

Close Encounters
Spring 2013



nova

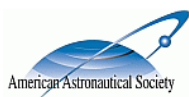
The Official Publication of SEDS-USA

In this issue

This year started off with a bang as an asteroid orbiting the sun in the asteroid belt found itself in a trajectory that allowed it to rip through Earth's atmosphere and settle in the city of Chelyabinsk, just to the east of the Ural Mountains in Russia. We were forced to ponder our safety on this pale blue dot which we call home and have discussions about using human presence in space to protect our planet. Our attention has also been focused on our own robotic rover, Curiosity, which has been exploring Mars since touching down back in August 2012. Over the past few months, as we've received initial data from Curiosity, scientists have finally been able to virtually analyze new samples from this otherworldly environment to search for indicators of life outside of Earth. 2013 marks a year of close encounters as humans boldly continue to explore and ask questions about the cosmos which is in and around us.

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Letter from the Chair

Hello Reader and Welcome to 2013!

With the announcement of several start-ups and continued progress by existing players in the space industry, 2012 proved to be a fantastic year for the cause of space exploration and development. The industry is unquestionably changing and here at SEDS, we are continually working to contribute to the successes of the space community by being a strong and unified voice for student space enthusiasts. You may recall that over this past year, SpaceX launched and docked with the International Space Station for the first time. This was only one major headline to hit the papers though, other major advancements in the industry included SEDS Founder and Alumni founding Planetary Resources and Deep Space Industries—two firms with intent to capture asteroids and mine them for resources.

These are welcomed milestones in the development of space and will pave the way for many milestones to come.

All across America, SEDS members and alumni are contributing to our united vision of exploration and development of space and this is a tremendous thing. We are always looking to further this contribution and inspire youth with space exploration. One of our main goals with this organization is to engage kids in being excited about space and eager to become the next top rocket scientist or rover engineer. We balance this vision with technical and non-technical projects to support our mission. Nationwide, SEDS chapters design and build satellites, rockets, robots and high altitude balloons. At SEDS-USA, we are working to make these activities widely available to the public. By collaborating with national partners, the board helps members accomplish their goals because we believe that showcasing our accomplishments is important to encouraging future students to pursue space-related projects.

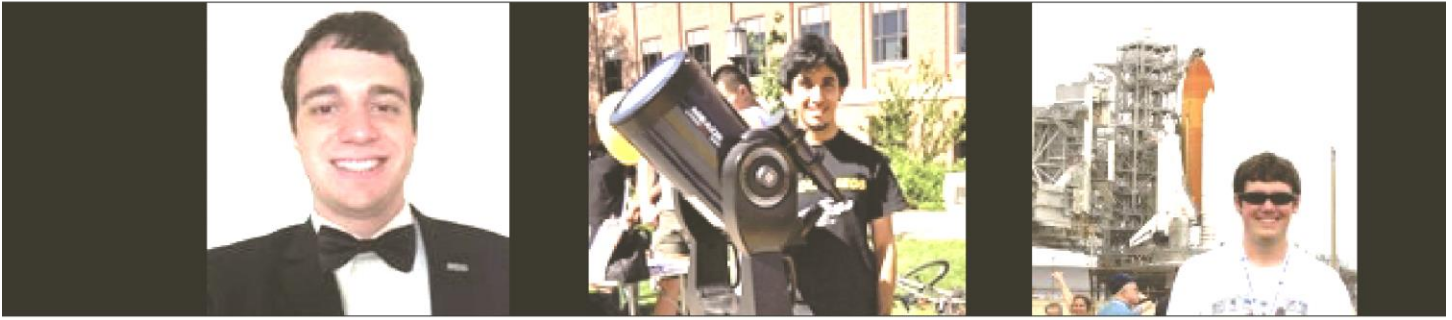
In the past year, SEDS-USA took many steps to increase efficiency in how we operate nationally. This includes the adoption of a strategic plan for the first time in over a decade to promote student and space leadership in 2013 and beyond. The plan includes streamlining the organizational structure at a national level to allow for further growth through the addition of staff members and a restructured Board of Advisers. With the appointment of an Executive Director leading the staff there is a place for every student whom is interested to get involved and I highly encourage all of our members to take the initiative to do so!

2013 is ramping up to be another astounding year for space development and the promise of increased exploration. There is no better time to get involved with SEDS!

Ad Astra!

Michael Zwach
SEDS-USA Chair

Meet the 2013 SEDS-USA Board of Directors



Chair / Michael Zwach

Purdue University

I am a senior at Purdue University studying Electrical Engineering, Astrophysics, and Entrepreneurship and Innovation. I was born and raised in Colorado Springs, CO living only a stone's throw from U.S. Space Command. I caught the space bug at an early age in the form of a fascination with technology and later discovered the cosmos during a camping trip in High School. I recall seeing the entire Milky Way crystal clear on a cold snowy Colorado night which inspired me to commit my life to helping make humans a space-settling species. I would later join SEDS in 2010 after learning of the organization at the Space Frontier Foundation's NewSpace Conference. I quickly became involved with the National Board after being recommended to serve as National Representative of Purdue SEDS and then applied to serve as Director of National Projects in 2011-2012. I still have a fascination with technology, having worked at NASA in both California and Texas on the Lunar Micro Rover Project and Robonaut 2 projects respectfully, I employ my skills in robotic applications. I am now designing and developing innovative technologies in my free time, tools which I think our species will need to realistically explore and settle deep space systems. This passion for space, knack for technology and innovation, and ability to seek professional experiences led to me being asked to join the Deep Space Industries team in September 2012. At DSI I am director of the NEO Squad, a DSI organized group to find and employ student innovators with a vision for space. I am an anticipated graduate of May 2013.

Vice Chair / Kaizad Raimalwala

Purdue University

I am pursuing a Bachelor's degree in Aeronautical & Astronautical Engineering at Purdue University with minors in astronomy, physics, and economics. I have founded two student organizations at Purdue: the Purdue Astronomy Club and a team for NASA's Lunabotics Mining Competition. Previously, I've worked at SEDS-USA as marketing manager for the Student NewSpace Business Plan Competition 2012 and as a writer for Nova in 2012. I have also played several roles at the Purdue SEDS chapter such as National Representative, Outreach Director, and Co-Director of the annual Spring Space Forum. My career focus lies in the domain of resource extraction and processing in space-based industries and I intend to pursue Master's and Doctoral degrees in related research. My hobbies include photography, astronomy, cooking and occasional outdoors activities such as caving and cycling. I also enjoy teaching and encouraging young school students to be excited about astronomy and space exploration.

Treasurer / Andrew Dianetti

University of Buffalo

I am a junior Aerospace and Mechanical Engineering major at the University at Buffalo, and the new Director of Finance for SEDS-USA. I have been involved with UB-SEDS since my freshman year and have served as chapter president for the past two years. Spaceflight has always been my passion, and I believe that SEDS is an excellent opportunity to bring students who share the same passion for space together. I am excited to serve as Treasurer this year.



Chief Representative, Chair of the Council of Chapters / Emily Metivier

Boston University

I am a senior in Mechanical/Aerospace engineering at Boston University. I am the Chief Council of Chapters Representative this year for SEDS-USA, as well as the president of my school's chapter. I first got interested in space when my family took me to Kennedy Space Center and we saw a Saturn V, and later that night watched Apollo 13. I first joined SEDS in high school and have been involved ever since. I don't think I would be where I am now if I didn't have the opportunities I've had because of being part of SEDS. As Council of Chapters chief representative, I hope to keep of the feeling of collaboration that the chapters feel when they go to SpaceVision every year. That's what keeps SEDS strong!

