

# AD ASTRA KANSAS NEWS

To the stars through high-tech / space-tech R & D

Spring 2007

Vol. 6, No. 1

In our continuous quest to promote use of our state motto to its fullest 21st century potential, we have submitted to the governor and received approval of the following proclamation:

## TO THE PEOPLE OF KANSAS, GREETINGS

**WHEREAS** Kansas' open and endless skies nurture the largest remaining stretch of tallgrass in the country, almost one-fifth of America's wheat and an aviation industry second to none; and

**WHEREAS** Kansans regularly reach stellar heights, which have included the 34th president, three Pulitzer and two Nobel prize-winners, three astronauts; and

**WHEREAS** our university system is poised as one of the nation's top three in the number of scientists and engineers enrolled per one million population; and

**WHEREAS** Kansas is soaring towards a high-tech economy and in a recent 5-year period was fourth in the nation in the number of high-tech jobs gained; and

**WHEREAS** astute and forward-thinking Kansas entrepreneurs aspire towards a global economy; and

**WHEREAS** we offer visitors unparalleled sunsets; a history that began with Coronado, made us the crossroads of a growing nation and compels us ever upwards; and

**WHEREAS** our state motto "Ad Astra Per Aspera" or "To the Stars Through Difficulties" embodies the inherent Kansas spirit as well as the unique promise of the 21st century;

**NOW THEREFORE, I, KATHLEEN SEBELIUS, GOVERNOR OF THE STATE OF KANSAS,** do hereby proclaim April 28, 2007 as

## Ad Astra Kansas Day

and encourage Kansans, though a naturally modest people, to don the cloak of this glorious motto by which we have lived and thrived for almost 150 years and promote Kansas with pride as "The Ad Astra State."



In the background are the mirror panels used by the Space Pirates in the 2006 Space Elevator Game s held in New Mexico. The light reflected by one mirror equals that of up to two of the spotlights in the foreground. Photo courtesy of Kansas City Space Pirates.

## Team lights the way in NASA competition

By Jeanette Steinert

The barn in the current movie "The Astronaut Farmer" isn't the only rural place with space activity.

At the Clair and Terri Niles farm in Lebo, in Coffey County, research for the Beam Power Challenge of the NASA Centennial Challenges Competition has been going on since early 2006. The couple are members of the Kansas City Space Pirates team which competed impressively in the 2006 Space Elevator Games in New Mexico and hopes to do so again in 2007.

NASA Centennial Challenges is a group of competition events designed to boost innovation by rewarding prize money for achievements in five strategic space areas. The prize money for the Beam Power Challenge, still unclaimed after two years of competition, increases to \$500,000 in 2007.

According to a NASA website, the Beam Power Challenge hopes to uncover new power distribution technologies which could have potential for point-to-point power transmission for human or robotic expeditions into space, for space elevators or solar power satellites.

The challenge requires a team to design and build a climber machine that can race fifty meters up a vertical tether at a minimum speed of 1 meter (3.3 feet) per second. The unmanned climbers cannot weigh more than 60 lbs. and must be powered by beamed energy. Scores are based on the power to weight ratio.

The only thing provided is the 4" wide by 1/8" thick rubber-coated flexible tether that each climber ascends on rollers. The 60 meter (200 foot) tether "was like a rubber band dangling from a crane," says Terri Niles.

The 25 lb. climber, designed by team co-captain Brian Turner, Kansas City, was made out

of lightweight carbon fiber and used solar power. One main reason was cost. "Mirrors are 85% effective and sunshine is free, whereas a searchlight is 20% effective and you are talking \$2,000 a day for a generator and rental," says Turner.

When Turner heard about the 2005 contest he thought, "These are just robots. Robotics is my hobby. The 2005 competition was all about minimalism and the family business when I was growing up was building ultralight aircraft, so I knew a thing or two about minimalism," says Turner, who was born in Wichita.

