details are enormous," Nedelkovich said. "We've got a couple of years to figure it out."

Some Childhood Prophesies Do Come True

Leroy Chiao

Leroy Chiao's official portrait for the ISS mission. Credit: NASA

You're reading a magazine called Space Lifestyle, so in all likelihood you or someone very close to you uttered the popular childhood phrase, "I'm going to be an astronaut when I grow up." Leroy Chiao is no different. Like many others, the 1969 Moon landing was a landmark event in his life, but even before that he was fascinated with airplanes and rockets and devoured books on the subject. By the time Apollo 11 touched down, that phrase was frequently coming out his mouth.

"Of course, my friends and I all said we wanted to be astronauts," said Chiao, who is the only one who actually achieved it. "We played space and pretended we were landing on the Moon. I even built a little spaceship, kind of a command module, underneath my workbench in the garage."

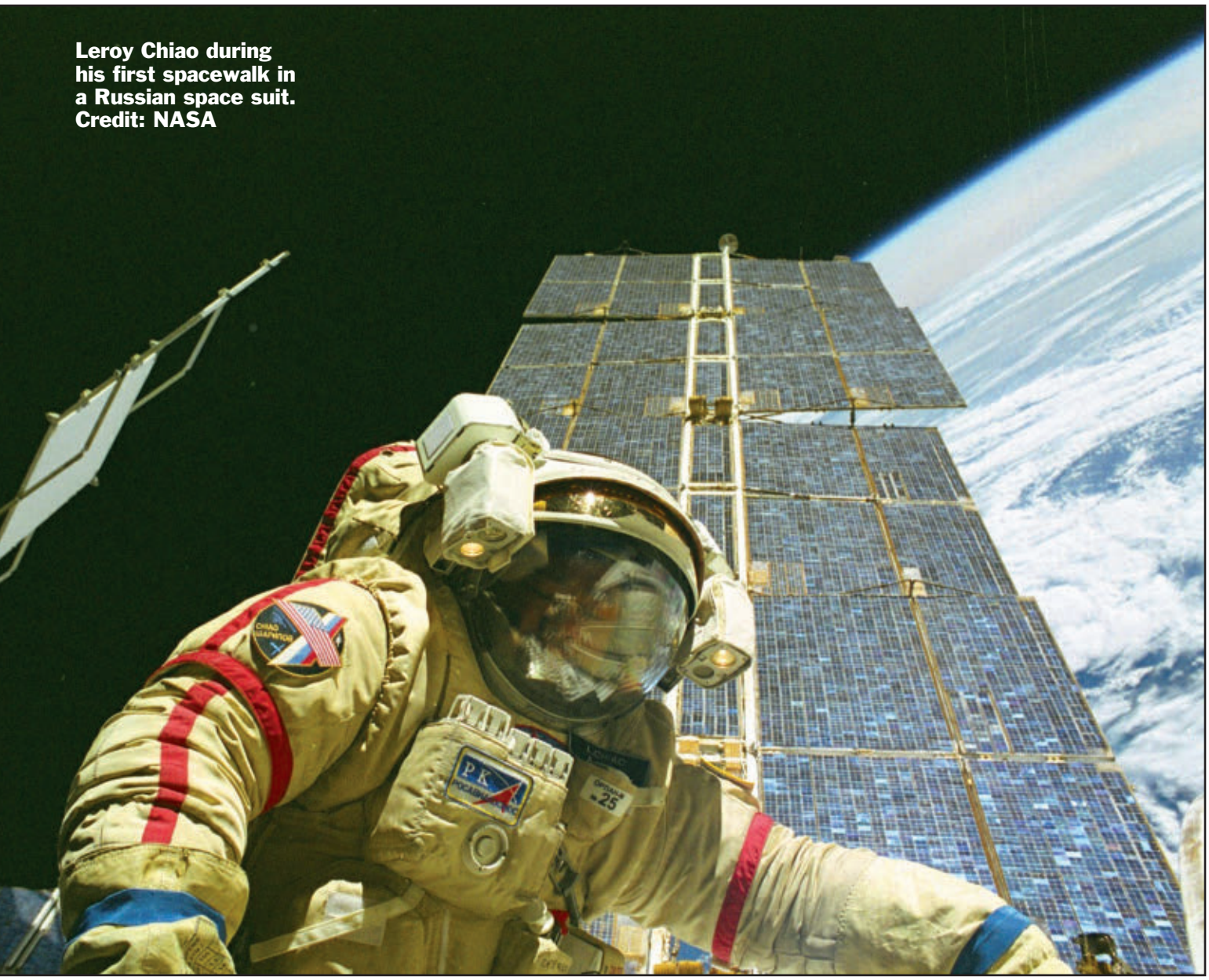
Perhaps, space was a bit more real to Chiao, now 48, than others because his father worked at Lawrence Livermore National Laboratory and did some consulting work with NASA. Nowadays, all the relevant information about applying to be an astronaut is online. But it was actually a colleague of Chiao's father who helped him get the initial information back in the early 80s.

Chiao is first generation American, and his Chinese-born parents were very pragmatic and education focused. Dreams were great, but the route to them could only be accomplished by doing well in school. While excelling in school, Chiao also understood that good grades alone would not lead the way to a career in space, so even as a teenager he was doing strategic planning, such as picking the right university.

"I had already decided I wanted to study engineering," he said. His dream of going into space took a huge leap forward the year he graduated high school, when NASA selected the first group of Space Shuttle astronauts and included in that selection non-military civilians.

"I decided I would go the civilian route," Chiao said. If he went into the military and that didn't lead to space, he would be stuck with a military career he didn't really want. But if he studied engineering and was never accepted into the astronaut program, he would still have a very marketable degree and the ability to plot an interesting career.

"When I was in graduate school, I sent away for my astronaut application package and started to try and make it real," he said. "My parents didn't take that dream of mine super seriously. They knew it was something I was interested in, but they were very realistic. Not in a discouraging way, but they said, 'It's great to have a dream, but you also have to be practical about it.'"