Secretary / Mary Magilligan

University of Buffalo

I am currently a junior at the University at Buffalo majoring in Mechanical and Aerospace Engineering with a Computer Science minor. I joined UB-SEDS at the beginning of my freshman year, served as the chapter secretary during my sophomore year and I am currently the chapter president. I've always had a great passion for space ever since I was younger. Throughout high school, I conducted astrobiology research involving planetary engineering Mars (my favorite planet!) and I participated in a residential program at NASA Langley Research Center. I have also worked at NASA Marshall Space Flight Center as an intern and I enjoy volunteering at the local air and space museum as a docent during my spare time. I look forward to serving as the secretary this year.

At Large Board Member / Derek Napierala

University of Michigan

I am a junior in Mechanical Engineering with a minor in Electrical Engineering at the University of Michigan. I have been a member of SEDS at UM for two years as a Board Administrator and was elected as president for the 2013 year. I am also a member of Distributed Universal Satellite Technology (DUST) at Michigan which is a student group attempting to redefine cube-sat technology by using smaller swarm based components with inter-communication capability. The beginning of my science career was in participating in Science Olympiad at Fayetteville-Manlius High School, competing at the national level multiple times. I have and always will be interested in space and yearn for the day when humanity can achieve multi-planetary life.

At Large Board Member / Ari Porter

University of Michigan

I am a sophomore Aerospace Engineering major at the University of Michigan and serve as an At Large Board Member. I have been involved with SEDS at UM over the past two years and am active in a lab developing three CubeSats. I have always loved space from a young age and my interest grew throughout high school where I designed and built microgravity drop tower experiments, high altitude balloon payloads, and a microgravity flight experiment. As a board member, I am excited to brainstorm and implement ideas on how SEDS-USA can improve to better serve its chapters and the public.

2013 SEDS-USA Staff



Executive Director / Dan Pastuf

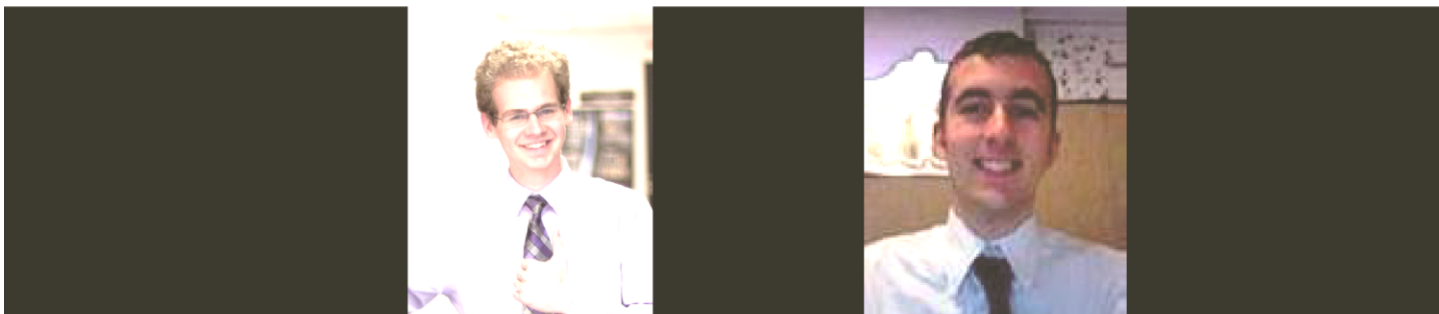
University of Buffalo

I am a member of the University at Buffalo Students for the Exploration and Development of Space, and currently serving as Executive Director of SEDS-USA. I am from the small town of Pulaski, NY in central New York. I first joined SEDS in 2007 through getting involved with the chapter's propulsion project, as well as taking a course that the club had helped to create, Topics in Space Exploration and Development. I was first elected president of UB-SEDS at the end of my freshman year. Over the course of the next two years as president, UB-SEDS greatly expanded activities from a few rocket launches and meetings to include events like Astronomy Viewing, High Power Rocketry, and many others. During 2009, UB-SEDS hosted the Northeast Regional Conference of SEDS, NECOS. At the last minute, the conference chair was forced to resign, and I stepped in to fill the role. In 2011, I was elected to the position of Chairman for SEDS-USA, and spearheaded implementation the organization's first Strategic Plan in over a decade. I currently hold a TRA level 2 rocket certification and a technician level Amateur radio license (KD2BBZ). I am a member of TRA, AIAA, and of course SEDS. I've been a member of the SEDS-USA Board of Directors since fall of 2010, having been elected as the Director of Chapter Affairs for 2010-2011, and the Chair in 2011-2012. I was appointed Executive Director at the end of 2012.

Public Relations Manager / Hannah Kerner

University of North Carolina, Chapel Hill

I am a sophomore studying Computer Science with a concentration in space sciences at UNC. I was born and raised in Charlotte, North Carolina, where the roars of NASCAR all but drown out any mention of the space industry. For whatever reason at an age before memories I fell in love with space and have devoted my life and love forever to this cause. Though my studies are towards the computational and technical side of astronomy and spacecraft, my ultimate goal is to travel into space and hopefully to live a significant part of my lifetime off the Earth. As Public Relations Manager I strive to reach as many and different people as possible through social media platforms and the online press. I want to help people all over the world discover and fall for the wonders of space as I and my fellow SEDS members have, and provide them with resources and outlets to get involved.



SpaceVision Development Coordinator / Zach Pace

Arizona State University

My name is Zach Pace, and I am a junior physics and mathematics major at the University at Buffalo. As you may be aware, I managed sponsorship of SpaceVision 2012 in Buffalo, NY, and I approached the new SEDS-USA Executive Board about integrating national management into the new staff structure. My main immediate role will be to provide sponsorship continuity between successive SpaceVision committees at different sites. In the coming year, I will assist the committee at Arizona State University with turning over previous corporate sponsors—who may only participate in some SpaceVision conferences—into yearly partners. So far, my efforts have been met with some successes with several SpaceVision 2012 sponsors. Eventually, I envision this to become not only a matter of sponsorship, but also a tool for companies to recruit the best and brightest SEDS members into their ranks. In addition, I will work towards building and maintaining strong relations with partner organizations such as the National Space Society, Space Frontier Foundation, and The Planetary Society, three specific cases where our existing relationships have not been taken to their most beneficial extent. In addition, I plan to open lines of communication with the American Physical Society, the American Institute of Physics, and the Society of Physics Students. The former two will aid us with outreach and conference advertisement, while the latter can be used to encourage chapter expansion and conference attendance.

Rocketry Competition Coordinator / Chris Ogden

Arizona State University

I am currently a senior economics major at the University at Buffalo, State University of New York. I've been involved with my local SEDS chapter at UB since my sophomore year. I'm passionate about spaceflight and the changing dynamics of the space industry. SEDS represents an excellent opportunity for students to come together and get involved with the larger space community. This year I'm helping out at the national level as a project coordinator for Rocketry and SpaceVision. I am proud to be a member of SEDS and I hope to be involved for many years to come. If you have questions for me or want to get involved with one of my project, please contact me at christopher.ogden@seds.org

Introductory
project workshops
and a hackathon will
be introduced
this year!

