***COSMIC Launch***

*COSMIC, a globe-spanning constellation of six satellites, was launched successfully aboard a Minotaur rocket from Vandenberg Ar Force Base on Aprl 14. Ground stations have received signals from all six satellites. More about the project and UCAR's role.*

# Staff Notes monthly

*For the people of NCAR, UCAR, and UOP* Vol.41 #4 • May 2006

## Notes from the field: Turbulence and pollution

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### Terrorism and climate change

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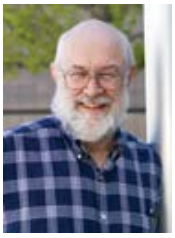

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## Just One Look

CGD's Craig Hartsough (left) and Jeff Yin lip sync the lines of Johnny Cash's "A Boy Named Sue" during Spring Fling 2006. The party took place on May 5 in the Center Green auditorium. As always, the lip sync contest was a hit, with performances by RAL, CGD, and EO. The event also included trivia contests, a sing-along, entertaining hosts, a buffet, and a live band. For more Spring Fling coverage, including photos and video clips.

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## Notes from the field: Turbulence and pollution

It's been a busy couple of months in the field for NCAR. The HIAPER aircraft in its maiden campaign performed flawlessly over California while, in the Mexico City area, scientists gathered vital information about air pollution.

*The pollution over Mexico City is clearly evident in this photo from the Basílica of Guadalupe. (Photos by Carlye Calvin.)*

Soaring over the Owens Valley in March and April, HIAPER (High-performance Instrumented Airborne Platform for Environmental Research) flew through areas of turbulence known as mountain waves and aimed its instruments at treacherous atmospheric whirlwinds, called rotors. Its mission was part of a large, multidivisional and multinational field campaign known as the Terrain-Induced Rotor Experiment (T-REX), which collected data about rotors and mountain waves, as well as atmospheric behavior closer to the valley floor.

Meanwhile, ACD researchers and collaborators from around the world studied air pollution in and around Mexico City for the much-anticipated Megacity Impacts on Regional and Global Environments (MIRAGE) field campaign. Their objective was to determine how the pollution affects regional and global air quality, climate, and ecosystems, with an eye toward applying what they learn to other megacities around the world.

Here's a look at these two important studies.

### High and low

HIAPER won rave reviews from the T-REX team almost from the moment that it took off from

*Dan Kirshbaum (MMM) stands by the REAL lidar during T-REX.*

Jeffco on March 2 for the first of 13 flights to California. "It's an excellent platform that's able to get up to high altitudes, cruise for a long time, and adjust to changes in flight conditions created by strong mountain waves," says EOL's Jorgen Jensen. "As far as the instrumentation on board, it has been very reliable. I'm really impressed with how things worked."

The HIAPER flights were an important component of T-REX, which brought 60 scientists, technicians, and students from across the United States and Europe to California's sparsely settled Owens Valley from March 1 to April 30. Researchers also flew two other aircraft at lower altitudes and set up a large ensemble of ground instruments.

The research team, led by Vanda Grubišić of the Desert Research Institute, picked the region because it has the steepest topography in the continental United States, with Owens Valley sitting some 9,000 feet (about 3,000 meters) directly below the highest peaks of the adjacent Sierra Nevada mountains. The mountains spawn atmospheric waves that propagate upward and can "break" into the stratosphere, creating clear-air turbulence. The strong wind shear and turbulence in these waves and lower- altitude rotors play havoc with aircraft.

HIAPER flew through the waves in the upper troposphere and lower stratosphere at altitudes of up to 45,000 feet (13,700 meters). It joined aircraft from the University of Wyoming and the United Kingdom, which flew at lower elevations and gave scientists additional views of the mountain waves, rotors, and valley phenomena.

