

SEDS

2nd Quarter 2011



nova

The official publication of SEDS-USA



SEDS

Front Page: The space shuttle Endeavour is seen on launch pad 39A after the rollback of the Rotating Service Structure. The completion of STS-134 begins the retirement of Space Shuttle Endeavour. Image credit: NASA

Above: The crew of Space Shuttle Endeavour's final flight, STS-134. Image credit: NASA

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My fellow SEDS students and friends,

We are happy to present the first NOVA newsletter of 2011. I think that however you look at it, this is going to be a pivotal and historic year for space exploration and the space industry. There will be many important events this year that I hope we can bring students together to discuss, celebrate, and take part in.

I know that lately a lot of focus has been drawn to the NASA budget, which is tied tightly to the unsolved 2011 national budget and is affecting the entire industry. There have been many fights over how much money our space agency in the United States should receive and how it **should be spent. I urge each of you to continue to keep track of NASA's fluctuating budget and make sure your representatives know how you feel about our space program as we move into a new period of history following the retirement of the Space Shuttle.**

We are also eagerly awaiting some very important flights this year, like the first test flights of SpaceShipTwo, the next tests of the Falcon 9 and Dragon, as well as some amazing advances by companies like Boeing, Blue Origin, and Armadillo Aerospace among others. It will be an exciting year for everyone and I hope you get a chance to see every flight you can between your class and work obligations.

Here at SEDS-USA we are also preparing for an exciting and eventful year. Our finance department is busily making plans to expand the endowment this year and we have already received some major donations from groups like the Musk Foundation. We have started reaching out to more donors and alumni to get the endowment past the \$100k mark so that SEDS-USA can finally become financially self-sufficient in 2012-2013.

We have also been very busy already in the early months of the year strengthening our partnerships with other space organizations and building new relationships that we hope will benefit all of our chapters and members.

Early in the year I worked with Dr. Ryan Kobrick of Yuri's Night to draft a formal Memorandum of Understanding (MOU) with the Yuri's Night executive team. Our hope is that we can convince all of the SEDS chapters to host or co-host a Yuri's night event in their area. Yuri's Night parties don't have to be major events (though they could be), they could simply consist of a time to party and bring your chapter together to celebrate the first human in space. You can read more about the SEDS-Yuri's Night MOU and history on page 14.

Recently we also signed a MOU with the Planetary Society, an international group that is in many ways similar to SEDS and hosts a huge membership of both professionals and students around the world. The SEDS board was very excited to talk with John Kotick and Bill Nye of the Planetary Society a few weeks ago about the different ways that our organizations can support each other in our efforts to shape the future of space exploration. The Planetary Society is looking for more input from students about what we want to see happen in the space industry and science community in coming years and also wants to invite you to join them as you move through SEDS and begin to find your place in the space community. While you can cheaply become a member of the Planetary Society today as a SEDS student, I urge you to seriously consider supporting our partners like the Planetary Society, the Space Frontier Foundation, and the National Space Society when you graduate from your school or university.

Lastly, please have fun this year and get involved in your SEDS chapter. Each chapter is only as strong as its members and we on the SEDS-USA board are constantly trying to help you develop new projects where you can learn new skills and meet new people. Right now our high school and education directors are working on a website to provide a one-stop resource for great outreach projects for your chapter to reach out to local schoolchildren and the general public. Our director of national projects has a rocketry contest for you to compete in and could use your help distributing books to schools. We will also soon tell you more about the Space Frontier Foundation's Video Contest where you can show us your creative side to win awesome prizes.

There is just simply too much going on right now to write in one letter, so please read the rest of the NOVA to learn much more and let us know if you have suggestions or comments. We would always love to hear what you have to say!

Sincerely,

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SEDS-USA High Powered Rocketry Competition

The SEDS-USA Executive Board is happy to announce the SEDS 2011 High Powered Rocketry Competition, an inter-chapter challenge in developing and launching FAA 101.2 Class 2 unmanned rockets with the goal of getting them to ten thousand feet above local ground level with the smallest mass possible.

The act of producing a Class 2 unmanned **rocket and getting it to ten thousand feet isn't in itself a daunting one**; however, as one of the deciding factors in scoring will be the weight of the rocket, SEDS chapters with pre-existing rocketry experience will still have a serious challenge on their hands in order to win: making the height as closely as possible while keeping their rocket as light as possible. At the same time, less experienced chapters making their first foray into high powered rocketry will still have a fighting chance at both making the goal and even winning through ingenuity.

A key element of this competition is that it is not localized to any one location, or any one time; it will be played out individually by chapters using a standardized altimeter in the presence of representatives of one of their competing chapters. This sort of friendly competition is designed to foster inter-chapter interactions between the groups, while also requiring chapters to individually learn and navigate local regulations and legal obstacles necessary for launches to occur.

It is hoped that by participating in this competition, SEDS Chapters will learn a wide variety of things, both technical and non-technical. We hope that all chapters, no matter how much or how little rocketry experience they have, will have a fun yet insightful learning experience in the complexities of rocketry.

Chapters wishing to enter must contact David DeBoth at projects@seds.org as soon as possible. Competition end date is set for October 9th, 2011, with winners announced at SpaceVision 2011. Information on prizes is still pending.



Above: SEDS-UCF sets up their USLI rocket to launch.



Full contest rules and additional information can be found at <http://seds.org/more/projects/seds-2011-high-powered-rocketry-competition/>

A Tribute to a Spacecraft that Never Was

By Bruce Davis, CU-SEDS

It was a spectacular night launch; the rocket carrying the Glory spacecraft thundered and glowed beautifully as it arced across the night sky and dipped below the horizon. This launch was a joy as well as a relief to the hundreds of engineers and scientists who spent the past eight years working on this mission, one which had more than its fair share of technical challenges, delays and cost overruns. Inside the control room, the engineers had T+178 seconds on their minds, the moment when the rocket's fairing would be deployed. **This launch was in fact a return-to-flight mission for the four-stage Taurus XL Launch vehicle. Nearly two years prior, Glory's sister spacecraft the Orbital Carbon Observatory (OCO) failed to reach orbit due to a glitch within the fairing separation system. Since then the engineers at Orbital Sciences Corporation completely overhauled the separation system design and were excited to put this past failure behind them. As the time passed T+200 seconds, Glory's mission controllers stared in disbelief as the confirmation for fairing separation never came. A short while later, the vehicle's altitude underperformance only confirmed that the payload was indeed too heavy and that something had gone terribly wrong. Seventeen minutes after liftoff, the Glory Spacecraft splashed into the South Pacific Ocean, adjacent to OCO.**

The temperature of our climate is highly influenced by the sun. The Glory mission aimed to better understand this interaction by measuring: 1) The total solar irradiance from the sun over long time periods to a high precision, (ie the Sun's brightness); 2) Detect/quantify aerosol particles (ie natural and man-made black carbon soot / dust) that are aloft in the earth's atmosphere, determine seasonal variation and how they absorb solar energy. Glory was to fly in the *A-train* orbit or a special constellation of spacecraft all measuring climate phenomena. The first instrument, the Total Irradiance Monitor (TIM) was built by the University of Colorado Laboratory of Atmospheric and Space Physics by a team of fifty professionals. The instrument worked by literally staring at the sun and measuring the heat flux radiated onto a set of black surfaces. Sounds simple, however many technical challenges exist to obtain an accuracy on the order of parts-per-million during the spacecraft's lifetime. **The second instrument was the Aerosol Polarimetry Sensor (APS) built by the Goddard Institute for Space Studies. This instrument contained a scanning sensor which detected visible, near infrared, and short-wave infrared radiation scattered by aerosols within the atmosphere. The true heartbreak about this failure is that earth-observing missions are not an assembly-line type of spacecraft. The state-of-the-art instruments aboard take not only time to design and build, but years to characterize so that they yield valuable data. These instruments are so pristine that no two act in the same way (even with identical designs) and it takes a significant amount of effort to prove that accuracy is indeed on the order of parts-per-million.**



Above: The Glory spacecraft at the launch site during final checkout and processing. Photo credit: NASA.