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SPEAKERS

Lawrence Krauss Theoretical Physicist and Cosmologist
Jim Bell President of the Planetary Society
Will Pomerantz VP of Special Projects at Virgin Galactic
Chris Lewicki Chief Asteroid Miner at Planetary Resources
Harold White Advanced Propulsion Lead at NASA
Phil Christensen Planetary Geologist
...and many more!

The largest student-led
space conference
in the world
is coming to ASU.

November 7-10



About the Cover:

Russian Photographer Experiences Shock of a Lifetime

By Ekaterina Khvostova

In searching for a cover photograph for this edition of the NOVA, I didn't expect to find fantastic documentation of the Chelyabinsk meteor. The meteor blasted through the skies above the small Russian town at 9:20AM local time on February 15, 2013, anticipated by no one. When I found photographer Marat Ahmetvaleev's blog, I was captivated by his experiences on that day.

Ahmetvaleev is a Chelyabinsk native, who happened to be at just the right place at just the right time in order to capture the meteor face on as it hurtled towards Earth. I contacted him and he agreed to let me reprint the story of that day. This is a summary of his report, the best I could translate it from Russian.

That morning was frosty, windless, and cloudless. The day before was very warm (about zero degrees Celsius) so the trees were covered with frost. Ahmetvaleev decided to spend the day photographing landscapes at his favorite location close to home. He was at the scene around 9:00 am. There was nothing unusual or remarkable in the sky and he spent the brief time he was out there before the meteor taking landscape photographs.



Then the explosion occurred. What a surprise! Moments earlier, the camera was on its tripod, almost exactly facing the direction where the object appeared. At the instant when Ahmetvaleev was leaning over the camera to change the angle, he saw a bright flash in his peripheral. Turning the camera to the object, he witnessed the moment at which the flash peaked, and everything around was bathed in bright light.

Ahmetvaleev describes his initial thoughts as confused and spontaneous, thinking at first that this was a nuclear bomb. He then remembered media reports about a possible asteroid making a close approach to Earth. Another idea was that this could have been a plane crash.

Images: 9:17:11 Landscape view facing Southwest direction, three minutes before the explosion of the meteorite (Left) 9:19:43 Preparatory image for a panorama, view to the east, a few seconds before the explosion –flash will be to the right (Right); Image Credit: Marat Ahmetvaleev, www.marateaman.livejournal.com



Images: 9:20:33 – Cover Image (Top) Panorama 9:21:35 - 9:21:45 (Bottom); Image Credit: Marat Ahmetvaleev, www.marateaman.livejournal.com

In the first seconds after the meteor, Ahmetvaleev's heartbeat and breathing quickened. His hands shook. When the flash was at its brightest, he felt a strong heat on his face, lasting only a split second. At that moment he also felt a strong pain in his eyes from the intolerable glare of the explosion. Two minutes after the flash, there was a series of explosions, the sounds clear and powerful. Afterwards a large number of birds rose up from the pine forest and flew in all directions. His state of shock – racing heartbeat, heavy breathing, and shaking hands – only strengthened.

Ahmetvaleev describes shooting the images as doing so “on automatic”. Only after the series of explosions was he able to come to and set correct exposures and set up the camera to take panoramas of the residual cloud. Once the cloud began dissipating, he collected his equipment, and stood still, not leaving the location. He looked at the nature which surrounded him and tried to comprehend his experiences. First thoughts were about his loved ones, who he wanted to call but the telephone network was overloaded. Once he finally got in touch with his family, he began trying to figure out what it was that he had seen. When the news finally hit – he processed the footage to prepare it for publication. Although the mood around him was depressing, Ahmetvaleev conveyed that he is glad we live in the information age, and one can share his or her experiences immediately so the world gains a clearer picture of what has happened after a shocking event.

Marat Ahmetvaleev only took up photography about three years ago as hobby to take better home pictures. He began shooting landscapes about 7-8 months ago and realized immediately that this area of photography is where he would really be able to communicate his creative ideas. He wrote to me that “to me—the landscape expresses the state of the soul, it is a way of communicating the feelings of nature and personal emotions”. His plans for the future involve continuing to express himself in photography based on the concepts of Still Life Landscape—focusing on conveying mood through capturing familiar objects in unusual places. The full set of photographs is currently featured in the Chelyabinsk State Museum's exhibit “Space Wanderer: Eyewitness Accounts”. The exhibit describes Ahmetvaleev as one of the most successful photographers, as though he was prepared to photograph the meteor in advance. You can find all the images on Marat Ahmetvaleev's website: www.marateaman.livejournal.com.

The full Chelyabinsk Meteor story can be read on page 17.



Images: Ahmetvaleev's typical photography: В гостях у сказки (A guest in a fairytale) (Left) О том, как осень в отпуск собиралась (How autumn prepared for vacation) (Right); Image Credit: Marat Ahmetvaleev, www.marateaman.livejournal.com

The SEDS 2013 Rocketry Challenge

SEDS is challenging over 10 student teams this year from across the US to Design, Build, and Launch a rocket capable of carrying a 3 pound to 10,000 ft AGL, in as short of time as possible. See the full competition rules and keep up with competition updates at seds.org/rocketry

Design!



Entry to the competition is still open please contact christopher.ogden@seds.org

Build!

Important Due Dates:

Design Report: Monday 4/8/13

Build Report: Friday 5/31/13

Launch by Monday 9/2/13

Final Report: Friday 9/6/13



Launch!

SEDS is currently seeking sponsors for the 2013 Rocketry Competition

Catching up with Curiosity

By Chris Nie



After a breathtaking arrival fall and successful landing on the red planet, the Mars Science Laboratory has begun using its extensive array of geological tools to probe the Martian surface. Commonly called Curiosity, the rover is outfit with more than a dozen large instruments and is powered by a radioisotope thermoelectric generator with the goal to determine if the Martian surface was, or could have ever been favorable for microbial life.

Several of Curiosity's instruments are capable of interacting with the planetary surface in ways never before possible. After passing a series of software and hardware checks, the rover was cleared to begin surface operations. The first operation included the use of the Dust Removal Tool to clear off regolith and allow the ChemCam instrument to analyze the underlying Martian rock.

The next planned activity was to use the percussive drill to bore a hole into the surface and perform science on rock fragments and rock powder for the first time on Mars. The fine dust created by the drilling activity was collected by a small scoop and "ingested" by the rover to be analyzed by two internal instruments, CheMin and SAM.

During the month of March two software concerns were encountered, causing the rover to enter into a safe mode state on two separate occasions. Both instances resulted in a minor fix through software patches.

Despite these minor issues, the first results of the CheMin and SAM were announced, with JPL stating that results indicate the Martian surface once contained water, and would have been habitable had microbial life been present. With this incredibly exciting news, MSL will continue to collect surface samples during the remaining 15 months of its mission.

Chris Nie is a member of CUSEDs. For more news and updates about the Mars Science Laboratory mission, follow JPLNews on YouTube, or @MarsCuriosity on Twitter.