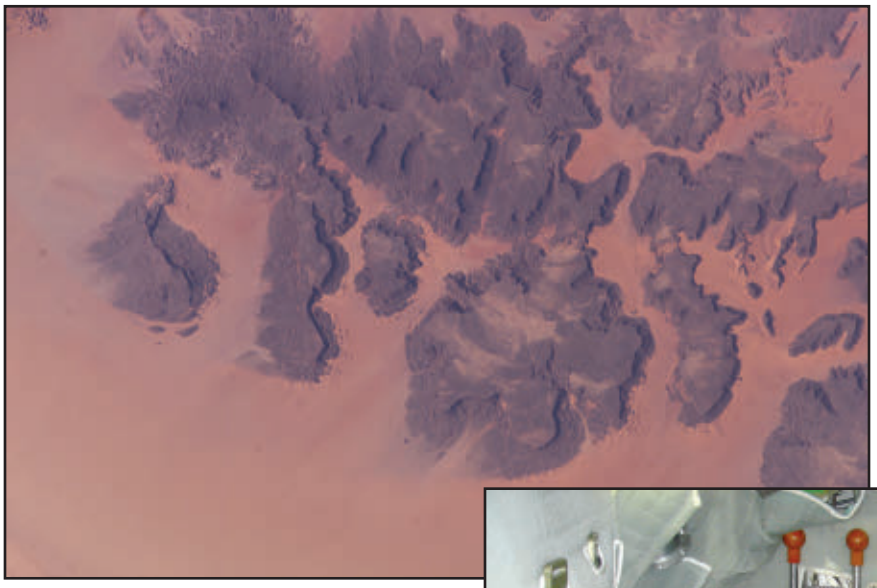


Leroy Chiao during his first spacewalk in a Russian space suit. Credit: NASA

For undergraduate, Chiao attended UC Berkeley. For graduate school, he decided on UC Santa Barbara, "because first of all they were offering me a research assistantship, so I'd get paid while I was going to grad school," he said. "It was a nice location. It was a smaller program and still had a good reputation. It was a change of pace from Berkeley." Chiao knew NASA was looking for all kinds of technical people, so it didn't matter what specific area of engineering his Ph.D. involved.

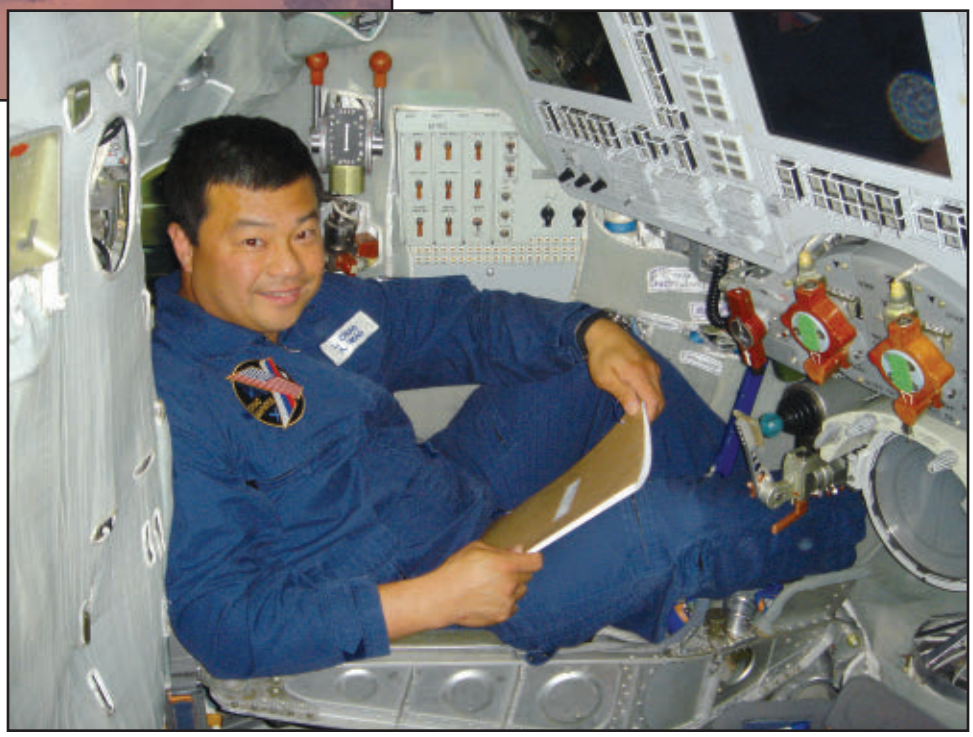
Today, he often speaks to groups of school kids and teenagers. He tells them to pursue their dreams in a purposeful way. "You can't blindly pursue something," he noted. "You've got to always be assessing your situation and your options and what's realistic. But you've got to go for your dreams. What would be worse than looking back at your life many years from now and saying, 'I didn't even try to do the things I wanted to do.'"

After earning his Ph.D., Chiao went to work for Hexcel, an aerospace composite material manufacturer. From there, he went to work at Lawrence Livermore National Laboratory. In February 1989, he submitted his application to NASA (by mail). That summer, he got a call from the Astronaut Selection Office asking if they could contact his current employer. Then in September, he was invited to come to Houston. In January 1990, he got a call saying he hadn't been accepted but please reapply.



Another image taken by Chiao during his stay on board the ISS, this one of the Salamat Basin in Chad. Credit: NASA

Below: Leroy Chiao prepares for flying in the Russian Soyuz vehicle by training inside the Soyuz simulator. Credit: NASA



"I was kind of crestfallen when I got the call," he said. At around 7 a.m. the next morning, his fates changed when he got a call saying he was being invited to join the incoming class. "I reported to work in early July."

It was four years before he'd go into space, which he said was around average at that time. The 23 people in his class came from very diverse backgrounds: military test pilots, medical doctors, physicists and other research engineers such as himself. The first year, they were together, and then were sent out to various support jobs and additional training. Once an astronaut is assigned to a mission, he or she starts mission specific training.