Researchers on HIAPER released dropsondes to collect data on the rotors. The aircraft also carried an array of atmospheric chemistry samplers to provide insights into the ways that mountain waves moved air masses between the stratosphere and the underlying troposphere. Heightened ozone levels indicated that air was coming down from the stratosphere, where ozone concentrations tend to be higher; heightened carbon monoxide levels, on the other hand, indicated that air was rising from the lower troposphere. "Ozone and other tracers provided us with nice

*EOL's Gordon Maclean (bottom) and John Militzer remove an antenna from a 110-foot flux profiling tower in the Owens Valley.*

correlative signatures of mountain waves," says ACD's Laura Pan.

To study airflow, the research team also used an array of ground-based instruments, including radars, lidars, automated weather stations, wind profilers, and balloons.

The project didn't focus just on higher altitudes. On days when HIAPER wasn't flying, researchers examined turbulent eddies of air just above the levels of trees and bushes. Among the instruments they used was a suite of three hot-film anemometers, developed at NCAR, that took 2,000 measurements per second of winds in three dimensions.

"We're looking at turbulence on all scales, from mountain waves that reach up to the stratosphere down to very small-scale turbulence near the surface," explains EOL's Greg Poulos, one of the project's principal investigators and the ground-based instrument coordinator. "It's a very complex study."

The weather generally cooperated, bringing in high winds with a train of potent Pacific storms. Researchers didn't always know the exact timing and strength of the airflow features in advance—which is part of the reason for the experiment in the first place—but their location, at least, was somewhat predictable. "Here we know where the turbulence is more likely to occur, relative to the mountain barrier. In severe storms, it sneaks up on you," says EOL's Dick Dirks, the field operations director.

Despite HIAPER's excellent performance, researchers did encounter some challenges. On the ground, team members found themselves contending with gusty winds that pushed around

*T-REX principal investigator Joach Kuettner (JOSS) exits the HIAPER aircraft.*

instruments and researchers alike. And on HIAPER, the team had to make adjustments to sensors and overly noisy amplifiers. "These are normal problems when you initially instrument a new aircraft," Jorgen explained.

But perhaps the greatest challenge was coordinating the aircraft. As Greg puts it: "If you can envision three airplanes stacked on top of each other flying around in coordinated fashion, with two of them releasing dropsondes and trying to avoid the other airplanes, while working around the sensitive national park lands in this area, that was a really significant challenge to overcome."

### Notorious air

On March 1, several dozen staffers, most from ACD and EOL, descended upon Mexico City for the MIRAGE field campaign. Working with collaborators from around the world, they took a close look at the chemistry of the city's notorious air pollution.

The researchers didn't have to search far to find the justification for their study. "Overall, we found an amazing haze everywhere, especially over the city but also outside it," says ACD's Sasha Madronich, one of the principal investigators. "It was a great mixture of different pollution conditions, including urban pollution, smoke from regional forest fires, and dust events."

The field campaign included air and ground components, with researchers measuring both aerosols (airborne particles of dust, soot, and other pollutants) and gaseous pollutants (including ozone, nitrogen oxides, carbon monoxide, sulfur dioxide, and hydrocarbons and their oxidation products).

One of the biggest surprises during the campaign was the extent of active particle production the team observed in the atmosphere—that is, gases condensing to form particles. The especially tiny particles common in highly polluted areas can damage human lung tissue and affect global climate.

*ACD's James Hannigan (left) and Michael Coffey, working in a trailer outside Mexico City, record the absorption of infrared solar radiation in the atmosphere. Such information is used to determine levels of gases in the atmosphere.*

"You'd expect in a very polluted location not to have particle production," explains ACD's Alex Guenther, who was stationed at a ground site outside Mexico City. "What happens in a polluted atmosphere is that you already have so many particles in the air that the gases attach to existing particles. But we observed particle production going on at the ground site, and that was something unexpected."

One of the researchers' goals will be to determine if the city's exceptionally high level of pollution actually changes the underlying chemistry of particle production.

ACD's Jim Smith ran an experiment at the ground site to look at how quickly particles of different sizes take on water and turn into cloud droplets, since the formation of clouds can impact climate. "The experiments worked out as well if not better than expected," he says.

From the air, researchers aboard the NSF/NCAR C-130 aircraft made multiple flights to transect the plume of air pollution that blows out of Mexico City, usually spreading northeast due to prevailing winds.