Target 'Wernecke' After Brushing by Curiosity: NASA/JPL-Caltech/MSSS



Preparatory Test of Drilling on Mars Generates Rock Powder:
Image Credit: NASA/JPL-Caltech/MSSS



Curiosity's First Sample Drilling: Image Credit: NASA/JPL-Caltech/MSSS

The Mars 2020 Rover

A Chance for a Sample Return Mission

By Casey O. Stedman

On December 4th 2012, it was announced that NASA intends to launch another rover to Mars in 2020. The successful landing and science conducted by the Mars Science Laboratory (MSL) Curiosity rover has renewed the confidence of the agency to replicate its success. Utilizing the same basic design as MSL and over \$200 million worth of flight ready hardware leftover from development, NASA hopes this will reduce mission costs by almost a billion dollars.

What the 2020 rover will be designed to investigate has yet to be announced. Many speculate, and hope, that this mission will be a chance to fulfil the highest priority of the 2010 Planetary Science Decadal Survey. Every ten years, the National Research Council prepares a document listing the highest priority goals listed by scientists from various fields, and in the case of planetary science, the report was published in 2010. The Decadal Survey listed a Mars “sample return” mission as the most sought after goal of the planetary science community.

Few mission concepts have endured like the tantalizing prospect of collecting a sample from the surface of Mars and returning it to Earth for study. Numerous studies have been performed, landing vehicles designed, and funding sought. The technical challenges would be immense. Prohibitive costs have always been cited as the greatest challenge, however.



President Obama at the Kennedy Space Center in April 2010. His speech involved predicting a U.S. crewed orbital Mars mission by the mid-2030s

The task of retrieving a Martian rock sample will be difficult and more than a little complicated. During the Apollo missions, astronauts were able to simply collect lunar regolith samples in a bag and return to Earth for study in their command module capsule. Unfortunately, there won't be any astronauts on Mars to attempt a similar method of sample collection for years to come. This means NASA and its partners will need to develop a robotic vehicle to operate in the place of human astronauts.

Presently, a Mars sample return mission would require a series of vehicles in order to complete this “holy-grail” of planetary science goals. A three-tiered mission architecture is envisioned; one vehicle to collect and cache a sample, a second to launch and fly to Martian orbit, and a third to collect it from the orbiter and return to Earth where it would re-enter the atmosphere and land so the sample could be extracted. The 2020 rover could, if chosen to do so, could become the first leg of this journey.

This is not the first time a sample return mission has been proposed. For as long as the world's space agencies have launched interplanetary probes, studies have been done to determine the feasibility of collecting a sample for return and examination on Earth. While technologically difficult, it is not without precedence – the Japanese Hayabusa probe successfully collected a microscopic surface sample of the asteroid Itokawa in 2010. The Russian space Agency Roscosmos attempted to launch a similar mission to Phobos, the larger of Mars' two moons, but the probe was lost following a launch vehicle anomaly.

NASA recently selected the members of the Science Definition Team (SDT) from a list of hundreds of potential candidates, who together will determine the mission and goals of the 2020 rover. With selection complete, the process of choosing instrumentation and science teams can now begin. One can expect that a number of instruments will be designed to identify potential elements that may have sustained life, if it ever existed on Mars. Many hope that this team will decide upon sample-return as the 2020 rover's primary mission. Both the Planetary Society and the American Astronomical Society's Division for Planetary Sciences (DPS) have endorsed the proposal to conduct a sample return mission.



The Mars 2020 Rover will feature many borrowed parts from the Curiosity Rover currently on Mars; Image Credit: NASA

However, the 2020 rover (which has yet to acquire a name similar to rovers that preceded it) will likely be the only “flagship” mission for planetary science in the next decade. Reductions to the planetary science budget, sequestration, and the rising costs of other NASA projects have forced planetary scientists to focus on smaller, less-expensive and shorter-term missions in order to study the moons and planets of our Solar System. Even exploration of the red planet, which has seen an armada of probes and rover in the last decade, will see fewer mission directed toward its study.

Because of the reduced spending on planetary science missions, NASA may decide it will be more prudent to equip the 2020 rover with instrumentation for analysis on Mars, as MSL and MER currently do. The possibility that the “return” legs of the sample return mission profile might not be adequately funded (or worse, cancelled) could lead to an expensive Mars rock collecting rover with no way to deliver its cargo to Earth for study. Like Curiosity, the 2020 rover might carry a range of remote sensing and contact instruments to study geology and potential astrobiology.

How likely is it that the 2020 Mars rover will be part of a greater sample return architecture? That remains to be seen. NASA will face a number of annual budget cycles before the rover’s construction must be completed for the intended launch window. In that time, Administrations will change, NASA leadership will change, and the agency will also be conducting the most ambitious beyond-low-Earth-orbit (BLEO) human exploration missions since the Apollo Lunar missions ended in 1972. How much commitment the planetary science community gives to Mars sample return may depend on how well the budget supports other missions, particularly the lagging exploration of the outer planets.

At the annual Lunar and Planetary Science Conference (LPSC), held in Woodlands, Texas this year, it was noted that future efforts toward studying the gas giant planets and their multitude of moons will be diminished because of the budget for Flagship-class missions. NASA’s Science Mission Directorate (SMD) continues to support Discovery-class missions to the outer planets, but the price cap on mission costs will make such endeavors unlikely. Is this indicative of a Mars-bias? Some scientists think so, but that would be in-line with the agency goals of eventually supporting human missions to Mars in the 2030 timeframe.

Indeed, 2 more missions were announced just prior to the announcement of the 2020 rover. Mars Atmosphere and Volatile Evolution, or MAVEN, an orbiter designed to study the Martian atmosphere will launch next year- and InSight (which stands for Interior exploration using Seismic Investigations, Geodesy, and Heat Transport) , a lander based on the successful 2008 Phoenix mission, which will use a drill device to probe the planet’s crust, will launch in 2016. Taking advantage of the 2018 launch window will be the joint European Space Agency (ESA) and Russian space agency (Roscosmos) ExoMars rover mission. The ExoMars mission will incorporate an ambitious plan to utilize an orbiter and a rover for a planned multi-year study. These missions, as well as the NASA rovers Opportunity and Curiosity, are adding to our knowledge of Mars over the coming decade.

While Mars exploration continues with the rovers presently on the surface and the orbiters overhead, the question remains as to whether NASA’s 2020 rover will play any role in a sample return mission. The planetary science community looks forward to the decisions made by the SDT. In either case, the coming decade will be an interesting one to watch when it comes to the 4th planet in our solar System.

Casey Stedman (@Stedman_casey) is affiliated with ERAU-Worldwide Campus

Close Encounters – Meteor lands in Russia

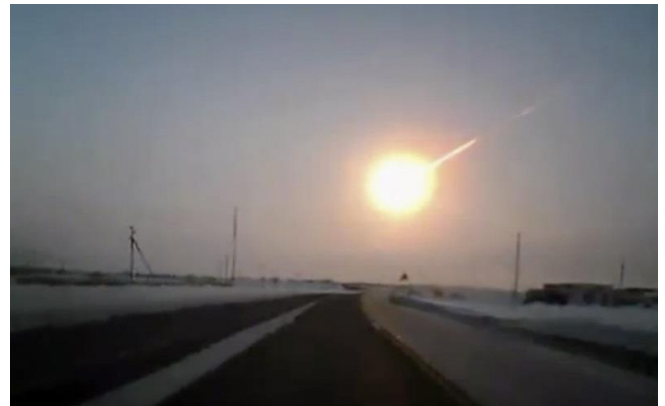
By Jenn Nowicki

An early morning surprise

On February 15th, 2013, the Russian city Chelyabinsk got the surprise of a lifetime when an asteroid hurtled down through the atmosphere, disintegrating into thousands of pieces that rained down on the ground. Amateur videos from car dashcams—intended to catch insurance frauds—instead captured a glowing fireball streaking across the sky. Reports indicate that at its peak, the object hurtling towards Earth was brighter than the sun. A great thundering sound was heard soon afterwards, and witnesses in the area said that the air of the city smelled like gunpowder.