Over the course of 15 years, he made several trips into space, including three Space Shuttle flights.

"Professionally, from a personal level, I feel very fortunate. I got to do just about everything I could have done in my career as an astronaut," Chiao said. "I got to fly on the Space Shuttle. I got to be the commander of the International Space Station. I got to fly up and down on a Russian Soyuz spacecraft for that mission. I got to do six space walks—four of them in U.S. space suits and two of them in Russian space suits. I got to learn the Russian language and made some lifelong friends over there.

"I flew science missions. I flew space walk missions. I helped to build the International Space Station. So from a personal professional level, I couldn't have asked for any more."

When he was selected to be an astronaut, Chiao said his intention was to stay at NASA and fly as long as he'd be allowed to fly and then move to a desk job. Early in his days at NASA he attended a going-away party and he heard someone say, "You'll know when it's time to go." He thought that realization would never come to him, but in late 2005 it did.

He said an astronaut's perspective changes over time. When you first get in the program

you're willing to accept any risk just to fulfill that dream to be in space.

"With each flight, most astronauts start thinking a little bit about the risk," he said. "People in my era, we lost friends on Space Shuttle Columbia. One guy was a neighbor and a pretty good friend. It gives you pause. It's not that we took the risk for granted, but you get a little comfortable. Then one doesn't make it."

Chiao said the nature of his job—the pressure, the moving around, the risk—made him think he'd never get married. When he turned 40 he started to realize he wanted a family. He married wife Karen the year before he flew the ISS mission, and after he retired their twins, Henry and Caroline, were born.

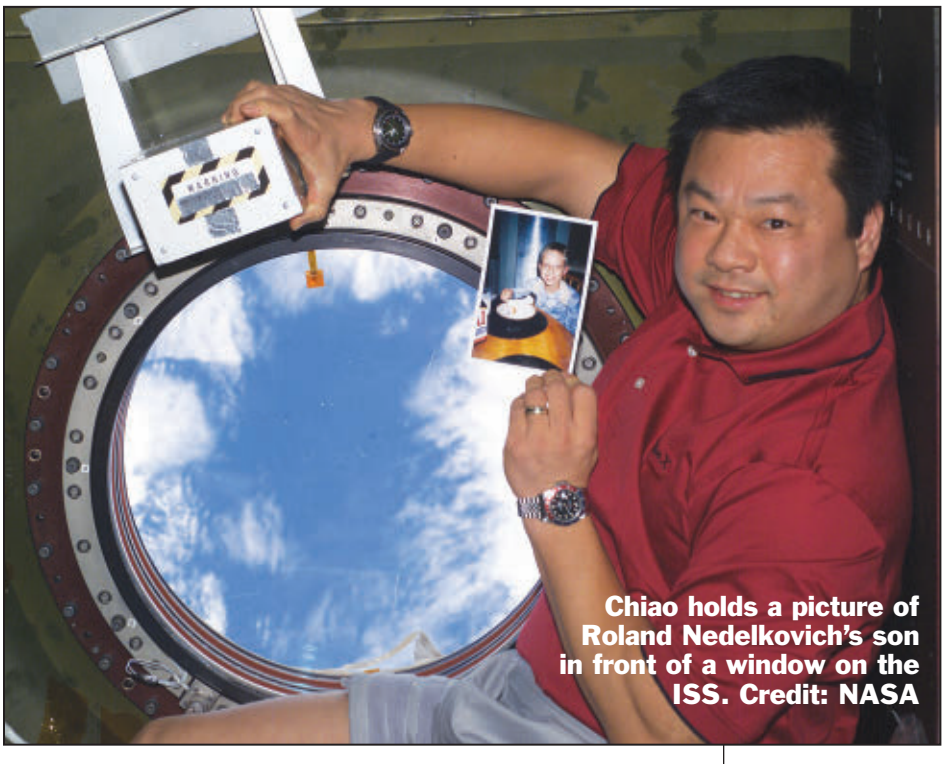
"It's hard for me now to imagine having toddlers and going away all the time and missing them growing up and short changing them on having their father around," he said. He came back from the ISS mission and sensed it was time to move on. He was offered another Space Shuttle mission, but turned it down.

He became an independent consultant on space issues and education issues and a highly sought after public speaker with Leading Authorities Speakers Bureau (leadingauthories.com). Chiao also became executive vice president for space operations and director of Excalibur Almaz Limited, a private space flight company that plans to market orbital flights for space tourists.

Knowing what great lengths and lifelong commitment and preparation it took for him to earn a seat on a spacecraft, how does he feel about space touristry?

"I have to admit, years ago when this was starting, my knee jerk reaction was 'no way,'" he said. "Then after thinking about it and getting used to the idea, in the appropriate time and place it's perfectly natural, kind of the same as the evolution of the airplane. In the beginning, the airplane was very risky, expensive and just for a few people. Eventually, the airplane evolved to what it is today, part of everyone's lives. I think space will follow the same path, but obviously it will take longer because it's a lot more difficult technically to get into space."

Part of Chiao's commitment to commercial space travel comes from what he admits are personal feelings and moments of self-discovery he achieved while in space. "I remember looking back at the Earth and how beautiful the Earth was," he recalled. "The colors were so vibrant and so much brighter than I imagined they would be.



Chiao holds a picture of Roland Nedelkovich's son in front of a window on the ISS. Credit: NASA

"The Earth looks absolutely peaceful from space. Intellectually, you know that is not the case. It gave me a perspective on life and taught me to take what I call the big picture. It helps you to understand, to be more tolerant. From a somewhat esoteric point of view, the more people we can get into space to have that view and have that self-examination, the better off we'll be."

He feels to really have the impact, it requires orbital flight. Now, what about training? The five space tourists who've gone up on a Russian Soyuz have had to undergo six months of training and spent more than $20 million a piece.

Chiao prefers the term "space

flight participants," and he said the length of training time and expense may vary based on what future space travelers will be doing during a mission.

