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Cover caption: Goddard Center Director Chris Scolese addresses key officials from NASA, federal agencies, Congress, academia and industry at the fourteenth annual lecture and reception at the National Air and Space Museum.

Photo Credit: NASA/Goddard/Bill Hrybyk

**Goddard View Info**

Goddard View is an official publication of NASA's Goddard Space Flight Center. Goddard View shows people and achievements in the Goddard community that support Goddard's mission to explore, discover, and understand our dynamic universe. Goddard View is published weekly by the Office of Communications.

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**GoddardView**

*Volume 8 Issue 9  •  October 2012*

**THE WEEKLY**

On Thursday, October 18, at 11:30 a.m., in the building 3 auditorium, Deputy Project Manager for Resources, Gifford Moak, will speak about TDRS-K, a communications satellite designed to provide additional bandwidth for a critical communications network. Bring your lunch and learn more about this important Goddard mission.

**Sunday Experiment**

Goddard’s Visitor Center will host this month’s Sunday Experiment on Oct. 21, from 1-3:30 p.m. Sunday Experiment is a free afternoon for children of all ages and their families to discover Goddard’s exciting missions. The October edition will uncover the world of thermal coating and contamination engineering. For more details, click on the image.

**21st Annual Fall Crafts Fair**

The fall crafts fair will be on Monday, October 22, from 10 a.m.-2 p.m. in the building 8 auditorium. Items include night lights, homemade dog treats, pillows and tapestry, unique jewelry, woodwork, crocheted clothing, handmade chocolates, pottery, scented candles, greeting cards, photography, and more. Question: Caraline Maweangane (6-8701).

**Discover Life@Goddard**

Life@Goddard is the hub for the stories that make up the human side of Goddard. Connect to interviews about how Goddard people support Goddard’s mission and stories about the fascinating activities our colleagues engage in outside the gates. Click on the image to explore Life@Goddard.

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By: Claire Saravia

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Children from the Goddard Child Development Center (G CDC) participated in an event on Sept. 13 that would make many adults jealous: they chatted live with an astronaut aboard the International Space Station.

As part of the Amateur Radio on the International Space Station event, a group of day care children aged four- to six-years-old grilled astronaut Akihiko Hoshide with questions about the ISS and space exploration. The session lasted about 10 minutes through a live audio feed before the ISS dipped below the horizon.

CDC director Syreftha Storey said the children’s questions were based off things they learned over the summer through the Space is the Place program. “Throughout this program, students were developing questions they would like to ask astronauts aboard the ISS,” Storey said. “This is a culminating event for our students after seven weeks of study about the ISS and space exploration.”

The summer program was broken up into six weeklong “missions” dedicated to a specific ISS or space exploration topic. The missions—which ranged from learning what life is like aboard the ISS to the experiments astronauts conduct while there—inreeded the students in space exploration.

The program was a unique way for the students to learn about what their parents were involved in at NASA. Storey said many parents came in throughout the summer to perform experiments with the students and speak to them about missions they were part of. “We felt it important that [the students] understand that NASA requires many forms of expertise to support space exploration.”

Storey said, “It was an opportunity for our students to learn more about the GSFC community and work that happens here each day.”

Storey said one of the program’s goals was to prepare the students to ask the ISS astronaut informed questions to cap off their summer learning experience. “By the end of the summer, it was evident that even our young pre-schoolers could engage in meaningful conversations about the ISS based on their exposure to our Space is the Place curriculum,” Storey said. “This is an opportunity for them to interact with the astronauts and further solidify what they have learned.”

The knowledge paid off at the GCCD’s first ARIS event: the students asked Hoshide almost all of their 10 questions, including what the view was like from the ISS and what challenges astronauts face while aboard.

Kindergarten student Jaydon Dove was one of the CDC children able to ask a question. “I practiced my question a lot so that it would be perfect,” Dove said. “I was so excited to get an answer.”

Kindergarten student Ava Stuart said she enjoyed seeing how proud everyone was after she finished her question. “It was so exciting to stand up there and see so many smiling faces while I asked my question. It was awesome to ask a question all the way up to the International Space Station.”

The summer program and ARIS event were part of a larger effort to get the students excited about science, technology, engineering, and mathematics. Storey said, “STEM is a key part of our program.” Storey said, “We believe that young children learn more when they experience topics first-hand.”