The event garnered immediate worldwide attention and social media sites erupted at the news. Initial reactions were skeptical for the most part since meteors rarely have a significant effect on the ground, given that most fully disintegrate on their descent. After confirmation by the Russian government, however, the meteor became the hottest story of the day. Videos from Russian citizens' dashcams of the meteor made their way to Youtube, cultivating millions of views in a matter of hours.

There were a number of injuries sustained by the local population, though very little resulted from the debris. Nearly 1,500 people sought medical attention in Chelyabinsk, and this number included over 300 children. Though most the injuries were minor, there were several reports of residents being hospitalized with significant injuries, though all were expected to survive.



Meteorite contrail is seen in a frame from a video acquired with a dashboard camera, on a highway from Kostanai, Kazakhstan, to Chelyabinsk region, Russia; Image Credit: AP Photo/Nasha gazeta, www.ng.kz

One of the largest causes of injury was curiosity—as the meteor brightened up the sky with its fiery light, people flocked to windows to get a better look. Unfortunately, windows are one of the most dangerous places to be in the event of an external explosion, since the force will blow back the glass into the faces of the onlookers. As a result, many people were hurt by falling shattered windows and glass, resulting in cuts and bruises. The meteor also shut down the local infrastructure, closing down government buildings alongside private businesses to bring the area to a grinding halt.

There was also serious damage sustained by residential and business buildings, schools and even hospitals, leaving thousands of citizens homeless following the blast. Most of these structures were not hit directly by the debris, but instead became damaged as a result of the shock wave. To this day, only a fraction of the repairs have occurred, leaving Chelyabinsk in a lurch in the aftermath.

Though the effects of meteor were disastrous, it was fortunate that it came into contact with a relatively isolated and low-populated area. Had the meteor come near a high-density region, such as New York City or Beijing, the effects would be catastrophic due to the high rises and skyscrapers, and deaths would have been a near certainty.

So, what kind of meteor was it, and why did it cause so much damage?

According to researchers, the Chelyabinsk meteor was the most powerful in over a 100 years, dating back to the Tunguska meteor from 1908. Calculations of the meteor range between research centers, but the average shows that the meteor was approximately 50 feet wide and weighed around 7,000 tons, or the weight of two large vehicles when it first broke through the earth's atmosphere.

The majority of the meteor's damage did not come from impact, as the pieces that fell were relatively small. Rather, the culprit was a series of shockwaves resulting from several explosions that occurred as the asteroid broke up in the atmosphere.

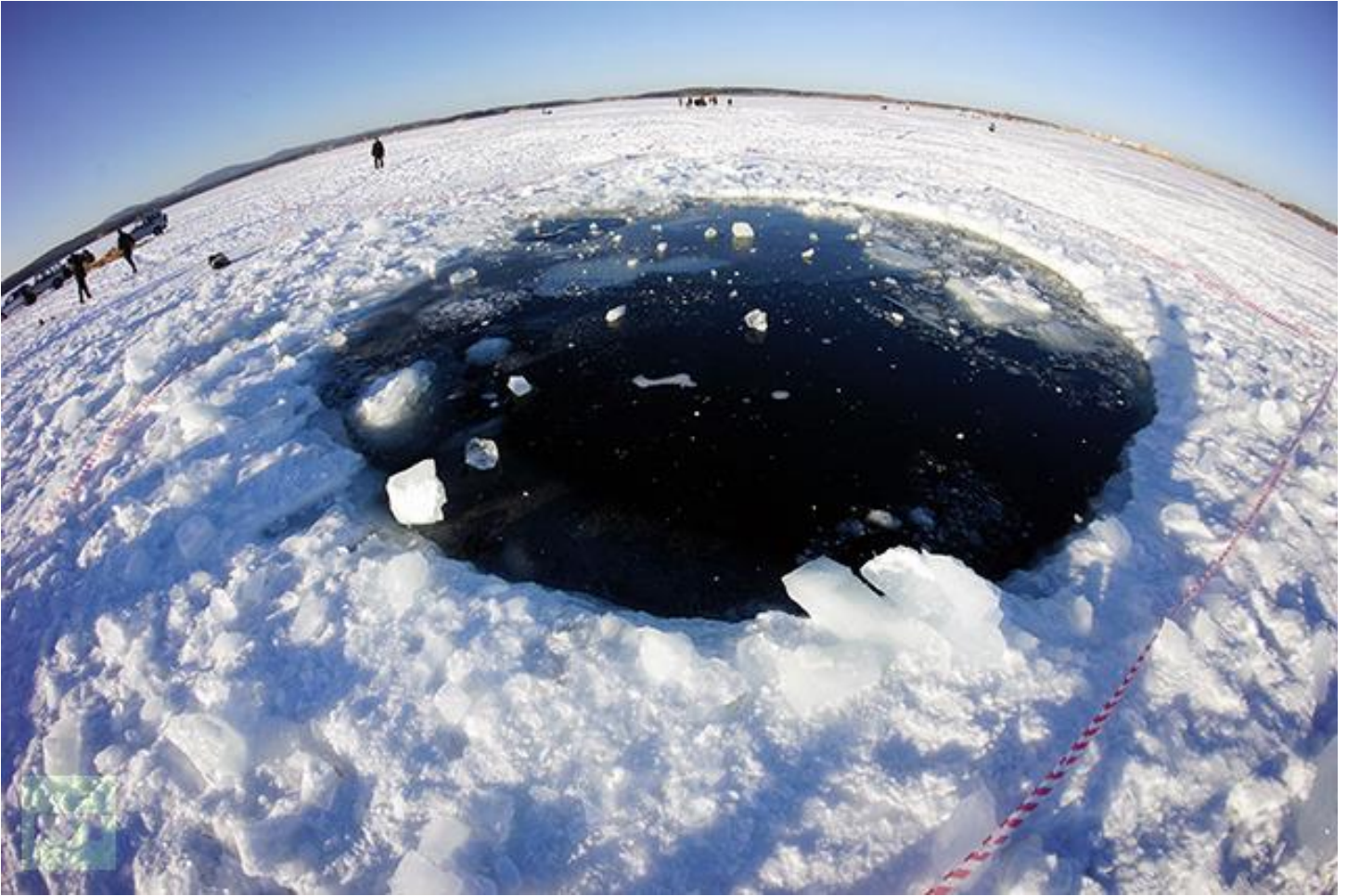


Zinc Factory in the Chelyabinsk Region of Russia post-meteor. Image Credit: Zhenya Khazhei via RIA Novosti at en.ria.ru

According to the Russian Geographical Society, the Chelyabinsk meteor created three blasts of varying power. The first explosion occurred around 60km above sea level and was the most powerful. The explosion was preceded by a bright flash, which lasted about five seconds, and estimates of the explosive power average around 500 kilotons. For comparison, the nuclear blast that devastated Hiroshima during World War II was approximately 13 kilotons, making the power of the blast commensurate with that of a small fusion bomb.