"They're not essential crew members, like a co-pilot. They're not throwing switches. They're not trouble shooting systems. They're not doing repair work or anything like that," he explained. "They are oftentimes participating in experimental work when they're on board. What I envision is we would have two different types of paying customers."

One type would be similar to the five who've gone so far, essentially passengers. "We're still defining our training and developing it." He said it will probably be substantially less than six months.

The other type of space flight participant could be someone, who if he or she possesses the right qualifications could perhaps co-pilot the spaceship. That training would obviously be longer.

Chiao said the hope is the cost per passenger will go down as volume of travel goes up. For that to happen, there have to be some technological breakthroughs in rocketry or a different way of propulsion and getting out of the atmosphere and up to orbital speed. There is definitely a need for researchers who can help advance these things.

There is not a specific timeline, but sometime over the next few years Excalibur Almaz hopes to have its first test launch. "We've got to be a self-policing industry," he noted. "We're very cognizant of that in our company as I hope other private space companies are as well. We've got to be a self-policing industry to make sure we don't cut corners and try to get something done faster or cheaper. Our partners in Russia are very experienced at building spacecrafts. We recognize safety's importance and we keep it as part of our culture."

As he looks forward to a decade from now and beyond, he hopes that commercial space travel will also become affordable to various research groups who desire to perform experiments in space.

"It could bring a Renaissance of space research for companies either trying to develop products or universities and other research institutes trying to understand fundamental phenomenon in microgravity and things like that," he said. "In the big picture, it's better for all of us the more people we can get into space."

Math Is for Girls

Peggy E. Thomas

Peggy E.Thomas, Director of avionics and software, International Space Station, NASA Systems at the Boeing Company. Courtesy of Boeing.

When Peggy E. Thomas was growing up, computer science was just emerging and she wanted to know more about it. But it was the 60s and girls were not being encouraged to pursue such things.

"I was in the sixth grade and after recess they asked the boys to line up in one line and the girls to line up in another," she recounted. "When all of us girls wound up in a classroom, we were told we were going to be told about the facts of life. This woman stood up and she basically told us, 'Your function in life is to become a wife and mother.' I was flabbergasted. I felt my function in life was to be a little bit more than a wife and mother. Being a wife and mother is a wonderful thing. I'm not trying to discount that. But I felt like I wanted to do more than that."

High school counselors told her if she had to have a career, she should pursue teaching. Thankfully, her parents encouraged her to do whatever she wanted.

While putting her ex-husband through college, she worked for a company called Computer Sciences Corp. as a software engineer. They knew she didn't have a degree, but they saw potential in her. Management encouraged her to go to college, which after getting a divorce she did.

In time, her computer skills led her into the space program. Her work with Computer Sciences

took her to the Jet Propulsion Lab, where she wrote telemetry processing programs. From there, it was onto Ames Research Center, where she actually found the research and development work not as exhilarating. Then she moved with Computer Sciences to the Johnson Space Center, where she thrived on the deadline driven, high pressure work.

Today, she is director, avionics and software, International Space Station, NASA Systems at The Boeing Company.

"I came to work at Boeing on the Space Station program," she said. "We were developing the flight software. One of the areas had some difficulty and my boss at that time, Brewster Shaw (a former astronaut and now vice president & general manager of Boeing's space exploration division), asked me to go to California for six months and help with the software area that was being developed there. This is software that runs all of the things on the outside of the space station. It's called the external control zone software. It does things like the mobile transporter. It's pretty complex software and my job was to get it back on track.

"My customer (NASA) and I worked together to help solve those problems." From there, after rave reviews for her performance, she moved into her current position.

When she began working in the space industry, there were not a lot of other women in influential positions. "It's challenging for anyone in a leadership role in this particular job, because we're doing things that we've never done before," she explained. "Some of the things I bring as a woman are beneficial. I care about people. I care about helping them be successful. That helps me in many cases to address performance issues perhaps more effectively than I've seen some of my male counterparts do."

As director she currently oversees about 600 software engineers. That number was once over 1,000, but it declines as the ISS nears completion. "We're going from developing to sustaining engineering," Thomas noted.

She's found working in the space industry a very rewarding expression of her love of math and computer science. Remarried, she loves inspiring her step-grandchildren to be interested in space, with things like posters and pins.

Her advice to those who are interested in a career in space is to be goal-oriented and persistent. Look for when new government contracts are awarded and see what jobs might become available with the contractor. For those at the beginning of their careers, every year Boeing brings in around 30-40 interns.

Peggy E. Thomas, meets with software engineers in her department. Credit: Courtesy of Boeing.

Thomas is looking forward to continuing her work with Boeing into the Constellation program. Before that, she has one big thing on her "to do" list.

"I have not yet seen a launch," she said. "I've written that down as one of my goals."

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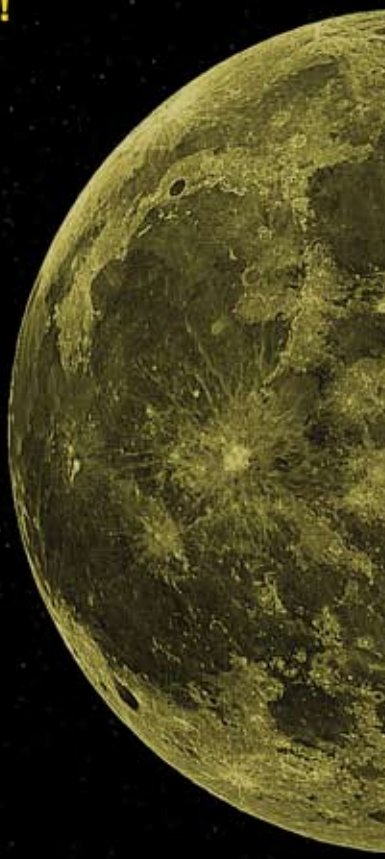

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Editorial

The Case for NewSpace
Why Entering the Emerging Space Frontier is Tough, And Can Be Successful

By David Bullock
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Is money tight? Does your career outlook now seem grim? Are you just trying to make ends meet? For most of us, there's a strong possibility the answers to those questions are all 'yes.' But try being a NewSpacer. With current high cost for parts and fuel, working in NewSpace start-ups (many of them competing for various X-Prizes and some of them independently try to make their dreams happen) are finding that life in the new final frontier is a tough business.