Colorado, Montana and Kentucky were competitively selected after a long and tedious review process. Given NASA's risk adverse culture, and the desire to protect the primary mission objectives, a set of harsh testing requirements were placed on these Cubesats. Over the course of two years, the student groups worked with NASA to evolve these requirements into obtainable tasks which met the needs of both parties. This effort is the start of a new standard which will enable future student groups to design cubesats for NASA missions. Perhaps in the future, every NASA mission will contain dozens of student Cubesats for student groups such as SEDS, to provide education and affordable access to space. And it all started with Glory!

Bruce Davis worked on Glory's TIM instrument at the University of Colorado from 2006-2008.



Above: The University of Colorado Cubesat which flew on Glory. Although not a CUSEDs project, several members were active within this project. Photo credit: The Colorado Space Grant Consortium

Flying Shuttle LIFE!

By Bill Nye

What has eight legs, is the size of a pinhead, and will launch on the final planned flight of Space Shuttle Endeavour?

If you answered a "Water Bear", congratulations!

You've just identified one of the five organisms in Shuttle LIFE, a Planetary Society experiment that will fly aboard Endeavour.

We, at the Planetary Society, have developed LIFE -- Living Interplanetary Flight Experiment -- to investigate the transpermia hypothesis, the idea that tiny living organisms might survive a journey through space buried in a meteorite.

Living things may have made their way to Earth aboard pieces of Mars that got knocked into space by a huge hurtling interplanetary rock. Wild!

Our LIFE Experiment is set to launch this Fall aboard a Russian mission to Phobos, one of Mars' two moons. As a first test, we are going to send some microscopic passengers aboard Shuttle Endeavour.

The eight-legged water bears will make the trip aboard Shuttle LIFE with four other organisms.

Shuttle LIFE has four main goals:

- Testing the effects of low Earth orbit spaceflight on the organisms,
- Providing a comparison for the upcoming long duration Phobos LIFE mission,
- Serving as a "dress rehearsal" for Phobos LIFE, complete with loading, unloading, and analyzing organisms in laboratory conditions, and
- Engaging the public in the exciting discussion of whether life might be able to travel naturally between planets.

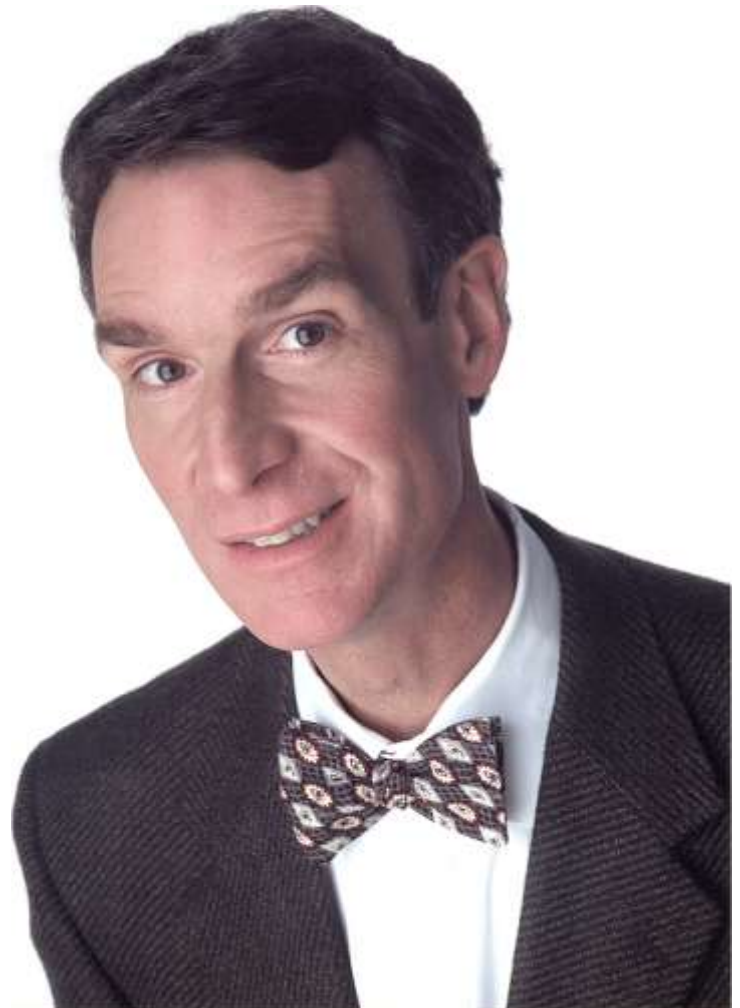
Both Phobos LIFE and Shuttle LIFE are made possible through donations from supporters around the world.

You can help me make this exciting experiment happen...tell your friends.

Let's change the world together!

<http://planetary.org/shuttlelife>

Images are courtesy of The Planetary Society

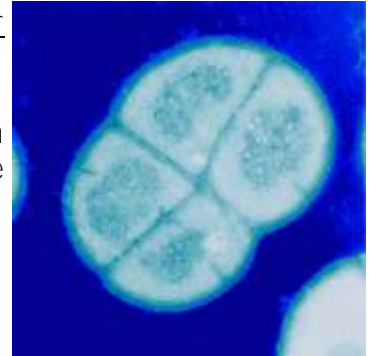
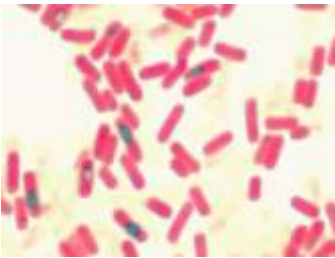


Meet our Shuttle LIFE micro-passengers:Water Bears (or Tardigrades)

Members of the animal kingdom, the Water Bears are “huge” microorganisms compared with the other LIFE travelers, although even the largest tardigrades are no more than 1.5 millimeters. Their bodies are composed of four segments, each with two legs ending in claws. Water bears are extremophiles, which means they can adapt to some pretty hostile environments -- from 150 degrees Celsius (300 Fahrenheit or hot enough to bake biscotti) to just a few degrees above absolute zero. Plus, they're radiation resistant.

Conan the Bacterium (common nickname for *Deinococcus radiodurans* or "terrifying berries")

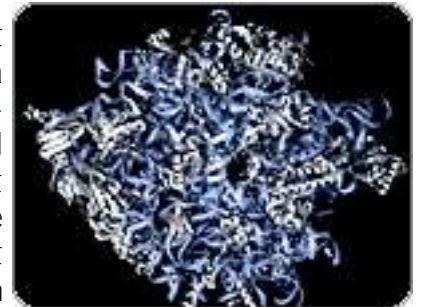
These fellows laugh at radiation! Whereas 10 Gy (Grays) of radiation would kill an average human, Conan the Bacterium can survive a whopping 5000 Gy. More than a third of the cells will even survive a dose of 15,000 Gy! Sounds like an ideal trait for long journeys through the dangerous radiation of outer space.