*EOL's Ed Ringleman at the controls of the C-130 during MIRAGE.*

"We didn't see the flow to the northeast as often as we had thought, but we had a much more varied situation," says MMM's Bill Skamarock, who ran the Weather Research and Forecasting model (WRF) during the campaign to predict the plume's movement. "But the model performed well and we were able to find the plume, more often than not, where we expected."

The aircraft team logged 88 hours of flight time in all, on some occasions following the plume all the way to the Texas coastline and the Yucatan peninsula. Five other research aircraft were also in the air as part of MILAGRO, an umbrella campaign of which MIRAGE was one component. “Aircraft controllers in Mexico were extremely helpful in coordinating six airplanes buzzing through their airspace,” Sasha says.

The logistical complications of transporting equipment across the U.S.-Mexico border proved to be the biggest challenge during the field campaign. “Things were a little slow getting started because we had issues with shipments arriving late, but eventually everything made it,” Sasha says.

From Mexico City, the C-130 flew directly to Seattle for INTEX-B (Intercontinental Chemical Transport Experiment-B), another of the four MILAGRO field campaigns. The main goal of INTEX-B was to quantify the transport and evolution of air pollution from Asia across the Pacific Ocean to North America, and assess its implications for regional air quality and climate.

• *by David Hosansky and Nicole Gordon*

**On the Web**

More about T-REX

More about MIRAGE

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**In this issue...**



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## Terrorism and climate change

Polls consistently show that Americans tend to see terrorism as a far greater threat than climate change, even though many experts view our changing climate as one of the greatest challenges to civilization. At a recent ISSE coffee talk, "Climate and Terrorism: Commonalities and Differences in Societal Response," ISSE's Susi Moser raised some thought-provoking comparisons between the two threats and why they are perceived so differently.

*Susi Moser. (Photo by Carlye Calvin.)*

Terrorism, she explained, evokes fear partly because Americans have been able to conceive of its impacts clearly since the destruction of the World Trade Center in 2001. In addition, the "war against terrorism" is portrayed as an archetypal "us versus them" story—an identifiable conflict between the United States and violent extremists.

"It's a very clear story that deeply resonates," Susi said. "It is almost completely contrary, in that respect, to climate change."

Americans generally are less concerned over climate change because the threat is more difficult to imagine, with the most severe impacts appearing to be far in the future and in faraway places, she explained. The public also still assumes that scientists are split over whether climate change actually poses a threat.

"The one thing that has really settled into the public's perception is that the scientific community is deeply divided," she said.

Susi blamed the misconception partly on the media, which tend to try to balance stories about climate change with quotes from skeptics. But she also blamed scientists for failing to adequately communicate the threat. "As scientists, we've learned to couch everything in terms of, 'We're not certain yet.' As soon as we've done that, we've given the public permission to stop listening," she said.

Despite such differences, Susi explained that risk assessment processes for climate change and terrorism actually have many commonalities. In both cases, researchers are

using sophisticated computer models to run scenarios, focus on vulnerabilities, and address uncertainties. They increasingly move their focus from global scenarios to regional and local impacts and contexts.

Also in both cases, the public appears to be pessimistic about the federal government's ability to ward off major impacts. While Americans initially supported the government's aggressive response to terrorism and the alleged threat from weapons of mass destruction even with uncertain intelligence, they are increasingly unsure whether the response has made the country safer. By contrast, the public accepted federal hesitation on climate change because of uncertainties about the science, but it is now increasingly impatient for action.

As concerns about climate change have grown over the last few years, a growing number of public policy experts, such as former U.N. chief weapons inspector Hans Blix and British science adviser Sir David King, are drawing comparisons between climate change and terrorism. "You see the two being linked together," Susi said. "People warn that climate change is as serious or more serious a threat than terrorism."

Susi suggested that climate change communicators may want to take lessons from communications about terrorism. For example, the language of empowerment appears to work better than simple appeals to fear. "Without specific instructions on what to do about the threat," she said, "without giving people a sense that they can do something, and that the suggested action actually solves the problem, people only end up - controlling their fears, not the danger.