The asteroid itself was likely a stray originating from the asteroid belt, the famous region containing hundreds of thousands of asteroids located between Mars and Jupiter. An analysis of the meteor's contents revealed that it was a rocky meteor composed of a relatively low iron content, and "was made of material that had been partially melted and recrystallized from the dust and gas cloud of the early solar nebula", according to nature.com.

Part of the reason the asteroid exploded in the first place was likely due to its fragile body. Instead of being a dense, solid, study object, the asteroid contained many internal cracks that allowed it to explode into thousands of fragments under the intense pressure of hurtling through earth's atmosphere. Researchers have theorized that the asteroid may have come into close contact with other celestial bodies, causing damage inside of the object before it collided with Earth.



An ice hole in Lake Chabarkul, Chelyabinsk Region, where pieces of a meteorite could allegedly fall December 15. (RIA Novosti)

Could we have seen it coming?

Most research centers on the lookout for asteroids can only detect meteors that are over 100 meters in size—this gives telescopes the ability to examine large enough reflections of light to determine the presence of a foreign object. The Chelyabinsk meteor, on the other hand, was only around 15 meters and dark in color, making it virtually impossible to identify ahead of time, and so it was able to fly into the atmosphere under the radar.

The damage of the Chelyabinsk meteor has hit a nerve, however, as it exposed the holes in current technology and renewed calls for an increased priority given to detecting foreign, celestial objects. At issue is funding, however, and at a NASA funding hearing following the event scientists could not reassure members of Congress that they could stop a potentially devastating asteroid without an increased budget to pay for the necessary technological advances. Their testimony prompted Rep. Lamar Smith to say, “We need to find ways to fund NASA’s projects.”

And the funding is needed. Due to its speed combined with the meteor’s size, current centers—if they could detect the asteroid at all—would only have a day or two at the most to provide a warning, which may not be enough time to properly evacuate regions like Siberia, and definitely not enough time for a large metropolitan area such as London.

Though the economic downturn has had only negative consequences for funding scientific endeavors, perhaps the story of the Chelyabinsk meteor will provide enough sway to divert funds toward potentially life-saving—and education investing—technology.

SARG and Suborbital Science

By Casey Stedman

In cooperation with the Commercial Spaceflight Federation, the commercial space industry's largest advocacy group, the Suborbital Application Research Group (SARG) is an advisory committee of scientists, researchers, astronauts, and educators working to increase the awareness of suborbital flight opportunities now available because of the emerging private & commercial space vehicle industry.

The nascent space tourism market has led to the development of spacecraft such as Virgin Galactic's SpaceShipTwo and XCOR Aerospace's Lynx. Both companies are constructing reusable, suborbital rocket planes and marketing their flight services to wealthy adventurers. While the price of purchasing a ticket to fly with either of these companies is out of reach for the common citizen, it is not outside the budgets of major research facilities and education institutions. This has a group of scientists, led by planetary scientist Dr. Alan Stern of the Southwest Research Institute, to organize SARG and promote the use of these spacecraft for scientific purposes.

Both spacecraft are designed to carry human passengers to the very edge of space- 62 miles or roughly 327,360 ft. (The same region NASA's X-15 flew) Flight profiles would follow a parabolic arc and offer several minutes of microgravity, perfect for variety of payload types, including experiments in physiology, radiation effects, helioscience, atmospheric sampling, and astronomy targets of opportunity. The spacecraft are both configured in a manner that will allow them the fly with payload racks or seats for spaceflight researchers.

Since the retirement of the NASA space shuttles, there are fewer methods by which experiments can be launched into space. While NASA Flight Opportunities programs are actively accepting submissions for experiments to be flown and operated on the International Space Station (ISS), launches and payload volume are limited. The advantage of employing suborbital commercial spacecraft to fly science payloads will be the high flight rates (frequency of launches), rapid turn-around, and lower costs.

SARG is actively engaging in education and public outreach to encourage more participation in suborbital research. The organization has recruited "ambassadors" to communicate the goals and opportunities in suborbital spaceflight to students, scientists, and entities wishing to fly payloads in space. Ambassadors can be requested from SARG to present at your conferences or meetings for those who wish to learn more about payload flight opportunities.

Another way to learn more and be involved is at the annual Next Generation Suborbital Researchers Conference (NSRC). The conference is the largest gathering of persons associated with suborbital spaceflight in the world and has been held each year since 2010. Last year's event attracted over 400 people including the development teams from several of the spacecraft manufacturers. NSRC gives students attending the chance to submit their resumes and meet with potential employers from the spaceflight industry. This year's event will be held in Broomfield, Colorado, June 3-5th. For more information, go to: <http://nsrc.swri.edu>

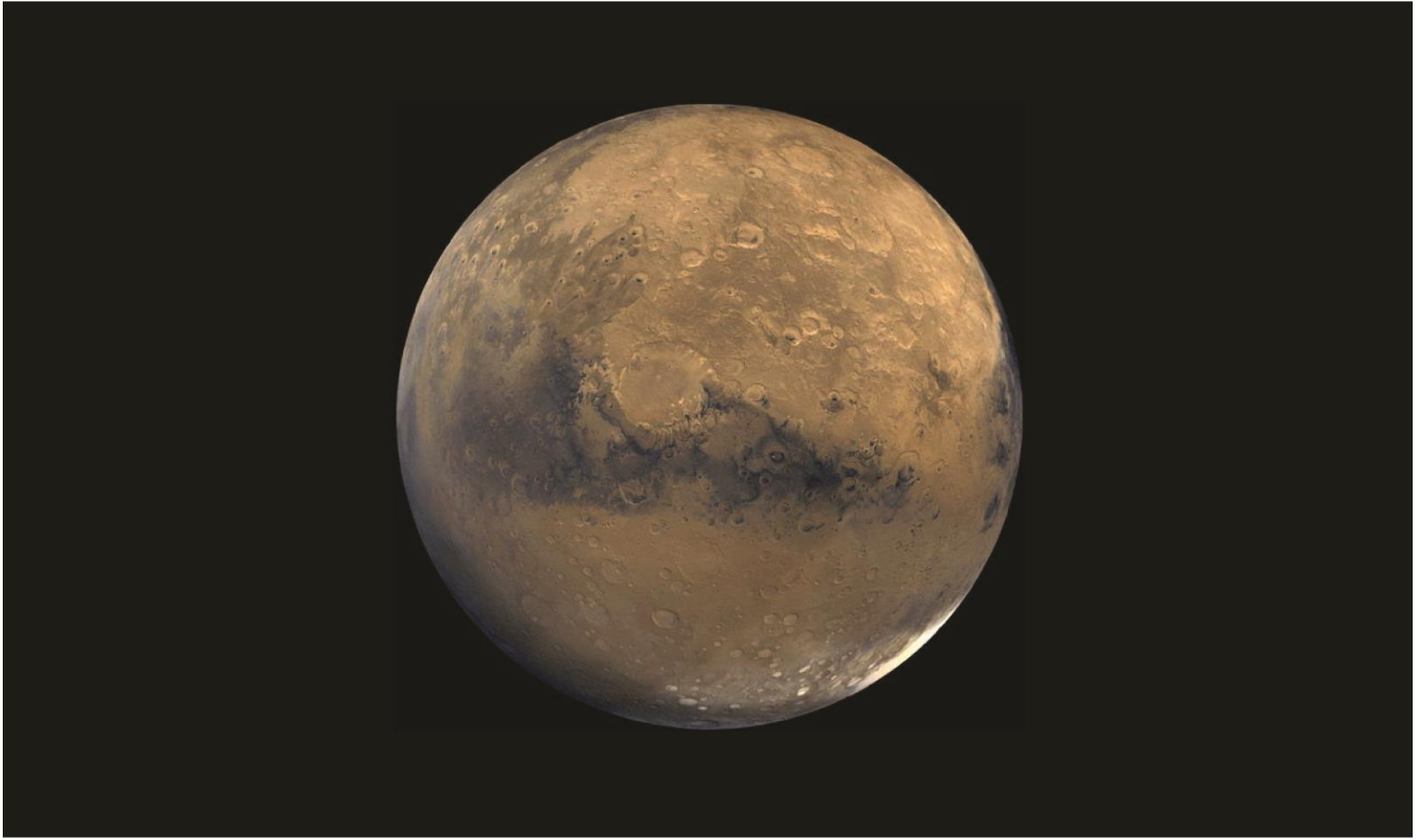
Casey Stedman is affiliated with ERAU Worldwide. More information can be found at www.commercialspaceflight.org, and @Suborbi_science on Twitter