The Average Joe of Bacteria (*Bacillus subtilis*)

Bacillus subtilis is a "model organism," a standard bacteria used over and over again in all kinds of biological experiments. We'll fly the "MW01" strain on Shuttle LIFE. It's also quite radiation resistant, and has a long history of space biology missions, going back to the days of Apollo. That will allow a good comparison point between Shuttle LIFE and some of the other space flights of this bacterium.

Old Salty (*Haloarcula marismortui*, an archaeon)

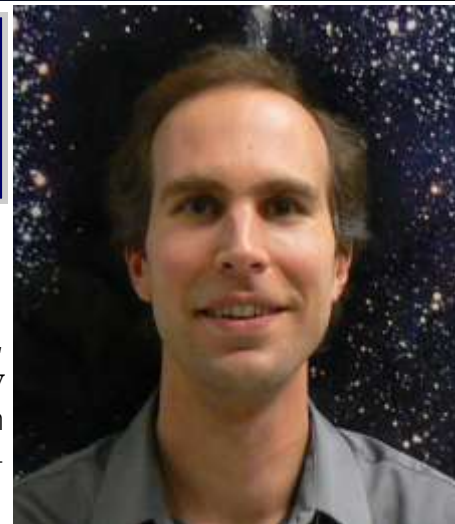
Many archaeons -- a type of single-celled organism -- are extremophiles that thrive under conditions that would destroy other organisms. *Haloarcula marismortui* lives in extremely salty environments. Why are we testing an organism that seems to enjoy high salinity? It's not for the chips and dip served aboard the shuttle! It's because if ancient Mars had water on its surface at some point in the past, it was in all likelihood very salty and briny. Any life that existed there would probably have lived in those salty seas. It's important to learn if such a salt-loving organism can survive a long journey through space.

Fire Eater (*Pyrococcus furiosus*, an archaeon)

This little extremophile loves heat. *Pyrococcus furiosus* was discovered in 1986 in volcanically heated ocean sediments off the coast of Italy, and it thrives in temperatures between 70 and more than 100 degrees Celsius (160 and 220 degrees Fahrenheit). But interplanetary space isn't hot; nor is the surface of Mars or Phobos. So why send a fire eater on the journey? There is always the small risk that somewhere in processing the payload, some mistake would cause the payload to overheat. In that case, *Pyrococcus furiosus* will serve as a kind of temperature control. If it is the only LIFE organism to survive the trip, this will indicate that overheating rather than conditions in space caused the loss of the other organisms.

SEDS ALUMNI SPOTLIGHT

Name: Ben McCall
 SEDS Branches: Caltech SEDS
 Degree: 1995/ B.S. (Chemistry)



What do you research at the University of Illinois?

My research is at the intersection between chemistry and astronomy, or “astrochemistry.” My group measures the laboratory spectra of likely interstellar molecules, and performs astronomical observations to search for those molecules in interstellar clouds – all in an effort to better understand interstellar chemistry.

What have you done with the American Astronomical Society?

I often attend meetings of the American Astronomical Society; these meetings are a great venue to learn about recent advances in all areas of both ground-based and space-based astronomy.

In what ways did your involvement with SEDS help you follow your dreams?

My work on the Caltech SEDS GAMCIT experiment provided my first experience in managing a research effort, and ultimately inspired me to start a research group of my own. My work with SEDS-USA (in the era when we were writing the constitution and bylaws) also helped me build my organizational experience.

What is one fun/crazy/memorable SEDS event or memory which you will always remember?

The early morning launch of *Endeavour* (STS-77) on May 19, 1996. Watching this launch in person with my fellow Caltech SEDS members, knowing that we built an experiment that was flying into space...that was an incredible feeling!!!

What advice can you offer to SEDS members in their trials during college from your own experiences?

My advice is to work hard, learn a lot in classes, but most importantly find (or make!) an opportunity to get involved in a scientific or engineering research project...even if it's in an area outside your major. Based on my experience, it can make a tremendous positive impact on the rest of your career!

Know an outstanding SEDS Alumni from your chapter who is currently involved in the Space Industry? E-mail publications@seds.org to suggest next issue's

SEDS ALUMNI SPOTLIGHT

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New SEDS Chapters

SEDS is an ever expanding organization, continuing to involve more and more students under its banner every year. Below is a brief introduction of some of the newest SEDS Chapters.

Harvard SEDS

I was invited to SpaceVision 2010 by one of my fellow interns from the NASA Robotics Academy. I had never heard of SEDS, but I thought it would be a great opportunity to meet people who were interested in space and exploration. While I was there, I met Will Pomerantz, a Harvard alumni and past president of Harvard SEDS. He put me in contact with other students on campus who were also interested



Above Images: Chandra Operations Center. Harvard SEDS got the opportunity to tour the mission control room of the Chandra X-Ray Observatory.

in space. Together, we re-started the Harvard SEDS chapter. We recently visited



the Chandra Operations Center, where we learned about Chandra's discoveries and what is involved in mission control. This year, we plan to hold a high power rocketry workshop, during which students will build their own high powered rocket. We also hope to enter the SEDS Rocketry Competition next year. Additionally, the chapter will hold a monthly speaker series for students to learn more about aerospace, astrophysics, and space policy.

- Ellen Farber, President of Harvard SEDS

Has your SEDS Chapter been formed recently?

Your new chapter can appear here too! When new chapters appear, it is often difficult for other chapters to know what they are all about. SEDS wants to know! Submit your new chapter introduction to publications@seds.org

Montana State SEDS

Montana State SEDS started out of my attendance at SpaceVision2010. I knew nothing about SEDS when I first attended, but quickly learned about just how awesome SEDS is and what a difference it makes for the students involved. I realized that I simply HAD to start SEDS at my school since we had such a strong interest in space engineering and an energetic student body. We had our first meeting in December, and since then have been meeting bi-weekly with speakers to talk about space engineering and science. We are trying to pursue a mid-level rocket program, and will be at SpaceVision 2011.

- Lars Osborne, Founder and President of MSU SEDS

CHAPTER UPDATES

University of Oklahoma SEDS

We've been holding sidewalk astronomy events on our main campus thoroughfare every couple of weeks with our 8" Dobsonian telescope (new this semester, purchased with student government funding). This has probably been the most successful and purposeful thing we've ever done. Responses from the many passersby have been amazing. We've also been joined on one such occasion by a member of the Oklahoma City Astronomy Club, Christian Bruggeman, who brought in a 12" Dobsonian.

The night of April 29, we hosted Dr. Susan Postawko, a planetary scientist from our Department of Meteorology at the National Weather Center. 20 to 30 people showed up to hear her talk about past, present, and future climates of Mars. Officer elections were held the same night, yielding President Adrian Lucy (astrophysics), Vice-President Amber Williams (meteorology), Treasurer Mathew Smeltzer (aerospace engineering), and Secretary Jodi Berdis (astronomy).

Our 2011-2012 budget currently stands at \$620, granted by our student government. We will be pursuing additional funding from the Oklahoma Space Grant Consortium, and plan to send some members to SpaceVision 2011.