• *by David Hosansky*

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# New program is a star

The stars have come out for a new GLOBE initiative.

*GLOBE at Night organizers (left to right): Randy Russell, Dennis Ward, Susan Gallagher, and Kirsten Meymaris (all from UCAR); Dave Salisbury (University of Colorado); and Sandra Henderson (UCAR).*

The organizers of GLOBE at Night, which recruited schoolchildren worldwide to make observations of the night sky in March, say the event was such a success that it will be held again next year. "The participation of schoolchildren, families, and citizen scientists across the country and around the world was incredible," says EO's Sandra Henderson, director of GLOBE education. "This is definitely an event that we can build upon."

More than 18,000 people in 96 countries took part in the program, which was held during the first days of spring (March 22–31). They gazed skyward on at least one evening, looked for the constellation Orion, and shared their observations through the Internet. The findings can help scientists map light pollution around the world.

GLOBE at Night was designed to promote family involvement in science. Participants used their observations of Orion to measure the brightness of the sky at a variety of urban and rural sites. "This event was useful in teaching about the impact of artificial lighting on local environments and in raising awareness about the ongoing loss of people's ability to study or simply enjoy the night sky in many parts of the world," explains EO's Dennis Ward, who helped coordinate the event and contributed to the GLOBE at Night Web site.

Kirsten Meymaris, GLOBE at Night project coordinator, explains that the program will be expanded to gather more information about variations in the night sky. "We see this year's observations as a beginning," she says. "We hope to increase the level of participation next year and focus on specific regions, such as dense cities and sparsely populated rural areas, to gain more insights into the impact of artificial lighting."

The program also aimed to teach young participants about the economic and geographic factors that affect light pollution in their communities and around the world. In many Colorado mountain towns, for example, where residents and visitors want to see stars clearly at night, local ordinances restrict the amount of light that can be aimed skyward.

One of the program's highlights was a Mesa Lab star party on March 23 that drew dozens of people. The family event featured a discussion about Orion, stargazing tips, and children's crafts activities such as outlining the shape of Orion with glow-in-the-dark puffy paint. SCD's Leonard Sitongia shared his telescope for star viewing.

**March 2007**

Next year's program will take place March 8–21. It will encompass two weekends, enabling more people to make observations. In addition, Kirsten says it will include a cloud estimate component so that people who live in overcast areas, such as the Pacific Northwest, can take part even if they don't see stars. "If participants go outside and look at the night sky and see nothing but clouds, I want them to feel like they can still make a contribution," she explains.

GLOBE at Night was inspired in part by a similar project carried out in Arizona and Chile by the National Optical Astronomy Observatory and the Centro de Apoyo a la Didáctica de la Astronomía (Support Center for the Teaching of Astronomy), which were cosponsors of GLOBE at Night. Other cosponsors were the GIS software and technology firm ESRI and the UCAR-based Windows to the Universe program. UCAR Communications helped the program organizers publicize the event.

Astronomers have already begun to analyze the GLOBE at Night observations. Mapped results can be explored using the GLOBE at Night Map Viewer, built with support from ESRI (see On the Web). A student exploration guide is in development for the Map Viewer to help students navigate observations from different parts of the world.

Light pollution is a growing problem for astronomical observing programs around the world. According to the International Dark-Sky Association, some 30% of all U.S. outdoor lighting is directed skyward, contaminating the night sky and costing at least $1.5 billion in electricity per year.

