LASP SPACE
Laboratory for Atmospheric and Space Physics
University of Colorado **Boulder**
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Issue features: **PI-led missions • Student jobs at LASP • Budget cuts, academia, and the future of space science**

Letter from the director

Dan Baker

On behalf of the nearly 500 people employed at the University of Colorado Laboratory for Atmospheric and Space Physics (LASP), I welcome you to the inaugural issue of LASP*SPACE* and invite you to become a reader of this new space industry publication. The newsletter will report what is happening at LASP and share how things are progressing on our many varied programs and projects. LASP*SPACE* is intended to be current and topical, delivering clear information about the often rapidly changing research and technology landscape in which LASP is a key player. We expect to publish the newsletter several times per year.

The intention is to reach our partners and friends in the aerospace (and related) industries, the science community as a whole, and the many government agencies that touch LASP. We hope that alumni, colleagues in the university community, and those who just love the space business will find LASP*SPACE* a means to obtain a quick update on what is going on. We have introduced the newsletter with a short emailed content

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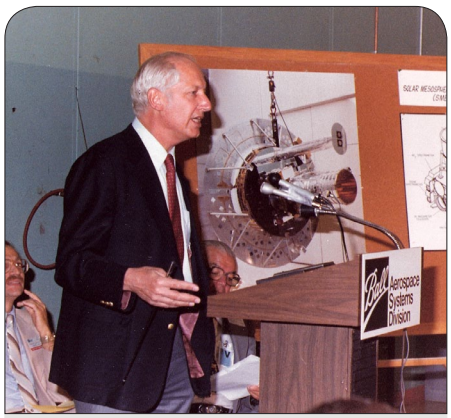
In focus

PI-led missions

Bruce Jakosky and Tom Woods

NASA has moved increasingly toward having smaller missions openly competed, with proposals led by a single Principal Investigator (PI). The advantages of PI-led missions include the ability to let the science community decide, on a competitive basis, what the most important science objectives are (based on the missions they proposed), and to promote competition for high-quality science, best implementation, and a cost-effective mission. A PI-led mission has a very focused science goal and smaller science team. A PI with full management authority can more quickly and clearly define the scientific vision and implementation to best achieve the objectives of a mission, avoiding the often frustrating "design by committee" approach.

LASP is an important player in PI-led missions. We have led missions with PIs at LASP, such as those highlighted below. We have also provided instruments for missions with PIs from other institutions, such as the Mercury Atmosphere and Surface Composition Spectrometer (MASCS) on MESSENGER and the Student



Charles Barth, former director of LASP and PI of the Solar Mesospheric Explorer (SME), addressed a flight readiness review in 1981. *(Courtesy Charles Barth/LASP)*

Tom Woods, PI of the Solar Climate Radiation Experiment (SORCE), spoke to the press in 2008; engineer Tom Sparn looked on. *(Courtesy Catharine Woods)*

Dust Counter (SDC) on the New Horizons mission. And we have been a major subcontractor providing primary oversight of spacecrafts and instruments, as with Aeronomy of Ice in the Mesosphere (AIM).

Four missions have been led by PIs at LASP. The **Solar Mesosphere Explorer** (SME) was innovative in the early development of PI-led missions; Charles Barth

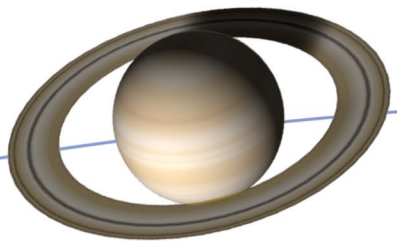
led the mission, which launched in 1981. Designed to understand the influence of the Sun on the Earth's mesosphere and thermosphere, it measured solar ultraviolet input to the upper atmosphere and the atmosphere's response. It was the first mission for which development was led entirely from a university. SME included four science instruments built at LASP, and LASP subcontracted to Ball Aerospace to provide the spacecraft. This was the first mission for which operations were done out of LASP, representing a significant step up for the nascent mission operations group.

The **Student Nitric Oxide Explorer** (SNOE) was one of three missions selected for a Student Explorer mission concept. Students were involved in all phases of design and build, overseen by professionals and working side by side with them. The scientific thrust was to understand the behavior of nitric oxide in the upper atmosphere, in particular its response to inputs from aurora (energetic particles) and highly variable solar X-ray radiation. The spacecraft and the three science instruments were all built at LASP and Charles Barth was the PI of the mission. SNOE was the first and most successful Student Explorer; it launched in 1998, orbiting for five years before re-entering the Earth's atmosphere in December of 2003.