Our new Facebook page, replacing the old group: OU SEDS — <http://www.facebook.com/pages/OU-SEDS/105217029565561>

Our Twitter, now under new management: @sedsou — <https://twitter.com/sedsou>

If you'd like to be on our email list, let us know at seds@ou.edu or ou@chapter.seds.org!

GWSS-SEDS

The GWSS-SEDS chapter has organized three space happy hour sessions this quarter, facilitating networking and interactions for young space professionals in the DC area. The chapter also held a "Next Gen Lunch," discussing various topics, including "Flintstone vs. Jetson." In addition, the chapter enjoyed going on a professional site visit to Lockheed Martin's Space Experience Center, during which about 10 members attended a guided tour, followed by a small reception.



Left: Aspiring astronauts Kirk Woellert and Alanna Krolikowski on the flight deck of CRV Avalon. Mission Commander Woellert is rigging the ship for FTL flight. Pilot Alanna Krolikowski is deriving an FTL solution from the ship's computer so that Avalon may safely make the jump to hyperspace.



Above: GWSS-SEDS students and visiting scholars of the Space Policy Institute enjoy an overview of current Lockheed Martin R&D projects. From left: Kate Becker, Laura Delgado, Jason Callahan, Alana Krolikowski, Megan Ansdell and Kalon Scott.

CHAPTER UPDATES

Harvard SEDS

Harvard SEDS organized a tour of the Chandra Mission Control Center.

Harvard SEDS is competing in the SEDS High Power Rocketry Team. We will launch 3 Level 1 certification rockets on Saturday. We will build Level 2 certification rockets this semester.

Boston University SEDS

SEDS at Boston University has gotten off to a great start with our new executive board for 2011-2012!

The most significant recent event has been a joint project between BU SEDS and BU AIAA. We are currently developing a weather balloon satellite which will be launched hopefully sometime in May 2011 up to an altitude of 106,000 feet. It will carry sensors measuring altitude, humidity, temperature, acceleration, GPS location and other variables as well as a GoPro high-definition video camera. There will also be a special payload on board, (no wheel of cheese here.) BU SEDS and AIAA hope to further develop this project into a low-cost and reliable platform for high-altitude atmospheric research available to BU faculty and students. The project is primarily funded by BU Student Activities Office.

Our regular meetings have concluded for the semester to allow members to prepare for finals, but our new President, Kevin Zagorski BU '12, and new Vice President, Emily Metivier BU '13, are getting ready to go to ISDC in a few weeks. We hope to see some of you there!

ASGSB-SEDS

New Member

Chelsey Robinson, Southern Illinois University, Edwardsville

Awards & Honors

- Ashley Gravelle (Midwestern State University)
- Outstanding Analytical Chemistry Student
- Outstanding Graduating Professional Student (American Chemical Society)
- Christina Johnson (Miami University of Ohio)
- New inductee to Sigma Xi (Scientific Research Society)



Accepted to Graduate School

Our following member(s) were accepted to graduate schools

- **Ashley Gravelle has been accepted for a master's program with Dr. Stan Roux, a space biologist, at The University of Texas, Austin.**

SEDS Space Letter

- Our group collected 35 signatures for this letter to policymakers. Signatures were from university students and recent graduates from 12 universities across the US. Good work!

Lectures / Seminars

- On April 12, student Christina Johnson gave a presentation about microbes in bioregenerative life support systems at Miami University of Ohio. The audience was small but attentive. The lecture was followed by an hour of questions on the topic.
- **On April 25, space researcher Dr. Elison Blancaflor from the Noble Foundation gave a speech entitled "Tales of Discovery: Boldly Going Where No Mustard Plant Has Gone Before" at Midwestern State's Annual College of Science & Mathematics Banquet. Dr. Blancaflor is our student Ashley Gravelle's research mentor.**



CHAPTER UPDATES

Research Presentations

Texas Undergraduate Research Day at the Capitol – February 14, 2011

· Ashley Gravelle (Midwestern State University) presented her poster entitled “Brassinolides Promote the Gravitropic Response of Maize Roots by Disrupting Actin Filament Organization.”

Texas Academy of Science 114th Annual Meeting – March 3-5, 2011

· Ashley Gravelle gave an oral presentation entitled “Brassinolides Promote the Gravitropic Response of Maize Roots by Disrupting Actin Filament Organization.”

Miami University of Ohio’s 17th Annual Undergraduate Research Forum – April 13, 2011

· Katharine Huntoon presented her poster entitled “Phototropism is enhanced in seedlings grown in fractional gravity on the ISS.”

Education Outreach Efforts

Distribution of *The High Frontier* - Ongoing

· 10 copies ordered for libraries in Saint Louis

· 2 copies ordered for high school science classrooms in northern Los Angeles

Visit to 8th Grade Physical Science Classes at Mad River Middle School in Riverside (Dayton), Ohio – February 4, 2011

· Student member Christina Johnson visited science classrooms at a middle school in Dayton, Ohio to share her experience with space research, and to encourage an interest in science.

At the end of her presentations, she asked the students to respond to the following question – What will you research, and where? Some memorable responses from these young students:

· Taylor Holman

I’d study astronomy, the stars and planets. I’d study it in the center of the galaxy. I’d see if I can discover any new planets or star constellations, maybe witness a new star being born or watch the start of a black hole.

· Shawn Derdue

I would study Astrobiology. The place where I would study is on Mars because I wouldn’t have to sit at a desk all day. You would get to look at things you haven’t seen before.

· Grayson T.

I would like to make it possible for the lack of gravity to not be in affect on space stations and shuttles. Not just in one area. I would do a lot of research and experiments to make this possible. From the information we have now we could make a bigger accomplishment.

· Marissa Reece Varner

If I were to study space I would study ... the health of people in space (Space Medicine). I would study this because it is interesting to me how the body reacts in space. The way your organs and blood, cells, and all of that (especially the brain) is something that has had me wondering for a while.

Outreach Preparations for ASGSB Annual Meeting – San Jose, CA – November 4-6, 2011

· Bay Area K-12 teachers will be invited to a workshop on teaching space science in the classroom, taught by AIAA education specialists

· Student members will meet with science classes at an economically disadvantaged school to introduce them to basic concepts of space research, and encourage university education.

· Student members handed off a comprehensive list of universities and colleges in the SF bay area to our friends at NASA-Ames. They are contacting biology departments to invite students to attend the ASGSB annual meeting at a special inexpensive day-rate.

Political Outreach Efforts

Congressional Visit Days – Washington, DC – March 15 – 22, 2011

Three of our students participated in lobbying efforts alongside AIAA & ASGSB during their joint Congressional Visit Days:

· Pedro Jofre (Purdue)

· Chelsey Robinson (SIU, Edwardsville)

· Christina Johnson (Miami of Ohio)

Students suggested an organized and increased student lobbying effort to ASGSB executive officer. She seemed responsive to the idea of a funding line for an exemplary undergraduate student to spend their summer working with ASGSB in Washington DC to further aid in the ongoing political efforts. **We must have a formal proposal ready before November’s meeting for such a program to begin in 2012.**

Website

Still a preliminary effort at <https://sites.google.com/a/seds.org/asgsb-seds/home>

Random Happy Announcements

Ashley Gravelle and her sweetheart Regis Cannon got engaged this quarter!