• by David Hosansky

**On the Web**

More about GLOBE at Night, including the Map Viewer

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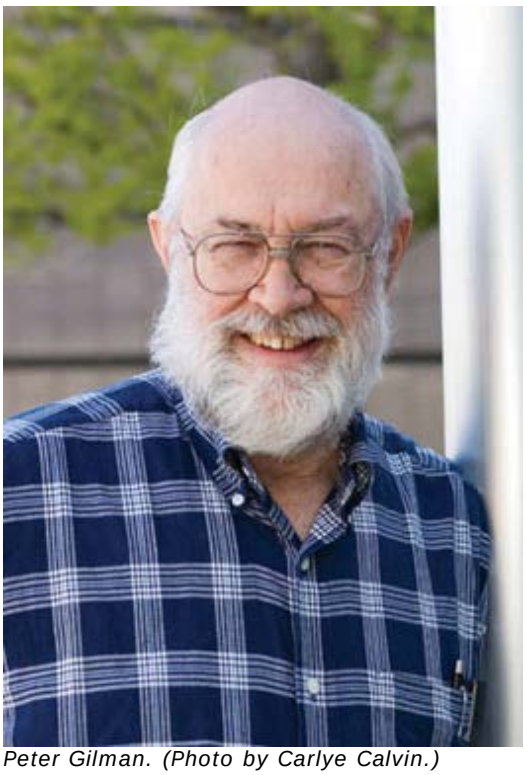
## Peter Gilman wins Hale Prize

Veteran solar researcher Peter Gilman (HAO) has won the prestigious 2006 Hale Prize from the American Astronomical Society.



*Peter Gilman. (Photo by Carlye Calvin.)*

The AAS recognized Peter "for his unique insights and substantial scientific achievements in understanding the dynamics of the solar convection zone and the mechanism of the Sun's magnetic dynamo, and for his leadership and support of solar physics research programs," according to the society's solar physics division. Peter is the first HAO scientist to be so honored.

Peter's research focuses on the fluid dynamics and magneto-fluid dynamics of the Sun, stars, and planets. His interests include the mechanisms behind sunspots and the causes of the 11-year solar cycle. Most recently, he worked with HAO's Mausumi Dikpati and Giuliana de Toma to produce a prediction of the next solar cycle.

Peter arrived at NCAR in 1969 and became a senior scientist in 1973. He has served as HAO director and NCAR associate director. His extensive community experience includes leadership roles for a number of solar and astronomical organizations and sitting on the editorial boards of Solar Physics and Geophysical and Astrophysical Fluid Dynamics.

"We all know how much we owe Peter for his contributions to research, education, and leadership," says HAO director Michael Knölker. "It is wonderful to see the outside community fully recognizing all of this."

The AAS awards the Hale Prize every year to a scientist for outstanding contributions to the field of solar astronomy. The prize is named for George Ellery Hale (1868-1938), who was one of the nation's leading astronomers.

• by David Hosansky

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## At the helm of ESSL

As a new NCAR associate director and the first permanent head of the Earth and Sun Systems Laboratory (ESSL), Guy Brasseur wants to enhance interdisciplinary research while maintaining a focus on traditional science.

*Guy Brasseur. (Photo courtesy Max Planck Institute.)*

"ESSL is the natural place to enhance more integrated research across divisions," he says. "But we should not neglect fundamental science."

Guy has long-established ties with NCAR, having served as ACD director from 1990 to 2000. He subsequently became the director of the Max Planck Institute for Meteorology in Hamburg, Germany, until NCAR tapped him this year for the ESSL position following an international search.

A large lab, ESSL brings together four divisions—ACD, CGD, MMM, and HAO—as well as the Institute for Integrative and Multidisciplinary Earth Studies, a new institute. Its research focus extends from the bottom of the oceans to the Sun and beyond, and incorporates such vital research areas as climate change, the interactions of chemicals in the atmosphere, hurricanes and other storms, and the impact of solar events on the upper atmosphere.

NCAR combined the divisions into ESSL as part of its 2004 reorganization to help facilitate broad, interdisciplinary initiatives. (For more on the reorganization, see the *Staffnotes* article on reorganization.)

In a recent interview, Guy outlined several goals for interdisciplinary work. Among the lab's key projects:

- Studying the upper troposphere/lower stratosphere. The boundary region between the two lowest layers of the atmosphere is a critical area for understanding climate, atmospheric dynamics, and chemistry.
- Tracking the water cycle. Scientists want to better understand Earth's hydrologic

cycle by improving measurements of water vapor and learning more about sources and sinks, thereby improving predictions of clouds and precipitation in weather and climate models.