To work on one of these projects, you may have to work for "graduate school" wages, or even hold a second job, which is a different tune from what we were hearing from the NewSpace advocates before. Before, they were asking for blood. Before, you came to work for no compensation. Now there is a bit more hope. And even if you're boss's name isn't Elon, you've got a lot to look forward to. And the only direction is up.

NewSpace has a lot of potential for advancement for individual company and overall industry growth. More people are buying tickets for Virgin Galactic's suborbital space flight tourism experience. More players are entering both the Google Lunar X-Prize and the Lunar Lander Challenge. Some of companies are even experiencing positive cash flow, with some of the most notable funds coming from side contracts with institutions like the once-bashed-at NASA.

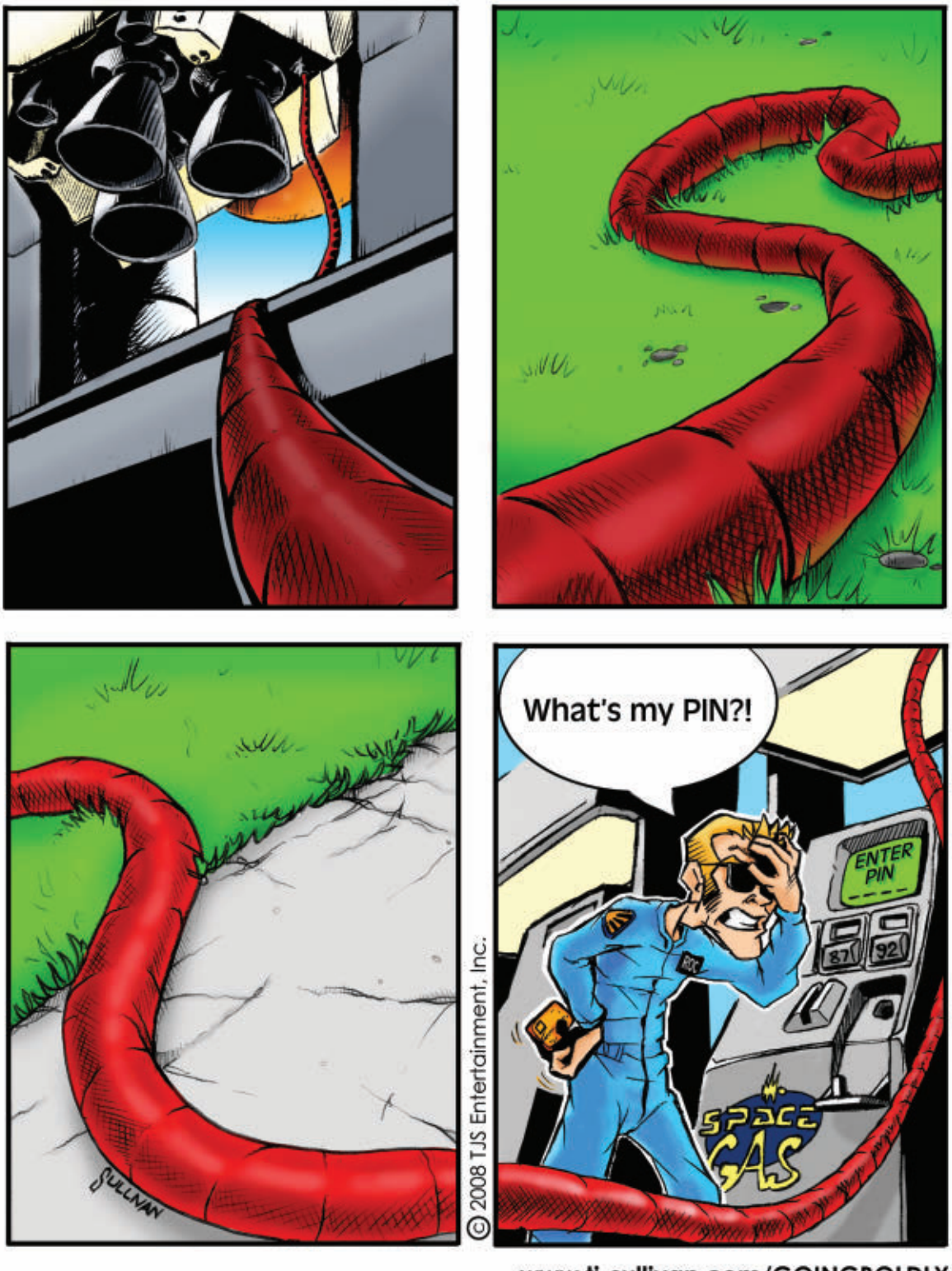
The potential for job growth and industry growth is also ever apparent. But there is still a strong need for people to take risks. There needs to be more people working in the industry. There needs to be more working support of the industry. There needs to be more investment of all kinds in the NewSpace industry.

Besides the need for engineers and machinists, which will always be true throughout the space sector, one growing need is for support businesses in the commercial space arena. Support can include legal, accounting, marketing, recruiting and other forms of business support. As said before, the pay would be low, but those hanging in there for the long haul will probably, ultimately, do well and will accomplish much.

Outside of the support aspects of the industry, of those who will make parts and spacecraft, the greatest potential may not come from young Internet-age people, but the Apollo-era set. The older generation may have more time in their retirement to tinker and make spacecraft and invest in their work, than the younger folks.

One thing is for sure, if you are looking to break into the industry, all you need to do is speak to one or several of the companies that have already started-up. In doing so, you can see if you can help out, and also find out how your skills match up with the industry as a whole, and possibly determine where you are needed. And NewSpace is all around the nation. From Wyoming to Florida, especially New Mexico and Los Angeles, and even abroad, the potential for a space frontier is truly before us.