SEDS-USA Forms an MOU with Yuri's Night

SEDS-USA has always had an excellent relationship with Yuri's Night and has been happy to host Yuri's Night founder Loretta Hidalgo-Whitesides at many different events and to put together Yuri's Night events at local chapters. In an effort to solidify our relationship with the Yuri's Night executive board, we put together a Memorandum of Understanding (MOU) with the board early this year. While the official memorandum is new, it simply codifies what we've been doing for years.

Yuri's Night is both a party and a celebration of humanity in space and occurs each year on April 12, the anniversary of Yuri Gagarin's first flight. It was started a number of years ago by George Whitesides and Loretta Hidalgo-Whitesides as a way for non-space geeks to learn about the amazing discoveries made in space and to celebrate our achievements in space with others all around the world. In the past, many NASA centers have gotten involved and hosted major parties for Yuri's Night from coast to coast. Space fans have also worked to arrange parties in major cities at clubs, universities, and science centers all around the world for this one event.

In our MOU, we have stated that SEDS-USA will make efforts to have our chapters put together Yuri's Night events at local chapters or assist with larger city-wide events in nearby locations. I encourage all of you to work on planning out something for Yuri's Night this year. It's a great way to teach the public about space exploration and have a fun time with other space and science geeks in your hometown. Your Yuri's Night could be a major event at a big local bar, club, or science center. Or, your event could just be an intimate gathering of people at your school in a auditorium or classroom. If you don't want to charge admission, check with local businesses or space companies to see if they can provide some money to help provide food, drinks, and prizes.

We also have agreed to provide links between the Yuri's Night website at www.yurisnight.net and the SEDS website and to give the Yuri's Night board a chance to explain the event to students at Spacevision each year as part of our agreement. Both of our boards hope that you will go to the Yuri's Night website and check out some of the awesome contests they are hosting prior to the event this year. At the very least, you can sign up for a free contest to win a behind-the-scenes tour of the Russian Space Center, an amazing experience at the very least.

So get out there, celebrate space, and party the night away to celebrate one of the greatest achievements in the history of humanity!



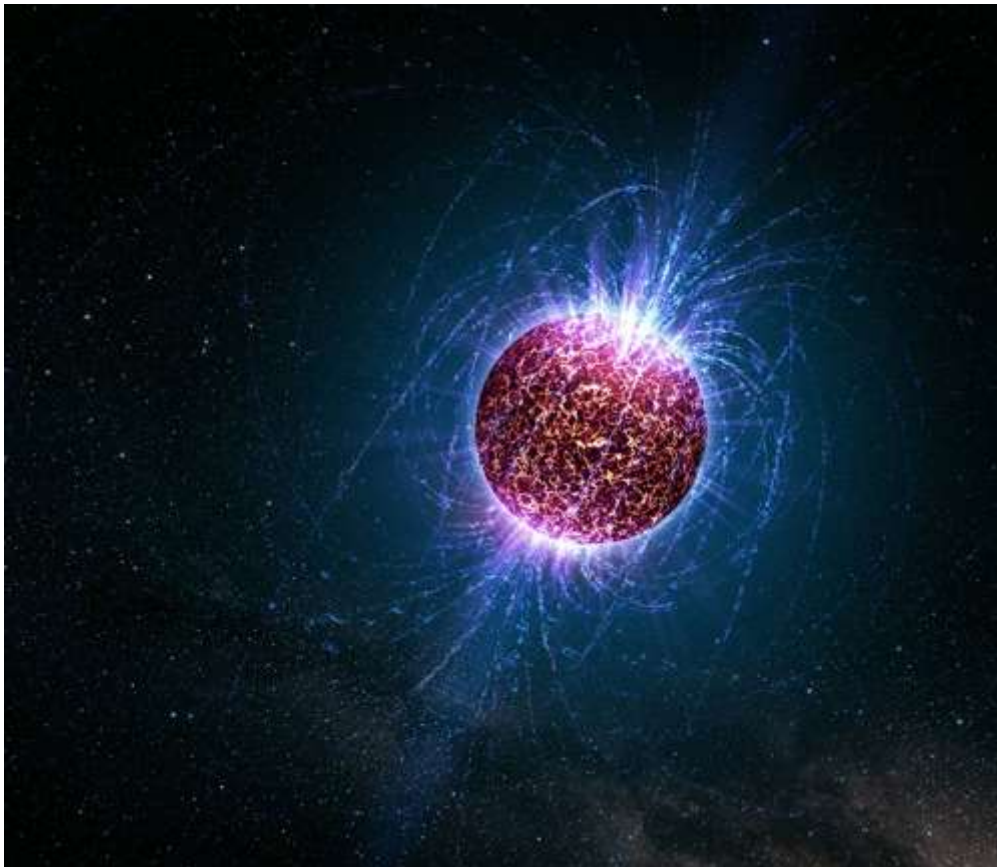
Hot Subdwarfs: A Rare and Fascinating Breed of Star

By Blythe Guvenen, UA-SEDS

Stars in the universe, like organisms on Earth, are born, live, and eventually die. All stars are born in essentially the same way: they collapse out of a hot and dense cloud of gas, primarily composed of hydrogen. Stars live out their lives in similar fashion: they fuse hydrogen into helium in their cores, as their ionized plasma gives off light and thermal energy, which provides an outward pressure and equilibrium against the ensuing force of gravity desperately attempting to collapse it further. Their store of hydrogen, however, **cannot last indefinitely, and herein lies the source of stars' demise. Once a star has burned past a critical** threshold of its original material, instability begins to set in. The nature of this instability and the end state of the star depends almost entirely on its initial mass, so in this respect stars can end their lives dramatically differently than how they are born or mature, making stellar death a fascinating field of study.

A star greater than three times the Sun's mass will burn through its fuel incredibly rapidly, and end its life in the most spectacular of ways. Once its fusion cannot sustain its core against gravity's implacable pull inwards, due to heavy material creation that does not release sufficient energy, the core will continue to collapse and in all likelihood result in a high-energy event called a supernova, in which most of the star essentially blows itself up. The remainder of the core spirals inward and continues to collapse until all known

physical forces are overcome; the electromagnetic force, the weak nuclear force, and the strong nuclear force, resulting in a black hole, which is an object with mass but no dimension. **A star roughly twice the Sun's** mass will end its life as a neutron star, which is the core of the star supported by the nuclear forces between subatomic particles, and is essentially one giant atomic nucleus. It can be thought of as a star shrunk to the size of a city, and a spoonful of its material would outweigh a mountain.