Basic design done, co-captain Clair Niles "stepped into the gap of how to do things," says Turner. Niles, a full-time farmer with a lifetime of problem-solving experience, chose the materials, did all the welding and all the mirror building including the fitting and tweaking—so much so that he was dubbed the "mirror master." It was at the Niles' farm that months of testing and work by over twenty team members took place. The part-time volunteers included family members from around the area, a homeschool family using this project as a science class, and members of a Kansas City robotics club.

Fifteen sets of mirrors, each set the size of a twin bed were arranged in the concave and angled to receive and beam sunlight, termed "heli-

cont. **Beam Power** page 3

## In This Issue

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## Cosmosphere gains new president and more space

Hutchinson, Kan.- Retired Cmdr. Christopher Orwoll has taken the reins as the new president and executive officer of the Kansas Cosmosphere and Space Center, a position effective March 5, 2007.

Orwoll is the former commanding officer, Naval Reserve Officer Training Corps and professor of naval science at the University of Kansas.

From 2000-2002 Orwoll was the executive officer of the USS Dolphin, the world's deepest diving submarine. Accepting full professorship at KU from 2003-2006, he directed all personnel production and education, facilities upkeep and the administration of more than 90 midshipmen, active duty naval personnel and their dependents. As the NROTC nationwide course coordinator, he developed curriculum and was responsible for leadership, management and ethics education of over 3,000 students.

Orwoll holds a bachelors degree in naval architecture from the U.S. Naval Academy, a masters degree in strategic studies from the Air War College and is currently completing a masters of engineering from Cornell University.

He grew up in Downey, Calif., and has been a passive participant in the U. S. space program since its early days. His father-in-law worked on both the Apollo and space shuttle programs.

Also, the Cosmosphere has purchased an additional building, the former Hutchinson Floral and Gifts building, located directly south across 11th Avenue. "Expansion on the current property is no longer possible, so we are excited to know there is growth potential," says Cosmosphere Senior Vice President Jim Remar. This will be the first major physical growth project since 1997. Options for site development are under discussion.



Photo by Linda Hubbard

**Dr. Richard Bergen** was honored as *Distinguished Kansan of the Year* by the *Native Sons and Daughters of Kansas* at a banquet on January 26, 2007. Dr. Bergen is the sculptor of the *Native American statue, Ad Astra*, atop the capitol rotunda. *Kansas* is the only state with a Native American on its state house. The statue is 20 foot tall and weighs 3500 lb.

## NASA training comes home with teachers

By Kim Hanke and Jeanette Steinert

It was the robotics lab at Johnson Space Center that most interested Marysville Junior High teacher John Hanke.

"I was amazed at the age of the people working there. Most of the engineers were young, 25-35. It's crazy to think that they will be able to sit anywhere in the world and run these robots which will act as human assistants at the International Space Station," the science teacher says.

Hanke and two other Marysville science teachers, Julie Meinhardt and Millie Laughlin, have taken two trips to Houston's Johnson Space Center as part of the National Middle School Aerospace Scholars Program (NaMAS). This \$1.2 million program funded by the National Science Foundation enables teachers in eight states to learn how to incorporate space age technology components into existing curriculum.

Over a year's time the program includes four teacher-training workshops, two NASA-Johnson Space Center interactive live links with students and a student design-and-build robotics competition.

Speaker topics include future flights to Mars, robotics and NASA careers. Tours include the Neutral Buoyancy Lab where astronauts train for zero gravity, Mission Control, flight simulators and robotics labs where educators were shown prototypes of robots being designed to use on Mars. They will be controlled by hand movement using telerobotics--someone far away using a joy stick-type mechanism to manipulate the robot.

"Scientists are also designing anthropomorphic robots, more humanlike in design with more dexterity than current ones, for use in building in space or on the moon in areas too dangerous for humans," says Laughlin, Marysville High chemistry and physics teacher.