Storey said the event was an amazing opportunity for the students. “This event turned out better than we could have ever imagined.”

Storey said, “It has really made an indelible mark on our students and teachers.”

Above: GCCD student Bryden Anders asks his question of ISS astronaut Hoshide. Credit: NASA/Goddard/Debra McCallum
The hottest and most massive stars don’t live long enough to disperse throughout the galaxy. Instead, they can be found near the clouds of gas and dust where they formed—and where they will explode as supernovae after a few million years. They huddle in tight clusters with other young stars or in looser groupings called OB associations, a name reflecting their impressive populations of rare O- and B-type stars.

One of the nearest and richest OB associations in our galaxy is Cygnus OB2, which is located about 4,700 light-years away and hosts some 3,000 hot stars, including about 100 in the O class. Weighing in at more than a dozen times the sun’s mass and sporting surface temperatures five to 10 times hotter, these enormous blue-white stars blast their surroundings with intense ultraviolet light and powerful outflows called stellar winds.

Two of these stars can be found in the intriguing binary system known as Cygnus OB2 #9. In 2011, NASA’s Swift satellite, the European Space Agency’s XMM-Newton observatory and several ground-based facilities took part in a campaign to monitor the system as the giant stars raced toward their closest approach.

Now, a paper published in the October issue Astronomy and Astrophysics provides the campaign’s first results and gives a more detailed picture of the stars, their orbits and the interaction of their stellar winds.

An O-type star is so luminous that the pressure of its starlight actually drives material from its surface, creating particle outflows with speeds of several million miles an hour. Put two of these humongous stars in the same system and their winds can collide during all or part of the orbit, creating both radio emission and X-rays.

In 2008, research showed that Cygnus OB2 #9 emitted radio signals that varied every 2.355 years. In parallel, Yael Nazé, an astronomer at the University of Liège in Belgium, detected for the first time a signature in the system’s optical spectrum that indicated the presence of two stars. The binary nature of Cygnus OB2 #9 provided a natural explanation for the periodic radio changes.

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To maximize their chances of catching X-rays from colliding winds, the researchers needed to monitor the system as the stars raced toward their closest approach, or periastron.

“Our first opportunity came in 2009, but we couldn’t perform all of the necessary observations because the sun was in the same part of the sky,” Nazé explained. “That meant waiting for the next close approach, on June 28, 2011.”

Swift made five sets of X-ray observations during the 10 months around the date of periastron, and XMM-Newton carried out one high-resolution observation near the predicted time of closest approach. In addition, the Expanded Very Large Array in New Mexico monitored radio emissions, and observations to better refine the orbit were made by the CHARA optical and infrared telescope array on Mount Wilson in California, the Wyoming Infrared Observatory, and the Haute-Provence Observatory in France.

The new data indicate that Cygnus OB2 #9 is a massive binary with components of similar mass and luminosity following long, highly eccentric orbits. The most massive star in the system has about 50 times the sun’s mass, and its companion is slightly smaller, with about 45 solar masses. At periastron, these stellar titans are separated by less than three times Earth’s average distance from the sun.

Two sets of measurements taken 5.5 days apart near the time of periastron—one in late June by XMM-Newton and one in early July by Swift—show that the X-ray flux increased by four times when the stars were closest together. This is compelling evidence for the interaction of fierce stellar winds.

Most massive star binaries lack this feature, and the few that exhibit it tend to show more complex behavior. For example, the wind-wind collision zone may crash onto one of the stars. But in Cygnus OB2 #9, this region remains the same throughout the stars’ orbits, a fact that will help astronomers unravel the various physical processes at work.

Massive stars dramatically shape their environment when they explode as supernovae, but their powerful winds dominate the space around them for millions of years, altering star-formation regions throughout their energy-producing lives.

“There is much we don’t know on how stars form and how galaxies evolve, and Cygnus OB2 #9 gives important new data on the role played by stellar winds from massive stars,” said Neil Gehrels, the principal investigator for Swift at Goddard.