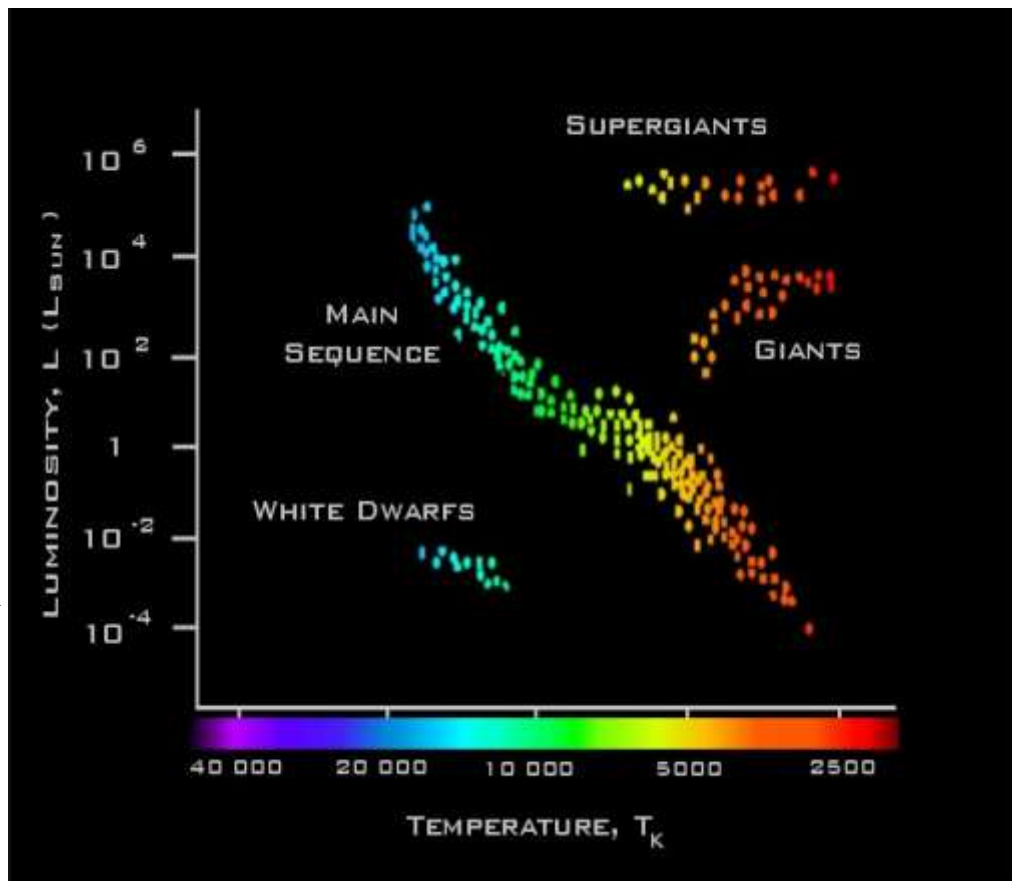


Above: A neutron star with strong magnetic field lines.

Stars roughly the Sun-sized, along the main sequence, have a much more somber and gradual end. The core volatility sends its outer atmosphere outward in shells of expanding gas, until it is all but expelled **and just the star's exposed core remains. This core is sustained by the forces between electrons, and primarily burns helium.** These are known as white dwarfs, and theoretically can continue to slowly burn and irradiate for trillions of years, or longer than the accepted age of the known universe. Though these are the three primary forms of stellar remnant; black hole, neutron star, and white dwarf, there are many interesting outliers that beckon the attention of researchers, since their channels of formation are still questionable **at best. Perhaps the most remarkable of these outliers is a class of star known as subdwarf B stars or "hot" subdwarfs.**

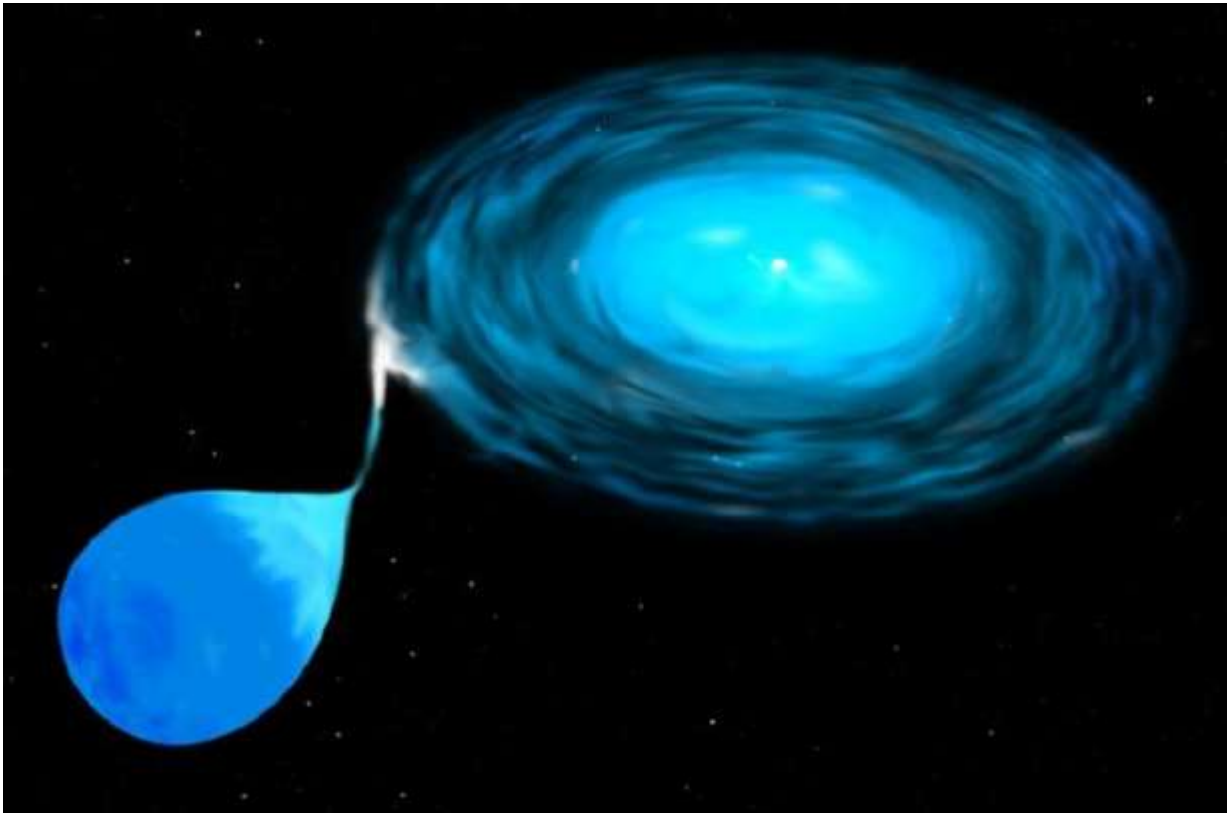
A subdwarf star has a simple enough definition: it is a star with brightness, or magnitude, slightly lower than main sequence stars of the same spectral type. The vast majority of these stars are found **between class G through M, or temperatures ranging from 3,700 to 6,200 K, known as "cool" subdwarfs.** Unlike white dwarfs, these stars burn hydrogen, not helium, and do not contain heavy elements, that is, elements greater than an atomic number of two. This suggests that these stars were largely formed from the primordial hydrogen resulting from the big bang, which corroborates with their projected age. The paucity of metals in the star results in a far lower radiation pressure, and produces a star that is much more compact and hot than other stars of similar mass.

"Hot" subdwarfs, or subdwarfs of spectral class B or O, are one of the rarest stars known. They are highly evolved, helium-burning stars at the far end of the horizontal branch, or the phase of stellar evolution following the main sequence and red giant stage. Helium fusion involves the transformation of three helium-4 isotopes into an atom of carbon and a gamma ray. Given their rarity, there is some debate as to how these stars come into being. The leading theory suggests that they are formed when a red giant



Above: The Hertzsprung-Russell diagram of spectral class and luminosity.

star sheds its outer layers of hydrogen prior to the initiation of helium reactions in its core, for which several mechanisms are proposed. The most feasible of these mechanisms is that a companion star has stripped off the outer layers prematurely through mass transfer.



Above: A B-type main sequence star with a compact subdwarf companion, including an accretion disk.