GOING BOLDLY BY TJ SULLIVAN



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An Alternative for NASA's New Launch Vehicle

DIRECT 2.0 Or Ares?

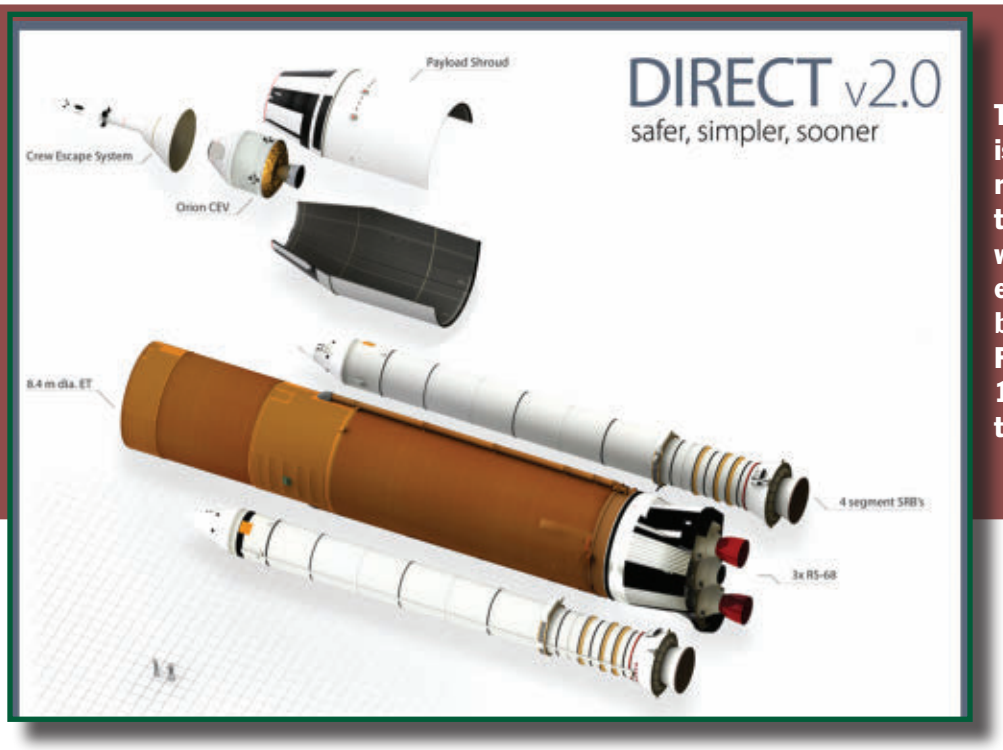
By John George

Since the National Aeronautics and Space Act was signed into law on July 29th, 1958, it mandates NASA to accomplish (or at least attempt) very specific objectives. The Act, itself, articulates eight objectives. Objective two states, "The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles," while objective eight requires, "The most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities and equipment."

The Executive Branch occasionally supplements what is described in the Act. The announcement by President Kennedy of the national commitment to go to the moon is just such an example.

In January 2004. President Bush announced his Vision for Space Exploration (VSE), or simply called the Vision. This plan articulated the future agenda for the domestic civilian space program. It called for many objectives. These objectives ask for the retirement of the shuttle by 2010, the completion of the space station by 2010, the development the Orion or crew exploration vehicle by 2008, and a manned mission with the crew exploration vehicle by 2014.

The Jupiter 232 is essentially the same rocket as the Jupiter 120, but it has more thrust, with three engines at base of ET, and can carry a larger payload. Orion, consisting of the CEV, the lunar lander module, and the EDS, are all carried on top of the ET.



The Jupiter 120 is the smaller rocket of the two systems, with two engines at the base of the ET. For the Jupeiter 120, the CEV is the payload.

More significantly here, the Vision also asks for the development shuttle-derived launch vehicles, thus affirming the Act through Executive decision.

The announcement of the VSE provoked various efforts to determine the most effective and efficient methods to accomplish its goals. The Exploration Systems Architecture Study (ESAS), had been set out to find what was most effective and efficient.

The Constellation Project

The results of the study recommended launching the Crew Exploration Vehicle (CEV) of the Constellation Project (to return to the moon) on a "shuttle derived launch vehicle," as an answer to fulfill the VSE goals. The ESAS report reviewed a number of shuttle-derived launch vehicles, and arrived at a basic plan for using two launch vehicles for the new Constellation program.

The CEV is intended to launch a crew. The launch vehicle, or one of the rocket parts, for the CEV is essentially a variant of the shuttle solid rocket booster (SRB). The other launcher, or the other rocket part, is the heavy lift vehicle required for the cargo, and it uses the shuttle SRB's and the external tank. The small launcher includes a fifth stage on the SRB and a liquid propellant upper stage on top of a disposable shuttle main engine (SSME). The design requires that the shuttle be removed from the side of the external tank (ET), which is the presently deployed configuration. The cargo is placed on top of the external tank and five SSME's are installed at the base of the ET. To obtain the thrust to leave Earth's orbit, it is necessary to add a fifth segment to the existent four segment SRB.

Using these rocket parts, two rocket systems are planned. The Ares 1, the smaller of the two planed rocket systems, will launch the CEV or Orion. The first stage of the Ares 1 looks like the SRB of the shuttle except that it has a fifth segment to allows it to burn longer and produce more thrust. The second or upper stage is propelled by a liquid fueled J-2X (liquid oxygen and liquid hydrogen). The only feature of the Ares 1 that is common with the Shuttle's external tank is the foam insulation that will go on the upper stage. This will protect the liquid propellants.