Above XMM-Newton view of the core of Cygnus OB2. The star nearest the center is Cygnus OB2 #8A and the bright star directly below it is Cygnus OB2 #9. Photo credit: ESA/Gregor Rauw, Univ. of Liège

Opposite: Artist’s rendering of a colliding wind binary. Photo credit: NASA/C. Reed
The U.S. Postal Service released on Oct. 1 a series of 15 Earthscapes Forever stamps that depict America’s diverse landscapes viewed from aerial and satellite perspectives. Taken from heights of several hundred feet above Earth to several hundred miles up in space, the images on the stamps provide a new perspective on the world we live in.

“Once you’ve seen the world from above, you never look at it quite the same way again,” said Joseph Corbett, Postal Service chief financial officer and executive vice president. “That’s why the Postal Service is proud to offer these Earthscapes stamps, which invite us to take a bird’s-eye view of the land we all share.”

The stamps present examples of three categories of Earthscapes: natural, agricultural and urban. The images were all taken high above the planet’s surface, either carefully composed by photographers in aircraft or snapped by satellites orbiting Earth.

“The residential subdivision” stamp shows suburbia in Clark County, Nev., the state’s most populous county. It shows a maze of pavement, sidewalks and single-family homes. In this desert development, swimming pools and clumps of trees provide some relief from the heat of summer. You can see the full expansion of the city of Las Vegas, Nev., captured over many years in this classic time series of Landsat images.

“Every Landsat image, even if it’s not so beautiful, is a rich science dataset…”

The “Glacier and Icebergs” stamp shows breaking ice from the foot of Alaska’s Bear Glacier that become icebergs in a lake. Dirt and rocks carried downhill by the glacier can be seen at the glacier’s edges. The image was captured by the GeoEye IKONOS satellite.

The landscapes depicted in the Earthscapes series illustrate the diversity and dynamism of Earth’s surface. Using global imagery to understand how Earth’s landscapes are changing through time, and the implications of these changes, is a major focus for NASA’s Earth science program. The next Landsat satellite, the Landsat Data Continuity Mission, is scheduled to launch in February 2013.

The Postal Service released the Earthscapes stamps in October to celebrate National Stamp Collecting Month. The stamps are now available.

Above: Left to right, WJLA/ABC-TV Meteorologist Bob Ryan, NASA Landsat Project Scientist Jeff Masek, U.S. Postal Service Chief Financial Officer and Executive Vice President Joseph Corbett, Goddard Center Director Christopher Scolese, Smithsonian National Postal Museum Education Director K. Allison Wickens, Linn’s Stamp News Senior Editor-Digital Media Jay Bigalke, and photographer Cameron Davidson.

Below: Center-pivot irrigation. Circular patterns on Kansas cropland show center-pivot sprinkler systems have been at work. The stamp art is a detail of an image captured by NASA/U.S. Geological Survey Landsat 7 satellite.

The “Glacier and Icebergs” stamp shows breaking ice from the foot of Alaska’s Bear Glacier that become icebergs in a lake. Dirt and rocks carried downhill by the glacier can be seen at the glacier’s edges. The image was captured by the GeoEye IKONOS satellite. NASA Earth scientists have been studying glaciers for years. Glacier retreat is one of the most direct and understandable effects of climate change. Click here for related Landsat imagery on the changing Columbia Glacier in Alaska.

The “Inland Marsh” stamp shows a shallow creek winding through marshes near Blackwater National Wildlife Refuge on Maryland’s Eastern Shore. Rich tidal marshes make up much of the refuge’s more than 25,000 acres, forming a haven for fox squirrels and bald eagles, and a stopover point for ducks and geese migrating along the Atlantic Flyway. Landsat captured two images of the marsh taken 27 years apart that show marsh loss occurring along the Blackwater and Little Blackwater rivers, where marsh vegetation has given way to open waters. View the images at NASA’s Earth Observatory.

The Landsat series of satellites have imaged Earth for 40 years and have observed changes on Earth’s surface over long periods of time. The archive of imagery is a goldmine of data about the planet.

“Obviously, Landsat images make beautiful stamps,” said Doug Morton, a NASA remote sensing scientist that works with Landsat data. “Every Landsat image, even if it’s not so beautiful, is a rich science dataset, carefully calibrated to provide a wealth of information about the health and composition of our planet.”

In the “Inland Marsh” stamp, Mount St. Helens and its surrounding area continue to recover from the explosive eruption of May 1980. Shades of white and gray indicate still-bare slopes; dark “rivers” are deep channels cut by fast-moving flows of hot ash, rock and gas. Green represents regrowth of vegetation.