After hearing from a NASA robotics expert and doing preliminary robotics exercises, groups were given kits, instructions and a time limit to build a robot along with two robotics challenges. The first was to program the robot to go a certain distance, pick up a ball, turn around, come back and drop the ball on the start line. Next was to incorporate a light sensor in the programming and make the robot follow a maze. Some of the teams completed the first task, none the second.

Studying these principles and bringing back age-appropriate learning activities for the kids "helps give an overview of NASA and what it does, teaches us how to incorporate this into the classroom to get kids more interested in space and NASA," says Hanke.

"Students have also gotten to talk to NASA instructors about the future of robotics and the exploration of Mars via video conferencing/distance learning," says Hanke.

At the same time Marysville students were having a conference recently, Kickapoo Nation School students were online at the Prairie Band Potawatomi Reservation Distance Learning Lab in



Above: Julie Meinhardt sits at a control center station. Below: John Hanke experiments with a robotic hand prototype designed to strengthen the hand and increase the ability to pick up things. Photos courtesy of Johnson Space Center.



Mayetta with their questions, also. One priority of NaMAS is American Indian and Hispanic students.

An upcoming activity for students will be an intramural robotics contest. "Using Lego robotics kits students will have to design and build a robot capable of carrying out a challenge and, using RoboLab software, program the robot to carry out its task automatically," says Laughlin.

This is the last year of the current NaMAS program with trips to Houston. It is in the process of being segued into a virtual program, according to Laughlin, a NaMAS mentor and member of the planning committee for the new virtual NaMAS program. "With everything online, this NaMAS [Johnson Space Center] teacher-training could go on throughout the world at the middle school level for years," says Laughlin. The new NaMAS program is expected to be in operation in 2009.

### On the Horizon...

#### April

- 7 Kansas Science Olympiad Tournament at WSU
- 13-14 Kansas Academy of Science Annual Meeting in Salina
- 13-14 37th annual Mid-America Regional Astrophysics Conference (MARAC) at the University of Missouri, KC
- 14-15 KloudBurst 17 high-powered rocketry event in Argonia sponsored by the KLOUDBusters organization
- 20-22 Kansas Association of Teachers of Science (KATS) Kamp at Rock Springs 4-H Ranch, Junction City
- 28 Ad Astra Kansas Day

#### May

- 3 Junior Academy of Science state meet at WSU
- 18-19 Science Olympiad National Tournament held at WSU

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Editor and Publisher: Steve Durst 650-324-3705 news@spaceagepub.com

Managing Editor: Jeanette Steinert 620-669-8558 steinj@ourtownusa.net

Contributing Editors: Randall M. Chambers, Ph.D., Distinguished Professor Emeritus, Wichita State University College of Engineering; President, NSS Wichita Chapter 316-684-2814  
Michelle Gonella, Space Age Publishing Co. 650-324-3705

*The following is part of an ongoing reference directory featuring representative research projects in Kansas. Ad Astra Kansas' goal is to serve as an information hub in Kansas focusing on different areas of high-tech and space research for networking and educational purposes.*

## ASTRONOMY / PHYSICS

**"Forward Energy from Photons and Neutrons at the Large Hadron Collider,"** \$1,200, Jessica Snyder, KU major astronomy / engineering physics. KU Undergraduate Research Award (URA) 1-07 to 6-07. jegab8@ku.edu

**"Statistical Analysis of Astrobiology,"** \$1,200, Alexander Krejci, KU major geology / physics. KU URA 1-07 to 6-07. akrejci@gmail.com

## ENERGY

**"Advanced Materials and Processes for High-Energy Resolution Room-Temperature-Operated Gamma Ray**

## Kansas Day activities at the Capitol look to the stars

by Linda Hubbard

With the governor's annual Kansas Day activities at the Capitol taking the theme "To the Stars," the Ad Astra Kansas Initiative sponsored an exhibit at Kansas Day activities in the Capitol on January 29, 2007.