Left: The XCOR Lynx Spacecraft (Image Credit: XCOR Aerospace) Right: SpaceShipTwo on its 23rd glide flight Dec 19 (Image Credit: Luke Colby/Virgin Galactic via www.space.com)

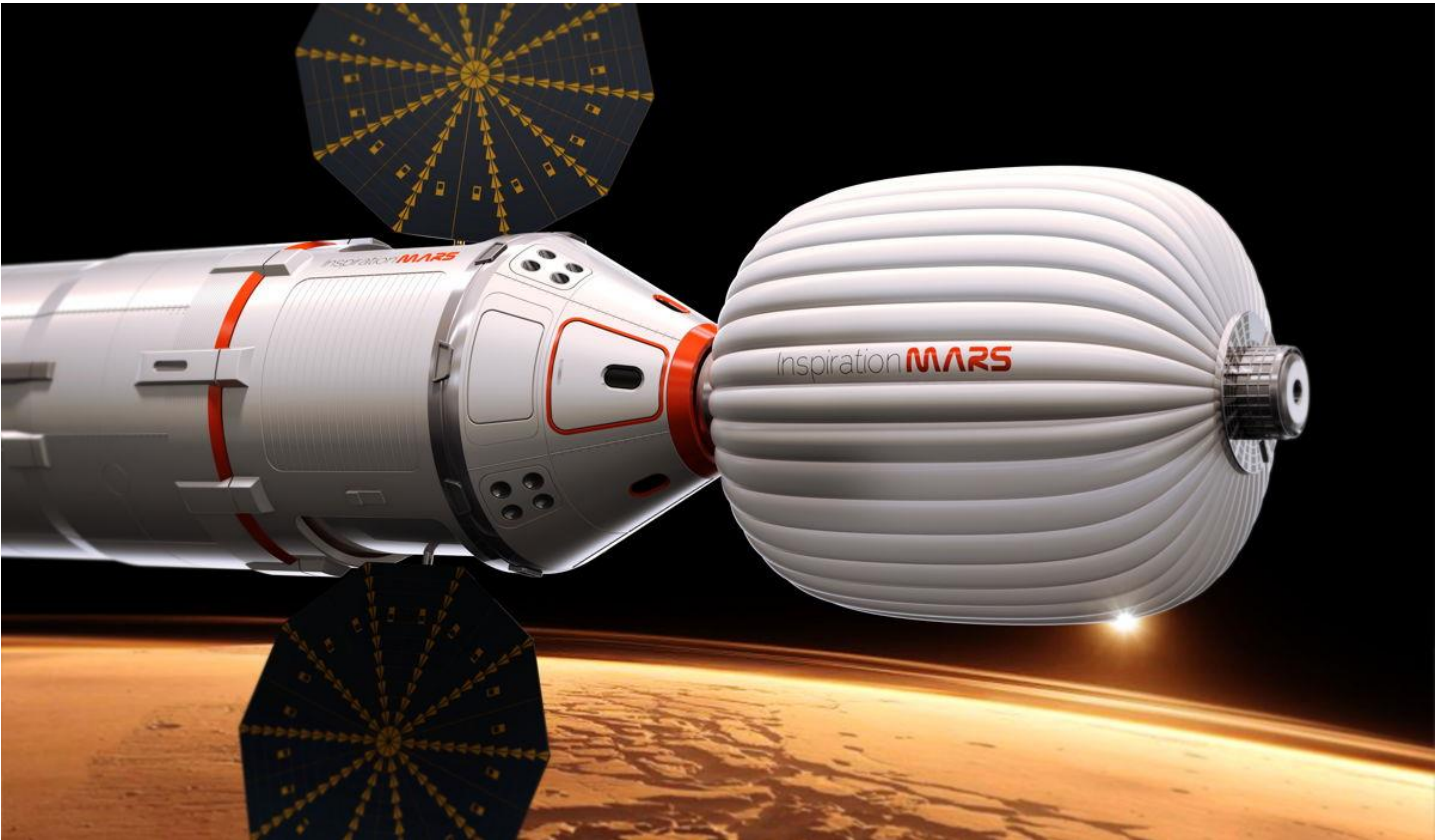
Dennis Tito's Mission to Mars

By Marty Michael McNutt



Dennis Tito is best known for being the first space tourist, spending just over a week onboard the International Space Station in 2001. Last month, however, he put his name back in the headlines by announcing his new non-profit organization, Inspiration Mars, and an ambitious plan to send a two-person crew on a mission to the red planet in 2018.





This is an artist's illustration of the Inspiration Mars Foundation's spacecraft for a 2018 mission to Mars by a two-person crew. Image Credit: Inspiration Mars Foundation via www.space.com

At a press conference in Washington, D.C. on February 27th, it was quickly pointed out that this is perhaps not the Mars mission many space enthusiasts have envisioned over the last several decades. To begin with, the crew will not actually set foot on Mars, but instead fly by at a distance of about 100 kilometers before returning to Earth. If it succeeds, however, the mission will still be one for the history books. Lasting an estimated 501 days, the crew will surpass the current record for consecutive days spent in space, travel farther from Earth than any previous manned space mission, and become the first humans to set eyes upon Mars at such close proximity.

Many of the technological aspects of the mission are still under review, including the type and configuration of the vehicle that will facilitate the journey. Taber MacCallum, Chief Technology Officer of Inspiration Mars and co-founder of Paragon Space Development Corporation, was able to reveal that the capsule will have a volume of about 35 cubic meters and weigh approximately 10 tons, excluding the propulsion system. Approximately half of this weight will consist of life support supplies, including roughly 3000 pounds of dehydrated food. MacCallum added that the crew would revitalize their atmosphere and water supply using physical-chemical technologies, based on those currently used in the International Space Station.

Jane Poynter, also co-founder of Paragon, spoke of the psychological challenges the crew may face. There is precedent for long-duration stays in low-Earth orbit and in isolation experiments on Earth, but most scenarios involve some type of emotional volatility and conflict among crewmembers. This observation actually supports their decision to select a husband and wife team. Poynter explained that during her two-year stay in the Biosphere-2 closed ecological system experiment, she found the trustworthy presence of her now husband, MacCallum, comforting in an otherwise extraordinary environment.