- Modeling the Sun-Earth system. The Whole Atmosphere Community Climate Model (WACCM) will study the atmospheric response to changes in radiative output from the Sun. “We are extremely well-placed here to do an end-to-end study, all the way from the Sun to where people live,” Guy says.

Guy stresses the importance of focusing on both models and observations. “We have to insure a good balance between experimental observational work and modeling work,” he says. “Models must constantly be confronted with the real world. Most of the large discoveries are made by people who use models and observations at the same time and find discrepancies, and try to find out why.”

He’s also hoping to collaborate with SERE to develop links between research into natural systems and social systems. Science, he believes, should be kept relevant to society. “We have to translate research findings into something that makes sense to society,” he says.

### A distinguished background

A native of Belgium, Guy holds two engineering degrees and a doctorate in aeronomy from the Free University of Brussels, where his Ph.D. dissertation dealt with the effects of nitrogen oxides on stratospheric ozone. He completed his postdoctoral work at the Belgian Institute for Space Aeronomy, where he worked on advanced models of photochemistry and chemical transport in the middle atmosphere.

Between 1977 and 1981, Guy shifted gears, serving as an elected member of the Belgian House of Representatives and as a delegate to both the Council of Europe Parliamentary Assembly in Strasbourg, France, and the Western European Union in Paris.

Guy’s community leadership posts have included serving as editor in chief of the Journal of Geophysical Research–Atmospheres and as chair of the International Atmospheric Chemistry Project of the International Geosphere-Biosphere Programme. He is a former chair of the IGBP’s Scientific Committee, which promotes Earth system science at the international level, with particular focus on the developing world. Guy is also a past president of the Atmospheric Sciences Section of the American Geophysical Union. “I’ve been privileged to lead the Max Planck Institute for Meteorology for six years,” he says. “It’s great to return to NCAR now, because this center is in a unique position to develop an interdisciplinary and integrative research program focusing on Earth system science.”

• by David Hosansky and Bob Henson

### On the Web

ESSL homepage

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**Just One Look**

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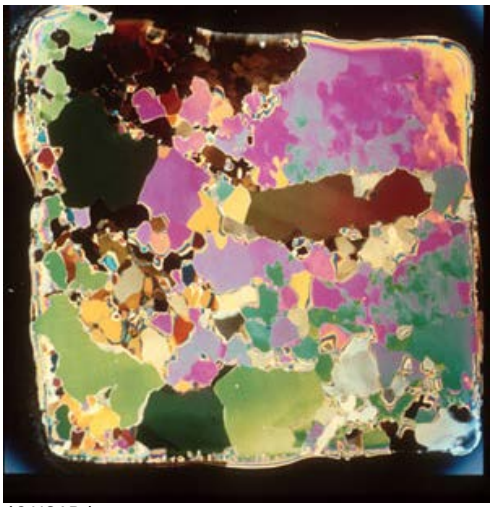
## New Digital Image Library

UCAR Communications is overhauling the Digital Image Library, adding hundreds of new images and making it more user-friendly. One of the new images (below on the left) by UCAR photographer Carlye Calvin shows a double rainbow over Boulder Canyon. The image on the right shows the crystalline structure of a thin slice of glacial ice, as revealed by polarized light. Scientists analyze the chemical makeup of glaciers in order to infer the state of the atmosphere many thousands of years ago.

The new library is at www.ucar.edu/imagelibrary.

• by David Hosansky

*(©UCAR. Photo by Carlye Calvin)*



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### On the Web

UCAR Digital Image Library

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# Staff Notes monthly Extra!