Many hot subdwarfs are variable stars, meaning they fluctuate in brightness and temperature. The periods on which they fluctuate have many different modes, and some hot subdwarfs exhibit more than one mode of pulsation. There are also varieties called cataclysmic variables, in which a

subdwarf and a main sequence companion are in such close proximity that the subdwarf deforms the other star and often forms a disc of accreting matter around itself. When matter ratios spur a burst of hydrogen fusion, there is a massive flare-up in luminosity from the system, seemingly without warning or regularity, **earning it the name “cataclysmic.”**

The study of these rare classes of stars remind us that there is still much mystery to be sorted out in this vast cosmos, even in a largely established and understood field such as stellar physics. Observations and analysis of strange forms of matter and energy enthuse and excite astronomers and generally inquiring minds alike, as it has throughout human history. As we see what else is possible, we gain perspective and appreciation for our place in the universe, and unwaveringly carry the torch of exploration forward for the whole of the human enterprise.

Source credit: The Astrophysical Journal, Harvard Department of Astrophysics and The University of Arizona

Blast from the Past

A look back at previous versions of the NOVA:

Reflection by: Matt Cannella

This Quarter's Blast from the Past comes to us from the Spring 2006 version of the NOVA:

Chapter Spotlight: South Dakota School of Mines and Technology

Hello from South Dakota School of Mines and Technology. Our first organizational meeting was in October and we have met twice since then. Currently we have six students that are active in SEDS and are in the final stages of forming a local SEDS chapter. We have drafted a constitution, elected officers and are awaiting word from the Student Association on our official acceptance as a recognized student organization. Our primary goals for the upcoming year are the recruitment of new members, educational outreach, and funding. Additionally, we hope to have a website up and running before summer's end.

South Dakota Space Grant Consortium (SDSGC) has been instrumental in the formation of our chapter. In addition to initial funding, they have also helped with advertisement on campus. In the future we will continue our close relations with SDSGC as they are an invaluable resource to our interests.

We do not have a technical project picked out as we would like to become better established before we take on such an endeavor. However, we have been brainstorming and hope to have one in the near future. We are excited about being a new chapter and the renewed inter-

est in SEDS. We look forward to meeting and possibly working with all of you some day.



Members of brand new SEDS chapter at the South Dakota School of Mines and Technology

5 years ago, SEDS was still in its "re-building" phase. However, it was growing at a steady rate, and building up to the diverse organization it is today. This article notes the creation of the South Dakota School of Mines and Technology chapter of SEDS. And while that chapter is currently inactive (a quick internet search brought up the webpage- <http://sdSPACEgrant.sdsmt.edu/SEDS.htm>), the tradition of welcoming our new chapters in the NOVA continues. Nationally, SEDS currently sits at one of its strongest points in recent history, boasting over 30 chapters around the USA. To hear about and welcome in our newest SEDS chapters, check out the New Chapter Spotlights on Page 10.

SEDS

SEDS LEGISLATIVE UPDATE

Council of Chapters Summary:

December 29th, 2010

- Discussion of Chapter Updates: UA, UKentucky, RPI, UIUC, SLU, UB, OU, UCLA, Iowa State, ASU, and GW presented brief summaries of activities
- Executive Board updates, including SEDS expansion to China, SEDS Endowment donations, and high school outreach
- Discussion of SEDS Space Advocacy
- Motion Passes 11-0-0: SEDS Space Advocacy document shall be edited by the Council of Chapters for one month

January 26th, 2011

- Discussion of Chapter Updates: RPI, CSM, Caltech, CU, UA, Iowa State, UCF, UB, Florida Tech, Illinois, SLU, Purdue, and UMichigan presented brief summaries of activities
- **Executive Board updates, including the creation of an MOU with Yuri's Night, work towards an MOU with SSPI, creation of an international chapter expansion packet, and distribution of *The High Frontier* with Space Frontier Foundation to high schools and universities across the United States**
- Motion Passes 11-0-3: Continue Space Advocacy discussion during future meetings

February 23rd, 2011

- New accounting systems
- Quarterly Chapter Updates

Executive Board Summary:

- **Letter addressed to President Obama and Members of Congress regarding SEDS' concerns about the future of Human Space Flight**
- Letter of Support for Representative Giffords, as found on SEDS.org
- SEDS 2011 High-Powered Rocketry Competition
- Assisted Space Frontier Foundation with the creation of *We-Are-Space* competition
- Discussion of innovative high school outreach
- Aiming for a net increase of 5 to 10 SEDS chapters for 2011
- Discussion of potential SEDS merchandise, such as pins
- Provided input for SpaceVision 2011
- Updated SEDS.org with new layout
- Discussion of potential future cooperation with Planetary Society

JUNE IN SPACE

June 3rd, 1965—Gemini 4 launched. Mission includes Ed White, who makes first American spacewalk.

June 3rd, 1966—Gemini 9 launched. Mission attempts to experiment with Astronaut Maneuvering unit (predecessor to today's Manned Maneuvering Unit), but objective not accomplished.

June 6th, 1971—Mankind occupies its first space station, with the soviet Salyut I space station. Unfortunately, when the Cosmonauts undocked, a faulty valve opened, allowing the capsule to vent its atmosphere during reentry, killing all three crew members.

June 8th, 1625—Astronomer Giovanni Cassini born. Goes on to study Saturn's rings.

June 8th, 1975—Soviet Venera 9 successfully lands on Venus. Pressures at the surface disable the Lander within one hour.

June 12th, 1967—Soviet Venera 4 probe sends back data on the Venus atmosphere, with data transmission ceasing 14 miles up from the surface.

June 16th, 1963—Soviet Vostok 6 launches, carrying first woman into orbit, Valentina Tereshkova

June 18th, 1983—Suttle Challenger Launched, carrying first American female astronaut, Sally Ride, into space.

June 24th, 1984—German rocket scientist, Hermann Oberth was born.

July 2nd, 1978— Charon, the moon of Pluto is discovered.

July 3rd, 1935—Harrison Schmidt, Apollo 17 Geology specialist and the only trained civilian scientist to walk on the moon, is born.

July 4th, 1054—A supernova was observed for the first time from an exploding star which would eventually become known as the crab nebula

JULY IN SPACE

July 7th, 1979—Voyager 2 passes Jupiter

July 7th, 1988—Soviet Union launches Phobos I to land on the Red planets largest moon

July 11th, 1979—Skylab breaks up in Earth's atmosphere, mostly burning up on reentry. However, small parts made it down to the surface. Some pieces landed in the Australian Shire of Esperance, who fined the US government \$400 for littering. This was unpaid for over 30 years, until a radio show raised the funds and paid the fine on NASA's behalf in April 2009.

July 12th 1988—Phobos 2 probe launched by the Soviet Union. Mission between the two Phobos spacecraft results in several pictures of the moon, but lacks the planned landing due to loss of contact with the craft.

July 16th, 1969—Apollo 11 launched

July 16th, 1994—Commet Shoemaker-Levy 9 begins its impact with Jupiter

July 17th, 1975—Successful docking of the final Apollo Capsule with the Russian Soyuz capsule in orbit.

July 18th, 1966—Gemini 10 launched, first manned spacecraft to make controlled change of orbital altitude

July 20th, 1969—Niel Armstrong and Buzz Aldrin become first persons to set foot on the moon. The astronauts spend about a total of two hours on the moon outside of the lander.