The Problems

A heavier-than-anticipated Orion crew vehicle resulted from these changes. The fifth segment had been planned to be added, which increase the thrust to compensate for weight. However, adding a fifth segment was determined to be the central bore in the center of the SRB and had to be changed. The solid fuel mixture had to be

A digital depiction of a DIRECT launch vehicle riding a crawler, going to a launch pad.

modified from its shuttle formula, as a result. This change was more problematic and more expensive than had been anticipated before. The weight of the Orion vehicle was also now too heavy. At this point, the crew vehicle had been reduced and safety features were removed to accommodate the weight changes.

Because of the need to create the J-2X and the five segment SRB, along with a different crew vehicle that resulted from these changes, the cost of the entire design increased. Budget overruns and development times on the project have been longer than anticipated. Other problems have also arisen that were not anticipated. For example, the vehicle vibrates so radically in what would be the first few moments of launch that a buckling in the structural features of the rocket occurred and when tested it ended up crashing into the ocean.

The Ares 5, the larger of the two rocket systems, also changed dramatically from the design described earlier. The Ares 5 is a heavy launch vehicle that is intended to launch the Earth Departure Stages (EDS), and the Altair lunar lander. The launcher has three stages: the first stage consists of a pair of SRB's, the second is a massive liquid Core stage and the third uses one J-2X and a brand-new composite structure for the tanking. The solid fueled portion will be housed in two SRB's with 5 segments instead of the shuttle's 4 segment SRB's. Six liquid fueled RS-68B engines will be mounted on the bottom of a "shuttle-derived" external tank. However, this tank is much wider and longer than the current shuttle ET. The third stage EDS has one J-2X engine that can propel the EDS or other payloads into a circular orbit. Once in orbit the EDS can fire a booster to initiate a journey to the moon or beyond.

Ares 1 is intended to launch the crew into orbit on a lunar mission. The cargo and vehicle to traverse to the moon is launched on the Ares 5. These vehicles will launch simultaneously. The crew will rendezvous with the cargo vehicle in orbit and then leave orbit on a trajectory for the moon or beyond. Ares 1 is not only intended to support the missions to the moon, but is planned to service the space station when the shuttle retires. The Ares 5 has a longer development time, so the Ares 1 will be in service to support the space station years before the Ares 5 is completely developed.

Because of the issues that Ares 1 is having in development, there is a possibility that it might get cancelled. When asked what he thought NASA should do considering the budget overruns of Ares and the significant design issues, Griffin replied, "Stay the course." NASA has not developed other options to Ares, and has spent so much money on the Ares launcher, that some say it is unlikely that Ares will be abandoned.

Another Option

However, there is another option. This option is known as DIRECT 2.0. and it derives its name from the fact that it is based on technology that is derived directly from shuttle hardware. The numerical signification indicates that this is the second version of the concept (the first being DIRECT or DIRECT 1.0) One of its conceptual founders Steve Metschan explains that "DIRECT is a catch-all for the concept." Jupiter is the name for the rocket or launch vehicle upon which DIRECT is based.

DIRECT would replace the two Ares launch vehicles with one launcher that can be adapted to two different configurations: one to fly the crew, the other to fly the cargo. These two versions are the Jupiter 120 and the Jupiter 232. Both of these rely on the use of two SRB's from the shuttle and the ET from the shuttle. The ET is adapted: the payload goes on the top of the tank, and engines are put on the bottom of the tank..

Although the Jupiter can be modified into more vehicles than the 120 and the 232, these two versions are promoted as solutions to the known problems of the currently planned Ares series. Jupiter 120 is expected to have the lift capacity of 40 metric tons, and is intended to be able to launch the crew with an extra 20 metric tons of capacity for supplies. The DIRECT 2.0 team expects the 120 to be available by 2013. The Jupiter 232 is expected to be able to lift over 100 metric tons. The Jupiter 232 could be ready by 2016..

The Jupiter concept is not new. Metschen, said "We did not come up with this ourselves. Basically, it was a NASA design that they had for more 30 years." The National Launch System that NASA had been considering between 1989 and 1991 looks very much like the present configuration of DIRECT. People within NASA have looked at different versions of DIRECT's basic concept before. The last time that a variation of DIRECT was considered by NASA was in the ESAS report, which brought about the current "shuttle derived" program.

The product of two distinct groups of people DIRECT consists of both engineers and a "public side." There are 62 engineers that are either working at NASA or the contractors that work for NASA. Additionally there are 4 people who make up the "public side" of the DIRECT program. The current version of DIRECT evolved with the guidance and support of these people.

Ross Tierney is the "public face" of the DIRECT program. Originally from England, Tierney worked for the entertainment software company EIDOS prior to traveling to the United States. On one trip to Florida, Tierney witnessed the launch of STS-97 on "a crystal clear night. I thought it was magical. Just lovely. I was hooked right there and then."

Tierney started a company selling models of launch complexes (www.modellaunchcomplexmodels.com) which required him to travel between England and Florida. During this time he saw 7 different launches "which tweaked my engineering fancy." Tierney moved to Florida, becoming the official front man for the DIRECT project.

One of Tierney's main concerns for the DIRECT project is safety. Tierney had the unique opportunity to visit the room where the remains of Columbia were assembled following its destruction. He shared the room with the families of the Astronauts who were killed in that accident. "This was probably the most moving experience of my life....It really brought home to me the importance of the safety program."

After looking at the shuttle design, Tierney concluded "There is no escape capability, and that is why you have to get the crew off of the side of the vehicle." DIRECT2.0 gets the crew off of the side of the external tank by putting them on its top. There on the tank, the crew is placed 10 meters away from the fuel. This distance is far enough away, in case the vehicle explodes. This is one of several discussed safety features.

Tierney and Chuck Longton, an engineer at Electric Boat in Groton, Connecticut, began a dialogue about the DIRECT1.0 concept. These series of conversations grew into a friendship and association. Longton has also committed to being a representative of the concept. Longton presented a paper on DIRECT 2.0 to the large aerospace professional organization, the AIAA, of which he is a member of. He has found that to work on the project is a "second full-time job". .