## May 2006

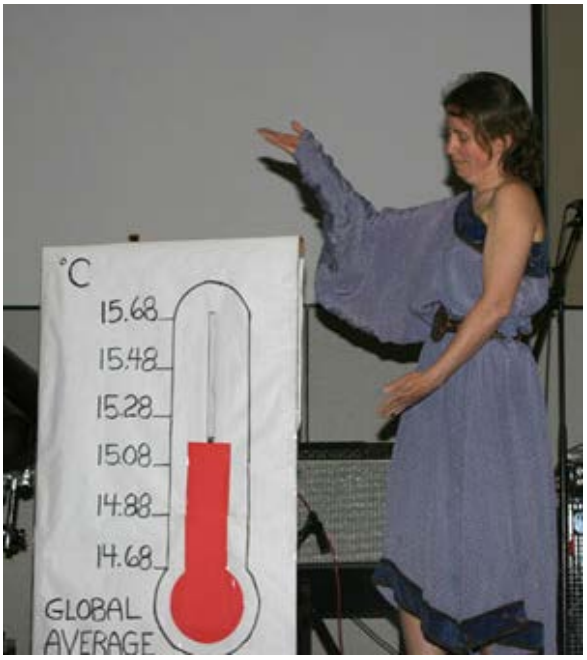
### Spring Fling Celebrates the Hippie Dippie '60s!

The annual Spring Fling, whose theme this year was "Hippie Dippie '60s," drew hundreds of partygoers to Center Green last Friday, including many too young to actually recall the '60s.

No matter. The EAC Spring Fling committee of Michelle Harrison, Patti Kidd, and Jamie Shuey organized a fun time for all ages that included lip syncs, trivia, polyester-clad hosts, a buffet, and a live band.

Staffers from CGD, EO, and RAL competed in the lip sync contest. (See the videos.) In true Boulder spirit, everyone was a winner. CGD looked to the pre-'60s era by performing to "A Boy Named Sue" by the "rough and rugged, definitely not dippie" Johnny Cash. Their lead singers, Jeff Yin (Sue) and Craig Hartsough (Pa) looked so "mighty fine" in dresses that they took home the Connie Francis Award.

Next up was RAL, which performed to "The Climate is A'Changin'," a clever rendition of Bob Dylan's "The Times They Are A'Changin'." With Tor Mohling standing in as the great American poet, staffers danced around the Larsen Ice Shelf, waddled in penguin costumes, checked a giant thermometer, and encouraged the audience to bike more. Their performance won them the Eric Clapton Award for best songwriting skills.




EO wrapped up the contest with a lively dance performance of "Snoopy Versus the Red Baron," by the Royal Guardsmen. Lip sync veteran Tim Barnes played Snoopy in this twist of the classic story of Snoopy (outfitted as HIAPER, with funding from the NSF Great Pumpkin) versus the ominous thunderstorm Baron von Richthofen. The team won the Chubby Checker Award for best choreography.


Between acts, EAC's Jennifer Griffin (SCD) and Bob Tan (Director's Office) entertained the crowd with '60s trivia. (How much did an advance ticket for Woodstock cost? $18. What year did Johnny Carson start hosting the Tonight Show? 1962.)

Events Services cooked up a spread of mac 'n cheese, stew, coleslaw, wings, zucchini bread, and more. The party was a Zero Waste event, with composting bins for all supplies and food scraps. The band Wild Six provided live entertainment while people ate, drank, and danced into the evening.