July 21st, 1961—Astronaut Gus Grissom becomes 2nd American to undertake a suborbital flight

July 26th, 1971—Apollo 15 launched to look at mountainous regions of the moon. First mission to carry the Lunar Rover.

July 28th, 1973—Second Skylab crew launched

AUGUST IN SPACE

August 5th, 1930—Neil Armstrong was born. Armstrong would go onto become the first man to step foot on the moon.

August 6th, 1961—Gherman S. Titov is launched from the Soviet Union, becoming the 2nd human being to orbit the earth.

August 7th, 1959—Explorer 6 is launched, a mission which would give us the first views of earth from space.

August 8th, 1978—Pioneer Venus 2 is launched, which would go on to probe the atmosphere of Venus.

August 11th, 1962—Vostok 3 is launched, carrying the Soviets third cosmonaut. This mission would go on to perform a close pass with the later launched Vostok 4.

August 12th, 1977—Space Shuttle Enterprise breaks free of its mother ship for the first time.

August 17th, 1958—Pioneer Zero blows up on the luanchpad, destroying mans first moon shot.

August 17th, 1970—the Soviets Venera 7 probe becomes the first man-made object to land on the surface of Venus, but is unable to transmit anything back due to the environment of Venus.

August 19th, 1787—Astronomer William Herschel discovers the Saturn moons of Enceladus and Mimas.

August 20th, 1975—Viking 1 is launched, becoming the first probe to land on Mars.

August 20th, 1977—Voyager 2 was launched, touring the four largest outer planets over the next 12 years.

August 21st, 1993—America's Mars Observer is lost due to a failure in the spacecrafts propulsion system.

August 25th, 1981—Voyager 2 swings by Saturn, discovering six moons while in the vicinity of the gas giant.

August 27th, 1962—Mariner 2 is launched, becoming the first probe to make a successful flyby of Venus.

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SEDS GALLERY



Left: The Orion Nebula as seen from the University at Buffalo in New York. Photo credit: Andrew Dianetti, UB-SEDS

Want to see your chapter's pictures featured here? Take pictures of your events and upload them to the SEDS Gallery!

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the official publication of SEDS-USA

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- Ben McCall—University of Illinois

SEDS Mission Statement:

SEDS, or Students for the Exploration and Development of Space, is an independent, student-based organization which promotes the exploration and development of space. SEDS pursues this mission by educating people about the benefits of space, by supporting a network of interested students, by providing an opportunity for members to develop their leadership skills, and inspiring people through our involvement in space-related projects. SEDS believes in a space-faring civilization and that focusing the enthusiasm of young people is the key to our future in space.

History of SEDS:

Students for the Exploration and Development of Space was founded in 1980 at MIT and Princeton and consists of an international group of high school, undergraduate, and graduate students from a diverse range of educational backgrounds who are working to promote space as a whole. SEDS is a chapter based organization with chapters throughout the United States, Canada, United Kingdom, Asia, Latin America, and the Middle East. The permanent National Headquarters for SEDS-USA resides at MIT. Each chapter is fairly independent and coordinates activities and projects in its own area.

What do SEDS members do?

SEDS members are people interested in doing as much as they can to promote space exploration and development. The first step in this continual process is learning. SEDS provides an excellent environment in which to obtain access to many sources of information including speakers, tours, films, discussion groups & daily NASA updates. Astronomical observing trips and tours of local space facilities also play a significant role in the life of many SEDS members.

SEDS members often take the knowledge they have gained and use it to influence the future of the space program. Students at several chapters have played major roles in organizing large conferences and have established important contacts with members of the space community. Others have helped increase public awareness of the benefits of space exploration by offering presentations to local primary and secondary schools as well as universities. All chapters keep in contact with each other through on-line computer networks.

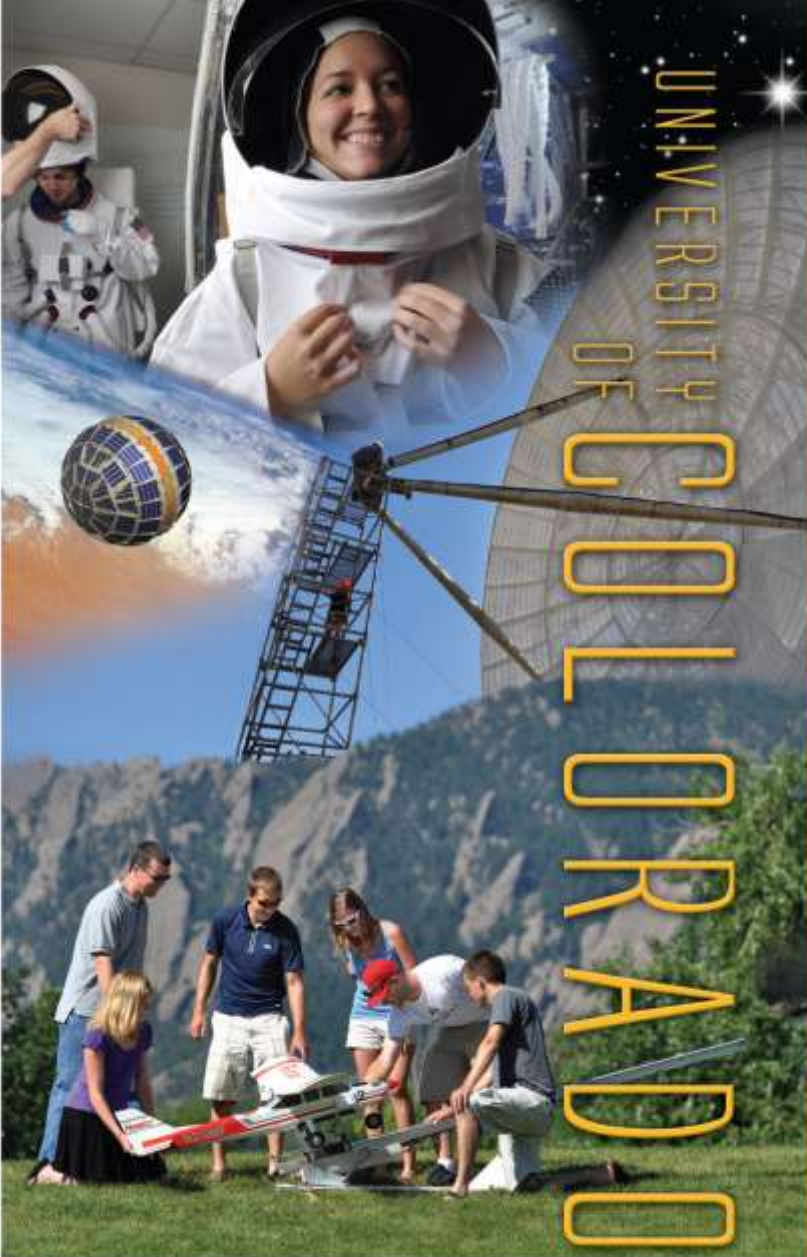
Finally, SEDS provides an environment in which people of common interests can relax and freely discuss issues important to them.

What can SEDS do for you?

SEDS can provide an organized pathway for you to begin space related projects and give you a chance to break away from the usual class work. You can also use SEDS as a stepping stone to a space-related career. Being actively involved in SEDS can put you in touch with many members of the space, technology, and education community and will allow you to develop the experience necessary to take leadership roles in your future career, whatever that may be.

For more information on SEDS, or to join/start a new chapter, go to www.seds.org.





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