Geared toward students in grades 3-9, the Ad Astra Initiative theme was "Kansas Kids Reaching for the Stars Thru: Hot Science, Cool Museums, Super Stargazing and Rockin' Rocketry."

Many visitors to the booth were children from schools around Kansas who were enthusiastic about the information and giveaway items provided. Especially popular were colorful pencils engraved with "Ad Astra Kansas--To The Stars."

Also popular was a bookmark provided by the Kansas Cosmosphere and space camp brochures from the same location.

Other entities donating brochures for the Ad Astra Kansas Initiative booth included: Exploration Place which also provided fliers about the Titanic artifact exhibit most recently on display; Wichita State University (brochures featuring the Kansas JASON Project, the 20th Annual Kansas Science Olympiad, the Kansas Junior Academy of Science, as well as a card for teachers to receive a resource guide online); the Kansas BEST competition. Also featured were the Wellington Challenger Space Center, Kansas observatories, Kloudbusters rocketry and 4-H and scouting rocketry.

A student from Cherryvale High School in southeast Kansas stopped by the booth and saw the brochure featuring the Kansas JASON project with Kansas native Dr. Robert Ballard's photo on front. He relayed the information that he had done a class report on Dr. Ballard, a world-renowned explorer and oceanographer. Several discussions were held with students about the meaning of "Ad Astra" and why it's important to our state.

While the number of visitors to the booth is unknown, well over 500 pencils were given away from about 9:00 a.m. until 1:00 p.m. when activities concluded.

**Spectrometers,"** \$411,036, Douglas McGregor, KSU Dept of Mechanical / Nuclear Engineering. U.S. Dept. of Energy award 9-06. 785-532-5284 mcgregor@ksu.edu

**"Compact Muon Solenoid Sensors,"** \$35,576, Timothy Bolton, KSU Dept of Physics. U.S. Dept. of Energy funding 10-06. 785-532-1664 tbolton@ksu.edu

**"From Fibers to Photons: Measuring Positions of the Zero Degree Calorimeter,"** \$1,200, Laura Stiles, KU major engineering physics. KU URA 1-07 to 6-07 lastiles@ku.edu

## INFORMATION TECHNOLOGY

**"Proximity Microtransceiver for Interoperable Mars Communications,"** \$58,278, William Kuhn, KSU Dept. of Electrical / Computer Engineering. NASA funding 8-06. 785-532-4649 wkuhn@ksu.edu

## MANUFACTURING and ADVANCED MATERIALS

**"Assembly and Properties of Functionalized Carbon Nanotubes: An Integrated Approach Towards New Functionalized BioMaterials,"** \$40,800, Christer Aakeroy and Daniel Higgins, et al. KSU Dept. of Chemistry. National Science Foundation funding 1-07. 785-532-6096 aakeroy@ksu.edu

**"Improved Polymer-based Electrolytes for Lithium Ion Batteries,"** \$23,673, Mary Rezac, KSU Dept. of Chemical Engineering. NASA funding 8-06. 785-532-5584 rezac@ksu.edu

**"Nanotube Synthesis and Applications,"** \$120,000, Duy Hua, KSU Dept. of Chemistry. National Science Foundation funding 1-07. 785-532-6699 duy@ksu.edu

Sources: KSU Research and Sponsored Program Awards, KU press release

## Beam Power cont. from page 1

beaming" by Turner, to a parabolic trough onboard the climber where solar cells powered its electric motor.

"Each mirror was focused and aimed independently with 90 screw adjustments meaning over 1000 screws needed to be adjusted at the start of the competition," says Turner. "With our mirrors focused on three levels, lower, medium and higher, we had constant power," says Terri Niles. "With our collector on board, and a carbon fiber constructed climber, we were a step above the other entries."