There is a seemingly endless list of challenges that this mission faces before it can be considered a success. It is precisely that fact that Inspiration Mars is publicizing to add a romantic subtext to the otherwise highly scientific and technological undertaking. As the organization's name suggests, perhaps the greatest non-scientific goal of the mission is to inspire. Whether by using this mission as a platform to encourage children to consider a STEM field education, or by simply expanding their visions of what is possible, the success of the mission will certainly have a lasting impact.

Marty Michael McNutt is a Space Studies Graduate Student at the University of North Dakota. More information on the mission is available at Inspiration Mars' website, www.inspirationmars.org.

Yuri's Night: A Space Event You Don't Want to Miss



By Rick Hanton

Do you ever wish that it was easier to get your non-spacegeek friends, your parents, your neighbors to understand the reasons you support space exploration? Well, it might be a bit easier to get them to understand an educational event or an amazing party at a local venue. That, in essence, is the philosophy of Yuri's Night.

For the uninitiated, 52 years ago (April 12, 1961) a 27 year old man, Yuri Gagarin, was blasted into orbit aboard the Vostok 1 from Baikonur Cosmodrome in what is now Kazakhstan. This marked the first score in the great "space race" that consumed both global powers for the next decade. Exactly 20 years later on April 12, 1981, the first of a new breed of spacecraft, the whitewashed bus-sized space shuttle STS-1 blasted off of its pad in Florida into orbit.

While Russia and other former soviet republics have celebrated Cosmonautics Day every April 12 since 1962, it was only in 2001 that a few representatives of the UN's new Space Generation Advisory Council decided that the rest of the world should share in this one-day celebration of spaceflight and exploration. That year they created Yuri's Night to help the rest of the world celebrate this pivotal moment in human history.

Since its beginning in 2001, Yuri's Night has recorded 2,200 events worldwide and counting. SEDS groups have been some of the most prominent organizers of events over the last decade. It has been awesome to see chapters partner with local student groups, observatories, and their universities to create unique fun and educational events for the public and for members.



Photo credit: NASA

Notable SEDS Events in 2013:

- SEDS@UM is partnering with the Michigan Electronic Dance Music Association to host a dance party (\$5 admission)
- UBSEDS is hosting an event at a Bar and Grill with talks as well as a buffet dinner (\$20 admission)
- SEDS-UCF are making space helmets, singing in Russian, and visiting the observatory.
- Yuri's Night in Boulder, CO will be at Press Play, an arcade bar in town
- Harvard is hosting a Yuri's Night event at their observatory
- UNC-SEDS is hosting their first ever Yuri's Night at the Library bar in downtown Chapel Hill

So follow the example of these chapters and think about hosting your own Yuri's Night event this year. If you don't have the time, consider moving the event back a week - that's ok, or start planning right now for Yuri's Night 2014 and make it awesome! With enough lead time you can partner with venues, groups, bands, and sponsors to make Yuri's Night a must-see event. Help us share our love of spaceflight with the world. Help us Rock the Planet!

Chapter Updates

Arizona State University

SEDS-ASU hit the ground running in August 2012 and hasn't slowed down. The chapter experienced significant growth in August after outreach activities like the Passport to ASU and World Space Week, where we brought our Turtle Bot and premiered our Planet Pop fundraising game to draw new members.

We met on a weekly basis in the Fall semester, and each week featured a special speaker. Among the speakers were Joseph Foys, an expert on pulsar wind nebulae, and Jim Bell, the President of the Planetary Society and our SEDS-ASU advisor. Bell visited us in September, when his work on Curiosity was causing him to live on Mars time.

Our entire chapter visited the AZ Challenger Space Center, where we participated in a heat shield building contest. This experience proved to be of bonding value for the chapter, as did our instatement of monthly Sci-Fi movie nights. SEDS-ASU also entered the SEDS National High Power Rocketry Competition. In addition, ASU ASCEND! experienced a successful payload launch and ASU Lunabotics is going to participate in the national competition. Finally, and perhaps most importantly, SEDS-ASU won the bid for SpaceVision 2013 at the 2012 conference. SEDS-ASU and the University of Arizona SEDS have been hard at working planning what we hope will be the greatest SpaceVision conference to date.

Iowa State Space Society

We began the semester by staffing a booth at Clubfest, a recruiting event for clubs at our school, which greatly increased the number of new members at our meetings. Because of this, our meeting attendance is now higher than it has been for a couple of years, a fact that we are very excited about. Some of our staff also attended an outreach event at Edwards Elementary School's Science Night, along with other clubs from Iowa State. At this event, we had the kids construct and, with our help, launch film canister rockets. More recently, our Rocketry Chair has been drumming up interest for members interested in obtaining their level 1 high power rocketry certification. We hope to get more members of our club certified so that we might be able to participate in more launches, something that we haven't done in some time. Looking to the future, we are currently planning a trip to Powell Observatory in Kansas sometime in April. And, as with everyone else, we are currently planning our Yuri's Night celebration.

Logan Prust, Chair

University of North Carolina, Chapel Hill

Recently, UNC SEDS has been focusing on organizing its second annual Carolina Space Symposium, where relevant speakers in the astronomy field come the UNC campus to speak to students, faculty, and any interested community members about what's going on in their specific industries and areas of expertise. We have recently received confirmation from several high profile speakers including Jody Davis, an aerospace engineer on the Mars Science Laboratory Entry, Descent, and Landing team; Jeffery Manber, a major role player in US-Soviet relations; and David Gump, CEO of Deep Space Industries Inc. At the symposium, we will also have a weather balloon launch and planetarium show and will be hosting a booth for the NC Science Festival, which will feature 3D printer demonstrations along with several other exciting activities.

Dan Plattenberger, President

Old Dominion University

Old Dominion University SEDS has been working to find our footing on campus. Being a new organization, we're still looking on growing our numbers and increasing our campus presence. We have held meetings in our planetarium and have many plans in the works. In April, we are having a space themed video game night (like Starfox 64 and Halo) in the planetarium, using the projectors to play the games on the ceiling. Last month we had our chapter logo designed and are ordering our first set of shirts which will be sold as a fundraiser and used as advertisement around the area. In addition to all that we are working towards partnering with a local astronomy club to co-host events.

Eric Ingram

Texas A&M University

Howdy from Texas A&M, In December, the Texas A&M University Chapter of SEDS toured NASA's Johnson Space Center (JSC) and Wyle Labs (a biomedical contractor that trains astronauts on space medicine and develops medical supplies for the International Space Station). This was our second annual tour of JSC, including the historic Apollo mission control, the current ISS mission control, the space vehicle mockup facility and Rocket Park (housing a Saturn V rocket). In January, chapter members volunteered at the University of Houston's Mars Rover Competition, judging middle school Mars rover design projects. The chapter's January meeting featured speakers from SpaceX's McGregor, Texas facility. In February, we toured the National Center for Electron Beam and Space Food Research, a facility on the Texas A&M campus that cooks food for astronauts aboard the International Space Station. On the tour, we also learned about preventing food-borne illness by treating food with particle accelerators (electron beams). Our winter social event was ice skating at a local indoor rink as the conventional term "winter weather" doesn't apply to central Texas.

Christopher Pannier, Chapter President

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