In the “Center-Pivot Irrigation” stamp, Landsat 7 shows circular patterns of irrigated crops in Garden City, Kan. Farmers now use groundwater pumps and a technique called “center-pivot irrigation” to essentially mine for water locked deep underground.

The “Residential Subdivision” stamp shows suburbia in Clark County, Nev., the state’s most populous county. It shows a maze of pavement, sidewalks and single-family homes. In this desert development, swimming pools and clumps of trees provide some relief from the heat of summer. You can see the full expansion of the city of Las Vegas, Nev., captured over many years in this classic time series of Landsat images.

By: Rani Gran
As a child, you probably had a LEGO® set. Spilling the contents carefully you’d spend hours constructing something that only made sense to you. LEGO® kits today are much more sophisticated, often containing hundreds if not thousands of pieces.

With a little help from LEGO® designers, students in West Virginia built a one-foot diameter model of a future NASA mission called the Magnetospheric Multiscale (MMS) spacecraft. Scheduled to launch in 2014, MMS will study a little known phenomena called magnetic reconnection. Using illustrations of the spacecraft provided by NASA engineers, the student team carefully sifted through more than 2,000 LEGO® pieces to assemble the spacecraft model. The team also designed and built a smaller 300-piece MMS model.

Dr. Scime, a plasma physicist with significant experience analyzing NASA magnetospheric satellite data, is the lead for the Morgantown West Virginia Area Robotics (MARS) organization. He presented the LEGO® spacecraft models to the MMS team on Sept. 11, 2012, during a Science Working Group Meeting at Goddard. “West Virginia is an intensely rural state and only about 16 percent of students who enter WV high schools complete any type of post-secondary education,” Scime told the MMS team. “MARS is a non-profit organization committed to advancing STEM education in Appalachia by mentoring fifth grade through undergraduate students in FIRST (For Inspiration and Recognition of Science and Technology) robotics programs. Members of MARS who participate in FIRST and related projects such as this often graduate high school and enter college in a STEM discipline at three to four times the national rate.”

The LEGO® instructions, educators’ guide and Space Math activities for the MMS model are being promoted on several NASA sites such as the MMS website, Sun-Earth Day website, Space Math website, on NASA Edge programs and social networks, and at NASA’s Educator Resource Centers across the nation.

Above: MARS organization lead Dr. Earl Scime holds the large model of NASA’s Magnetosperic Multiscale Mission spacecraft that his students built. Photo credit: NASA/Rebecca Roth

STUDENTS BUILD MMS MODEL USING LEGOS
By: Susan Hendrix

is working with Space Math project lead Dr. Steven Odendorf at Goddard to develop authentic mathematic problems that MMS scientists and engineers face.

According to MMS education and public outreach specialist Troy Cline at Goddard, “MARS is a non-profit organization committed to advancing STEM education in Appalachia by mentoring fifth grade through undergraduate students in FIRST (For Inspiration and Recognition of Science and Technology) robotics programs. Members of MARS who participate in FIRST and related projects such as this often graduate high school and enter college in a STEM discipline at three to four times the national rate.” The LEGO® instructions, educators’ guide and Space Math activities for the MMS model are being promoted on several NASA sites such as the MMS website, Sun-Earth Day website, Space Math website, on NASA Edge programs and social networks, and at NASA’s Educator Resource Centers across the nation.

Above: MARS organization lead Dr. Earl Scime holds the large model of NASA’s Magnetosperic Multiscale Mission spacecraft that his students built. Photo credit: NASA/Rebecca Roth

Under construction since September 2010, Building 35 will be completed in two stages. In Phase I, the one-story portion will be completed and occupied before the end of 2012. It will contain a large open space for shipping and central receiving operations and the Mail Service Center. The warehouse portion, Phase II, will be completed in fiscal year 2013.

Tolliver and Dave Maxwell, Deputy Manager for TRAX International, remember it being a ‘dark and stormy’ day when they first surveyed the former Goddard Rifle Range that would become the site of the new facility. The site was perfect since it met the strict security requirements implemented since 9/11 and commercial deliveries can be made safely without endangering center employees or structures.