The **Solar Radiation Climate Experiment** (SORCE) was designed to measure solar energy input into the Earth climate system. With Gary Rottman as PI, and Tom Woods taking over when Gary retired, SORCE measures energy from X-ray to infrared wavelengths, including a measurement of the total solar irradiance incident on the Earth. SORCE is one of the key sources of data on energetic variability that can lead to climate change, and on the energetic inputs that drive photochemistry and dynamical processes at different levels in the atmosphere. Launched in 2003, it carries four LASP-built science instruments. Orbital Sciences Corporation (OSC) provided the spacecraft and launch services. SORCE has been tremendously successful, and continues to operate and return data today.

The **Mars Atmosphere and Volatile Evolution Mission** (MAVEN), led by PI Bruce Jakosky, is scheduled for launch in November 2013. It will explore the Martian upper atmosphere and determine the role that loss of atmospheric gas to space has played in the history of the Mars climate. MAVEN is larger than the other LASP missions, and is being managed for LASP by NASA's Goddard Space Flight Center. LASP is building two of the science instruments, is running the science operations center, and is leading education and public outreach activities. The instruments will be delivered this fall, and full-scale integration of the spacecraft, at Lockheed Martin in Denver, begins this summer.

In addition to PI-led missions, LASP scientists propose and provide individual instruments and are science team members for what are called directed missions. These missions are part of NASA's core plan to address more-complex science questions. Directed missions generally are larger programs, assigned to one of the NASA centers to implement, defined by a Science Definition Team, and usually host several instruments that are competitively selected. Smaller PI-led and larger directed missions complement each other in approach, science, and focus. LASP continues to make significant contributions to both smaller PI-led missions and larger directed missions for NASA.



Letter from the director

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introduction and a link to an easily accessible PDF of the full publication. We very much intend that this approach can be informative without being intrusive.

As I hope many of you already know, LASP has some bedrock principles upon which it is founded. We are a science-led organization that focuses on solar, atmospheric, planetary, and space physics research. We are committed to using the full range of investigative methods including theory, modeling, experiments, and intensive data analysis. Our full-cycle capability supports endeavors including engineering, mission operations, data systems, and test/calibration techniques. LASP is particularly committed to leadership through the "Principal Investigator (PI)" approach that has been shown time and again to be an efficient and highly effective project management approach. Thoroughly infusing all that we do at LASP is the deeply held belief that students should be strongly involved in every facet of our work.

So, I invite you to read on. You'll find articles that expand on the aforementioned principles of LASP, as well an editorial in which I reflect a bit more in depth about the significant role that universities can (and must) play in a successful national space program.

Welcome to LASP*SPACE*!

Student news

Melanie Dubin—Graduation May 2012, BS in aerospace engineering: Working at Raytheon as a systems engineer.

Rachel Hock—Graduation May 2012, PhD in astrophysics and planetary science: Received a National Research Council (NRC) post-doctoral fellowship at the Air Force Research Laboratory, Space Vehicle Directorate, Kirtland Air Force Base, on development of a new solar flare forecasting model.

Lin Su—Graduation May 2012, PhD in atmospheric sciences: Received a post-doctoral fellowship at the National Center for Atmospheric Research (NCAR).

Are you a former LASP student employee? Let us know what you're doing now. Email: rose.hoag@lasp.colorado.edu

Administrative stats

Scientific researchers	45
Tenure-track faculty	17
Professionals	263
Graduate students	64
Undergraduate students	79
Total	468

For Fiscal Year 2011

Awards	$55,348,430
Active programs	213
Research expenditures	$73,349,369

If you know someone who might like to receive LASP*SPACE, please encourage them to email Laura Bloom at laura.bloom@lasp.colorado.edu to subscribe. Should you prefer not to receive future issues, please email Laura Bloom with "Unsubscribe" in the subject line.*

Student jobs at LASP

Mission ops—a unique option

Bill Possel

LASP is one of the few institutes in the world that uses students for the mission operations of NASA spacecraft. Currently, LASP operates four spacecraft totaling more than $1 billion in space hardware: AIM, SORCE, QuikSCAT, and Kepler. With direction from professionals, CU-Boulder students send the commands to and monitor telemetry from the satellites and space instruments. Students are also responsible for analyzing the telemetry to determine the health of the on-board systems. In addition to satellite operations ("ops"), LASP employs students in science, engineering, software development, data analysis, education and outreach, and administration—currently nearly 150 graduate and undergraduate students.