At the Space Elevator Games competition at the 2006 Wirefly X-Prize Cup, held last fall in Las Cruces, N.M., the Kansas City Space Pirates were the only team using reflected solar power. They placed in the top five in a field of twelve teams consisting of seven universities, three professional engineering teams and one aerospace company. The team also appeared on PBS' NOVA in a January segment which covered the Beam Power Challenge.

Interestingly enough, according to Terri Niles, during one round of competition, the University of Saskatchewan (USST), the competition favorite and the team that eventually came closest to winning (two seconds short) had a handshake deal for \$30,000 with the Space Pirates to use their mirrors to supplement the USST spotlight technology. Unfortunately, the competition was being held at an airport and airport authorities would not let the Pirates cross a runway to bring mirrors from their exhibition site to the USST site, so this did not occur. With a prize of \$150,000 up for grabs, it would have been a win-win situation for both teams—and defrayed much of the Space Pirates \$50,000 project cost. This 2006 private attempt was funded by all the team members with everyone chipping in. For 2007, the team is looking for sponsors.

The Space Pirates' ingenuity didn't go unnoticed. The team received a NASA award for most innovative climber at the competition. And it appears that two teams from last year's competition, the University of British Columbia (UBC) and a California team will be using the KCSP solar technology in the 2007 competition to be held again this fall in New Mexico.

As to space elevators, the concept is that cargo or passengers travel up into space thousands of miles via an elevator instead of rockets. (The International Space Station is only several hundred miles above earth.) In a typical design the elevator would run up and down a stationary cable. In theory, a space elevator track would look like a capital "I" with a base on the bottom (earth) and a counterweight on top (in space) and a taut cable between the two for the elevator to run on. Centrifugal force would keep the elevator tight and in place. Laser, microwave and power beaming are some of the power suggestions. And a new technology, carbon nanotube technology, shows promise of providing the high density strength needed for such an application. One private company hopes to have a space elevator by 2031.

Does the Space Pirates solar application have the possibility for powering a space elevator? "As yet, no. Because the range is too short. But it is functionally possible for mining for water or helium 3 on the moon or Mars. [For example] by beaming power into the dark craters at the poles where water is believed to be or by powering a furnace onboard an excavator," says Turner.

Why enter the competition? "It's the challenge, the prize money and there's a higher purpose to it than just winning," says Turner.

For more information, go to <http://kcspacepirates.com> <http://centennialchallenges.nasa.gov> or [http://en.wikipedia.org/wiki/space\\_elevator](http://en.wikipedia.org/wiki/space_elevator)

# Interstellar R&D

## Ad Astra Kansas News



This "Interstellar R&D" eleventh-time feature in this **Ad Astra Kansas News** eleventh issue continues an enterprise to research and gather information on the most important developments preparatory to humanity's greatest adventure — voyaging to the stars. Now, at millennium's turn, is an appropriate time for grand vision and forward thinking, and there are strong signs of a renaissance in interstellar travel thought and activity. This new feature and newsletter, thus, now set forth to develop a national / international / global clearing center and storehouse of knowledge and know-how for travel to the stars: **Ad Astra**. — Steve Durst, Michelle Gonella

### OBSERVATION

#### The International Lunar Observatory Association (ILOA) Will Emplace and Operate the Multi-Function ILO Near the Moon's South Pole

Originating in Hawaii near the center of the Pacific hemisphere, the ILOA in 2007 has been endorsed by and seeks membership from institutes, individuals and enterprises to realize, place and operate a multifunction astrophysical observatory near the Moon's south pole as early as 2010, and to help support a follow-on human service mission to that facility. The ILOA is an Earth-Moon interglobal enterprise with projected membership from major spacefaring powers Canada, China, India, Japan, Europe, Russia, Brazil, Crescent Moon Countries, USA and others representing the great majority of the planet's people.

Primarily an observatory for radio, submillimeter, infrared and visible wavelength astrophysics, for other non-astronomical observations, and for some geophysical science, the ILO also will function as a solar power station (with silicon photovoltaic research), communications center (with varied commercial broadcast possibilities), site characterizer (solar wind, radiation, temperature, duration; micrometeorites, ground truth), property claim agent, virtual dynamic nexus, toe-hold for lunar base build-out and settlement, and Hawaii astronomy booster.