The Logistics Building first appeared on Goddard’s Facility Master Plan in 2000 and the plans were refined numerous times to meet budget limitations. Unlike the majority of Goddard buildings, the new 100,000 square foot metal structure is “pre-engineered,” based on specifications and foundation drawings provided to a metal building supplier that responded with their specific components to meet the requirement. This type of construction is more cost-effective, however, it does not allow for as much customization as standard construction.

Keene Hall is the Project Manager representing Goddard’s Facilities Management Division (FMD) as well as the Contracting Officer’s Technical Representative. “Being located at the site fosters constant exchange of information allowing us to pinpoint issues as they arise and move out quickly to resolve them,” Hall remarked. “It is rewarding to finally see the structure and the systems that will run this facility come together.”

Although the two-story warehouse portion will be enclosed in the first stage of construction, it will not be fully utilized until 2013. This cavernous area has 20-plus-foot ceilings with three 15 foot by 20 foot rolling doors that will allow oversized shipments such as spacecraft or ground equipment to move easily from outside the loading dock completely through the interior and out the opposite side of the building. Large reusable shipping containers can also be stored inside the facility, a service not available anywhere else at Goddard.

“The relocation of the Logistics Facility will open up multiple opportunities for future development of the Goddard campus and the implementation of the Facilities Master Plan,” stated Dave Larsen, Deputy Branch Head, Engineering Branch of FMD. “As the Center grows and expands its missions, we are building an environment that will ensure its success.”

According to Maxwell, the lower warehouse area will become the new location for the disposal and redistribution of excess furniture, materials and parts. An integrated Supply, Space Flight Project Parts, and ESD-certified Microelectronics Assembly Laboratory suite will be included in the upper warehouse as part of the Phase II build out. The Microelectronics Lab will continue producing printed circuit boards for NASA flight projects and other mission needs. The current logistics facility has been in constant use since 1964 and it is slated to be demolished sometime in 2014.

Above: The new Logistics Facility building under construction. Photo credit: NASA
LIVING IN THE ATMOSPHERE OF THE SUN

By: Leslee Cork

September 19 marked the thirteenth year of Goddard’s annual lecture and reception at the National Air and Space Museum (NASM) in Washington, D.C. This invite-only event, sponsored by the Maryland Space Business Roundtable, attracts key officials from NASA, federal agencies, Congress, academia and industry.

The evening reception in the museum’s Space Race Gallery was followed by an hour-long program in the Lockheed Martin IMAX® Theater. Following this year’s program was a special showing in the Albert Einstein Planetarium of Dynamic Earth exploring how Earth’s climate system is impacted by the sun’s energy.

Dr. David DeVorkin, Senior Curator at NASM; Mr. David Radzanowski, Chief of Staff at NASA; Mr. Chris Scolese, Center Director at Goddard; and Dr. David W. Titley, Deputy Undersecretary for NOAA, started the program. Each speaker stressed the importance of fostering continual partnerships between academia, industry and intergovernmental agencies—such as NASA and NOAA—in furthering our understanding of space weather and science and enhancing our ability to forecast and plan for phenomena that may adversely impact humans and our communications systems.

Dr. Holly Gilbert, Chief of Goddard’s Solar Physics Laboratory, explained, “The Solar Dynamic Observatory provides ten times better resolution than your high definition television and incredible high-temporal resolution, completely revolutionizing our understanding of the sun’s magnetic fields, which are at the core of space weather.”

Earth is constantly being bombarded by solar wind. Though the Earth’s magnetic field and atmosphere provide a layer of protection, coronal mass ejections impact these layers causing magnetic reconnections, which sends space weather particles down to Earth’s atmosphere resulting in auroras.

There are dangerous affects of space weather as well, such as compromised communication systems and satellite interruptions. Dr. Antti Pulkkinen, Associate Professor at The Catholic University of America and Research Associate at Goddard, delved into this side of space weather depicting “worst case scenarios [of] large scale blackouts and large loss of high voltage power transformers.”

The Solar Terrestrial Relations Observatory (STEREO) provides real-time data and 3D imagery that revolutionizes forecasting of space weather. Pulkkinen said, “This new emerging capability is really the result of three key ingredients: increased computational capacity, new observational capabilities provided by missions such as STEREO, and also by maturity of our space science models.”