The Kepler mission searches for Earth-like planets orbiting distant stars; LASP is responsible for the mission operations. Launched in 2009, Kepler has already found over 2,000 new planet candidates. LASP students were at the controls when the first commands were sent to the satellite. Now, they participate in twice-weekly satellite and payload health checks, as well as monthly contacts to send down the science data. We work closely with the spacecraft builder, Ball Aerospace, to ensure all systems are operating as expected.

In the summer of 2010, LASP students participated in decommissioning the ICESat spacecraft (basically allowing the spacecraft to "crash" safely back to Earth). The science mission was complete and NASA directed that the satellite be commanded to a lower orbit and the remaining on-board fuel be depleted. Usually, weekend shifts aren't very coveted, but the Saturday of the end of the ICESat mission was an exception. The students assigned to work that shift sent the final commands.

After graduation, many LASP students move on to exciting new careers in the space industry and at NASA. Recent graduate Matt Lenda now works at the Jet Propulsion Laboratory (JPL). His first job at JPL involved operations for the Mars rovers. He's currently working on the recently launched Mars Science Laboratory and will be supporting the surface operations of the new rover.

Being an ops student at LASP is certainly not easy. We ask our students to work 20 hours a week during the school year and 40 hours a week in the summer. But when they graduate, they can say, "I have a degree from CU-Boulder and I operated NASA satellites." How cool is that?

Student satellite operators in the LASP Mission Operations Center. (*Courtesy Glenn Asakawa/University of Colorado Boulder*)

Budget cuts, academia, and the future of space science

Dan Baker

It is increasingly clear that U.S. economic vitality and competitiveness have strong and critical ties to space. Remote sensing, communications, surveillance, and other areas of leadership are underpinned by space technology. Moreover, our pursuit of robotic and human space exploration remains a cornerstone of U.S. aspirations.

A hallmark of the U.S. space program is the partnership between government, industry, and academia. In this case, "academia" can range from a single professor with a small group of students to large university laboratories, such as LASP, with hundreds of researchers, engineers, and students. Academia provides a geographically distributed, diverse, and highly engaged community that, by nature, brings a wealth of creative ideas and students. This mix adds a nimbleness and responsiveness that can be immensely beneficial, yet very low cost, to space projects.

Unfortunately, the backbone of our space program—academia—is under threat of serious budget constraints. These will put a strain on our nation's ability to creatively address national- and economic-security issues related to space. For a vigorous and successful national space research enterprise, we need continuous observations of the Sun, Earth environs, and the solar system beyond. For many prior spaceflight projects, key universities have worked successfully with NASA centers on missions managed in a traditionally high-overhead way. But now, it is less likely that our nation and its space research program can afford to work solely in this manner.

Perhaps a renewed academic and commercial partnership could be the salvation of many space observational objectives. Such a partnership could let universities and companies work on low-cost, innovative space missions using the best design practices of research groups and successful businesses. This concept could also allow a reduction in the reviews and overburdening paperwork that are strangling the space business.

Students collaborating with LASP Staff. (*Courtesy LASP*)

In the constrained circumstances that U.S. science and engineering now face, we need to use our best tools and most creative approaches. Universities can (and should) be mountains of innovation in the "flat world" described by Thomas Friedman in his best-selling book about globalization. In this setting, it will be possible to take more prudent risk, carry out research more affordably, and ultimately achieve the maximum potential of space research investments. Now more than ever, the crying need for better space observations demands that the nation return to the successful formula of strong partnerships among academia, industry, and government that ushered in the very formation of NASA in 1958. I sincerely hope LASP and CU will play essential roles in this effort long into the future.

Mission status

Phase A (funded study)
- Solar Probe Plus
- Ohmic Explorer
- GOLD

Phase C (design and fabrication)
- MAVEN

Phase D (assembly and test)
- LADEE/LDEX
- MMS Fields/Boom
- GOES-R/EXIS
- TSIS

Launch/Early Orbit [launch date]
- RBSP REPT/FIELDS [8/23–9/6, 2012]
- NSF CSSWE CubeSat [8/2, 2012]

Prime Mission [end date]
- SDO/EVE [2016]
- Kepler [11, 2012]
- MESSENGER/MASCS [2013]
- New Horizons/SDC [2020]

Extended Mission [end date]
- QuikSCAT [10, 2015]
- SORCE [10, 2015]
- AIM [10, 2014]
- Cassini/UVIS [2017]
- THEMIS & ARTEMIS [10, 2014]
- TIMED/SEE [9, 2013]

For more information on current missions, as well as full instrument and mission names, visit http://lasp.colorado.edu.