ILO astronomical objectives under consideration include observation of the Galactic Center; Extra-Solar Earth-Like Planets; Near Earth-approaching Objects; Earth, Sun and Earth-Sun system; Mars, Europa, Titan atmosphere / weather and that of other solar system bodies; obscured, cold and dusty regions of the universe where stars and planets are being formed from molecular clouds which generate organic molecules, precursors of life; and countless other extragalactic phenomena. Every astronomical and / or astrophysical observation, in fact, made from Earth, also can be made from the Moon, with consistently superior results.

### COMMUNICATION

#### Fermi's Paradox and No Desire to be Found

Rasmus Bjork of the Niels Bohr Institute calculates that 8 probes, each launching up to 8 smaller probes, and moving at one-tenth the speed of light, could explore an area of space containing 40,000 stars in about 100,000 years. Applying this math to our galaxy means that 10 billion years are required for a thorough search.

Bjork responds to Fermi's Paradox by asserting that ET and humans have not had time to find one another. But it's also possible that ET doesn't use the beamed radio or light transmissions which researchers monitor in their searches. ETs utilizing advanced systems, possibly with quantum mechanical effects to encode messages, may be undetectable. ETs utilizing something similar to carrier pigeons would be equally undetectable.

### TRANSPORTATION

#### Pioneers and Voyagers: Bound for the Stars

In a little over 2 million years, Pioneer 10, launched in 1972, will reach its final destination: the red star Aldebaran which is the eye of the constellation Taurus. The distance is about 68 light years. Sister ship Pioneer 11 will travel for about 4 million years before passing near the constellation Aquila, The Eagle.

Reaching the stars has always fascinated humans, and we are just gaining momentum in that arena. Five years following the launch of Pioneers 10 and 11, Voyagers 1 and 2 launched to study the outer planets of this solar system, like the Pioneers. But even with a half decade lead, Voyager 1 passed both Pioneers, becoming Earth's most distant emissary.

Voyager 1 has traveled about 9 billion miles to date. Quite an accomplishment for a propulsion system the size of a coffee can.

Launched in 1977, it passed close to Jupiter and took advantage of a strong gravitational boost. Voyager 1 passed by Voyager 2 (which had, in fact, been launched one month earlier) and by 1998 had passed both Pioneers.

As the first spacecraft leave the solar system, new questions arise about forces present in deep space travel. The Pioneer Anomaly, a phenomenon which causes the Pioneers to seem to be pulled toward the Sun, is the subject of international research and debate. While possible that the effect stems from design considerations, there may be evidence of unidentified forces of physics.

Some conjecture that the mass of the Milky Way may be exerting a gravitational tug. Others suggest that Pioneer's dish antenna is behaving like a solar sail as it is struck by infrared photons from the radioisotope thermal generator. But with both Pioneers 400,000 km from where Newton's Law would place them, answers are needed.

Previously, the anomaly was being analyzed from limited data sets covering 11.5 years of Pioneer 10 and 4 years of Pioneer 11. Following a search sponsored by the Planetary Society, 400 magnetic tapes have been located in storage at JPL. Now utilizing 30 years of Pioneer 10 data and 20 years for Pioneer 11, researchers have been transferring the information to a digital format for clearer analysis.

This information will be important to a new mission, the Innovative Interstellar Explorer, which will launch in 2014 and travel 20 billion miles by 2040. Dr. Ralph McNutt of Johns Hopkins University states, "The real key is speed." IIE will take a cue from the success of its predecessor, Voyager 1, and use Jupiter's gravity as a slingshot to boost its velocity. IIE will travel to the outer edge of the Sun's influence, called the heliopause, and perhaps reveal the path our Solar System follows through the galaxy.