**On the Web**

Spring Fling Photo Album
Spring Fling Videos

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News Center




EXIT


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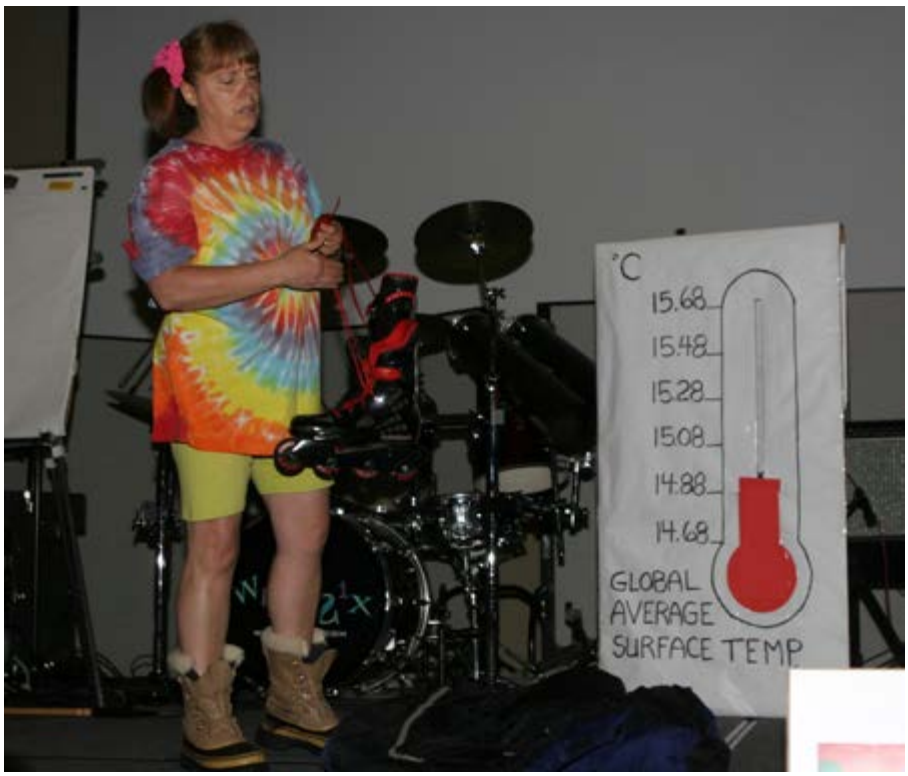
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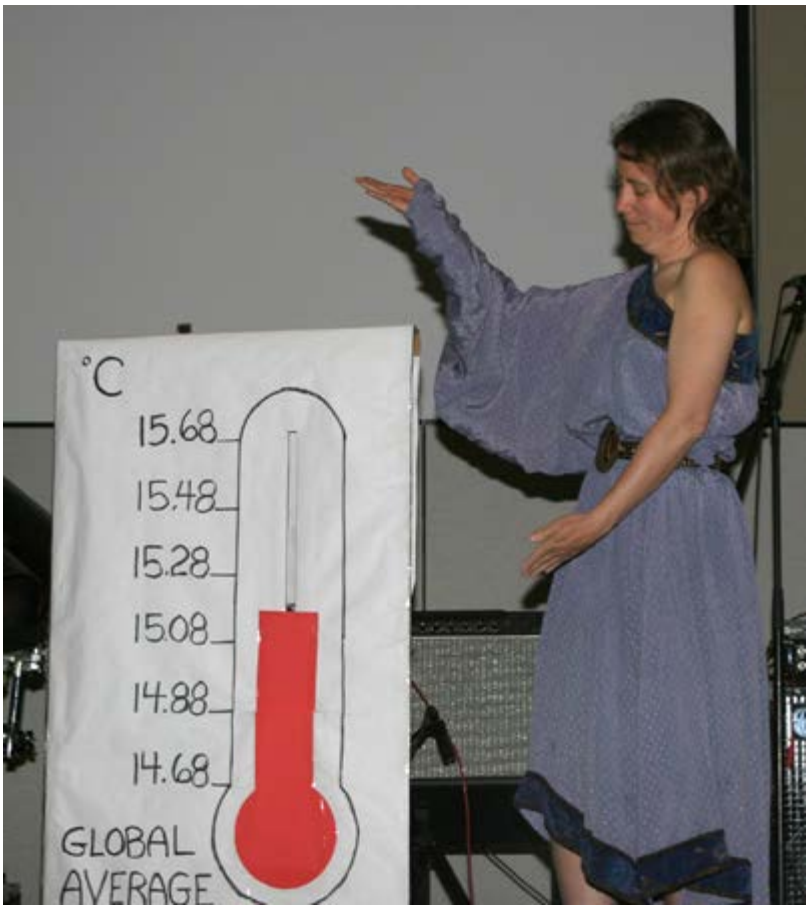
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NSF


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National Center for Atmospheric Research