Mission & technical stats

- LASP currently has 12 instruments in space on 8 different NASA satellites.
- LASP currently operates four satellites for NASA.
- LASP is currently developing 17 instruments for 6 different satellite missions that are expected to launch between 2012 and 2018.

Employment

Key hires

David Laumbach joined LASP as the financial analyst manager.

Susan Rogers joined LASP as the human resources manager. Most recently, she was the director of human resources at Raytheon's Aurora, CO campus.

Jerry Spivey joined LASP as the information technology manager.

For current openings, see the Jobs page on the LASP Website: http://lasp.colorado.edu/about/jobs.

Visit LASP online

LASP homepage

Newsletter archives

Links to a variety of social media networks can be found on our homepage, http://lasp.colorado.edu.

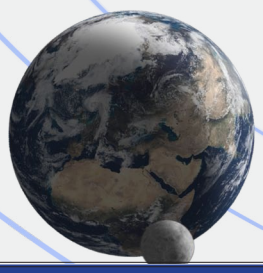
Feature authors

Daniel Baker is the director of LASP, a professor of Astrophysical and Planetary Sciences, and the Broad Reach endowed chair of space sciences at CU-Boulder.

Bruce Jakosky is the associate director of science at LASP and a professor of Geological Sciences at CU-Boulder.

Bill Possel is the director of Mission Operations & Data Systems at LASP.

Tom Woods is the associate director of technical divisions at LASP.



Events and outreach

Office of Communications & Outreach

Research Experience for Undergraduates in Solar and Space Physics
June 11–Aug 4, 2012

Space Science Teachers Summit
June 18–22, 2012

CCLDAS New Media Practitioner Professional Development Workshop
July 20–22, 2012

For more information, visit http://lasp.colorado.edu/education.

Middle school balloon program

Scientists Lars Kalnajs and Pat Brown, with graduate student Sam Dorsi, kicked off a three-year high-altitude balloon pilot program with students from Trail Ridge Middle School at the end of April. Four students built and designed a balloon platform with an experiment that consisted of gelatin, a thermometer, a marshmallow, a small school mascot made of modeling clay, and a video camera. The goal was to observe the effects of low pressure and cold on various objects. Launched from the school grounds in Longmont, CO, the balloon ascended 110,000 feet before descending in Cheyenne, WY. The students are creating a five-minute documentary about their experience. Greg Kopp is the PI of this program, which is managed by the Office of Communications & Outreach.

In the next school year, LASP will solicit applications from schools statewide and one will be selected to participate in the next program session based upon the need for science, technology, engineering, and math programming.

University of Colorado Boulder chosen for National Solar Observatory headquarters

Mark Rast, associate professor

On September 30, 2011, the University of Colorado Boulder was chosen as the new location for the National Solar Observatory (NSO) headquarters. The project will bring up to 70 scientists, engineers, and staff to CU-Boulder, providing opportunities in solar physics for students using the Advanced Technology Solar Telescope (ATST). The ATST is a four-meter off-axis solar telescope, the largest solar telescope in the world, and is being built on the summit of Haleakala in HI.

As part of the relocation, CU and partners—the New Jersey Institute of Technology (NJIT) and the University of Hawaii (UH)—are developing a Collaborative Graduate Education Program. The program will bring faculty and national center scientists and engineers together to teach solar and space physics across distributed campuses. The NSO headquarters move will begin with a small group of scientists and engineers arriving in the spring of 2013.

Achievement awards

Laura Bloom, LASPSPACE editor

On March 7, the Kepler mission won the highest honor for space programs at the 2012 Aviation Week Laureate Awards. The award recognizes individuals and teams whose "extraordinary accomplishments embody the spirit of exploration, innovation, vision or any combination of these attributes that inspire others to strive for significant, broad-reaching progress in aviation and aerospace."

On March 21, The Smithsonian's National Air and Space Museum bestowed its highest group honor, the Trophy for Current Achievement, on the Cassini mission. The annual award recognizes outstanding achievements in the fields of aerospace science and technology. William Knopf, NASA Cassini program executive, said, "This joint mission has produced an unprecedented science return."