Longton has been captivated by space since Sputnik, and said "When the ESAS report was released discussing the merits of the shuttle-derived approach, I was pleased with the choice." When he saw the changes that NASA Administrator Michael Griffin made in the original Ares architecture, he and Tierney started working on their own. He said, "We asked ourselves what we could put together that complied with the law and could achieve the objectives articulated in ESAS. We wanted to stay within the limits of the 2005 authorization act."

Chuck Longton, Engineer for General Dynamics at Electric Boat in Groton Connecticut and founder of DIRECT.

Longton said that one of his personal concerns has to do with saving the infrastructure of the shuttle program and utilizing it in the future. He "witnessed the human misery that was left after the Apollo program. I saw the Saturn 5 dismantled and tossed away. That to me was a sin."

When asked if he thought the performance numbers and figures that he and his team have compiled would translate and be accurately reflected if DIRECT 2.0 were to go into production, Longton said "We have built in sufficient margins to cover that. Our published performance numbers are actually only 90% of what the vehicle is capable of."

Steve Metschan, the third major part of the DIRECT 2.0 team, is a mechanical engineer that worked for Boeing for ten years, but then started his own software business. Metschan developed a program that NASA had a use for so his company became a NASA contractor. This software enabled NASA to do studies that have been helpful to Steve in his efforts with DIRECT 2.0. Metschan discontinued his involvement with NASA after disagreements with how NASA Administrator Griffin administrates. "I agree with most of what he writes, but very little of what he does."

Metschan was designing his own concept for a launch vehicle when he encountered Longton on www.NASASpaceflight.com. NASASpaceflight.com is a non-governmental website that provides information about the United States space program and NASA. Longton then introduced him to Tierney. "We met online," Metschan said, "We were on the same path and we looked at the same information. I bring to the team an understanding of NASA. He brings to the team enthusiasm and an ability to meet and work with people in the Kennedy area."

Metshan is an advocate of the usability of NASASpaceflight. "This is something that has become a powerful part of our team. The ability to put an idea out there and get some Vetting free with the participation of a large group of qualified people....You need a culture in place where the most important part for your team is to get it right." NASASpaceflight "allows this by allowing anonymity."

The three varied talents and extensive educations of this team have resulted in the DIRECT 2.0 project. These three people bring different perspective and thoughts to the project. Also, Philip Metshan and António Maia are responsible for the artwork and visual representations of the DIRECT 2.0 team. In conjunction with the assistance of the 62 engineers at NASA, the DIRECT 2.0 team has put together a potentially viable option to the currently questionable Ares project. These three have organized this option on their own time, at their own expense, and with no financial or practical reward.

Steve Metschan, creator of software company TeamVision Inc., and founder of DIRECT.

When asked if they were interested in making a profit from this project if it were to be the direction that NASA takes, they all said "no." Tierney said he and Longton want "front row VIP seats for the first Jupiter launch." Longton said, "To be able to go to the Kennedy Space

Center and watch a Jupiter Launch would be pure satisfaction for me." Metschan sees his involvement with DIRECT2.0 as a personal effort to improve the human condition. "If your objective is to improve the human condition, the activity tends to be a reward in itself."

Both the "public face" of DIRECT and the volunteer engineers have developed DIRECT on their own time. The credentials of the DIRECT community are unassailable by the stewards of the program which DIRECT has evolved in response to, i.e. NASA. Currently employed NASA engineers have contributed to the development and evolution of DIRECT. Many of these engineers are working on the Ares program and many of them have decided to participate in DIRECT because they feel experientially, professionally and intellectually that Ares is not adequate to accomplish the goals of the Vision. They are convinced that Ares cannot fulfill the legislative, executive, and bureaucratically self-imposed mandate to: 1) rely on shuttle hardware 2) maintain the infrastructure that supports and produces the shuttle equipment 3) remain in current and anticipated budget parameters and 4) adhere to original and even recently-modified schedules guiding the progress and implementation of the Constellation Project.

With all of these claimed potential benefits that the Jupiter launch vehicle promises, why has NASA not considered it as a viable option? There were feasibility studies done by NASA in May of 2007 and September of 2007 that compare the Ares vehicle and the DIRECT 2.0 vehicle, and then assess the DIRECT2.0 vehicle on its own. These are fairly recent comparisons. The following is a synopsis of the conclusions of one of these studies.

"Several of the Shuttle-derived concepts that were considered during ESAS, and other studies were similar to the Jupiter system identified as part of the DIRECT proposal. However, using current ground rules and assumptions, and utilizing validated NASA and industry design and analysis tools, NASA has determined that the DIRECT proposal is unlikely to achieve its claims of improved performance, safety and development costs when compared to the Ares I and Ares V approach. In addition, the limited data available in the online DIRECT proposal do not support the claims of increased safety. Also, analysis shows that the DIRECT proposal would cost more than the Ares family in the near-term and also on a recurring launch basis. Finally, the DIRECT proposal would take longer to develop when compared to the Ares vehicles when factoring in the extensive core stage development effort and the associated acquisitions."

Metschan claims that while NASA was compiling the ESAS report, some studies were conducted on DIRECT-type vehicles that revealed to NASA the superiority of the DIRECT launcher, but that the results of these studies were condensed into an appendix of the ESAS report: "Appendix 6(A) -(F)". The appendices of the ESAS report are not included in the publicly disseminated version due to the "sensitive" nature of the information. Griffin has not allowed the release of these appendices, even to the Government Accountability Office following an official request on their part.

If the appendixes can confirm the superiority of the DIRECT architecture, then the Government Accountability Office can ask that Griffin hand over the appendixes. If it turns out that the claims of the DIRECT team are accurate and the DIRECT program can accomplish what it sets out to do, the United States might have a launcher made to fulfill our light and heavy lift needs on a more expeditious schedule.

Both Griffin and DIRECT want to use shuttle derived technology, but the two groups can't agree on exactly how much or what kind of the shuttle derived technology exactly needs to be reused. It seems both groups are considering economy, safety and mission objectives, but can't agree on which technology to put in use. Through future decision making, it will be interesting to see how NASA and these Vision technologies evolve in the coming years