Dr. Dan Baker, Director of the Laboratory for Atmospheric and Space Physics and Professor of Astrophysical and Planetary Sciences at The University of Colorado, stressed the importance of monitoring the sun with continuing advancements in space weather missions, research and technologies. “With this understanding, we have the hope of helping to mitigate the events that otherwise can completely incapacitate operational systems, and possibly obliterate our communication, navigation, weather, and reconnaissance capabilities.”

Many started the evening unfamiliar with the intricacies and impacts of space weather. All left with a better understanding of, new found appreciation for, and different perspective on space weather and the Sun-Earth connection.

Photo credit: NASA/Goddard/Bill Hrybyk
Not satisfied to merely cycle through neighborhoods and take in the sights of the suburbs, Goddard engineer Oren Sheinman prefers mountain vistas, primitive campgrounds, and—for some reason—the chance to see a grizzly or two.

Sheinman likes his riding to be an adventure, which is why he took his “very used bike” on a three-week, 1,400-mile, self-sustained ride from Missoula, Mont., to Edmonton, the capital city of Alberta, Canada.

“Sheinman says. “You stay in campgrounds, not hotels. You miss half the experience, the camaraderie, staying in a hotel.” Thirteen cyclists made the professionally organized and guided trip with him.

“At the campgrounds, the locals would tell us about all the cool places to go,” says Sheinman. “Places like natural hot springs on the edge of a mountain where we could sit at dusk and watch the sun set.”

“You get this feeling of invulnerability once you’ve acclimated to the miles in the saddle,” he says. “Then you hear that some Tour de France guy went 35 mph up a hill while you thought you were doing well going 35 mph down a hill.”

“The first week you get sore and just pedal through it,” he says. “The body tends to take care of itself if you don’t push too hard initially.” The first week they averaged 55 to 75 miles a day increasing up to 100 miles a day the second week. The team allotted one day a week for rest including enjoying nature, healing the wounds, and even once rafting rapids in Montana’s Glacier National Park.

It’s a type of cycling that burns a lot of calories: “Sometimes I ate two breakfasts, two lunches, a dinner including a pound of pasta and still lost weight,” he says. “As preparation, I did a bunch of practice rides putting 50 pounds of bricks in the bags.”

Sheinman’s riding partner for the trip was a gourmet cook who managed five-star fare like pasta primavera and salmon croquettes despite the outdoor kitchen. “You didn’t want to screw up because there were 13 hungry people counting on you—often with no running water, stores, or McDonalds in sight,” Sheinman says.

The group was able to receive mail at a post office halfway through the trip. Sheinman, ever the practical joker, was himself the brunt of a long-distance gag from his coworkers. One coworker sent him a diversionary care package of Hostess cakes. Another sent the ride leader a 10-pound tungsten cylinder with secret instructions to hide it on Sheinman’s bike. Tungsten is a metal used as balance weight on spacecraft because of its high density. This piece was about the size of a can of V8: small enough to easily conceal. After discovering the tungsten, Sheinman turned the block into a running joke and hid it on his fellow riders’ bikes.

The rider who carried the metal stowaway for seven uphill hours on Going-to-the-Sun Road in Glacier National Park was not amused, Sheinman says.

“After a while, in the mornings before we rode, out of paranoia, everyone asked to see the tungsten,” Sheinman says. “But the last joke was on me. One morning after breakfast duty, I was the last rider out of the campground. I went back to the campsite only to find my bike in pieces. One wheel was bungee-corded up into a tree, Vaseline was on my mirror, and tree stumps and boulders were rolled into my tent.”

The group trip concluded in Jasper, Alberta. Sheinman rode the final 300 miles—through the Rocky Mountains with full packs—to Edmonston solo. By the time he reached the airport for his flight home, Sheinman had racked up a miraculous grand total of zero flat tires.

For the next adventure, Sheinman would like to bike up the Alaska Highway, from Dawson Creek, British Columbia, to Fairbanks. While he waits, he enjoys local day trips, including the annual Seagull Century, a 100-mile trek from Salisbury, Md., to Assateague Island.

As for the infamous tungsten, Sheinman presented it to the ride’s group leader before the team separated in Jasper. When the cyclists went their separate ways, the tungsten (and the gag) remained in the Pacific Northwest. Mystery solved.