I thank Chairman Wolf, Ranking Member Mollohan, and other Members of the Committee for the opportunity to speak with you today on the FY 2006 budget request for science. My name is Tim Killeen and I am director of the National Center for Atmospheric Research (NCAR), a research laboratory sponsored by the National Science Foundation and operated and managed by University Corporation for Atmospheric Research (UCAR). UCAR is a consortium of 68 North American research universities involved in weather, climate, and solar research and related education, training, and support activities. As an officer of UCAR, I submit this testimony for the record. In addition to its 68 members, UCAR has formal relationships with approximately 100 undergraduate and graduate schools including historically black and minority-serving institutions, and 40 international universities and laboratories. UCAR is supported principally by the National Science Foundation (NSF) and by other federal agencies including the National Aeronautics and Space Administration (NASA), and the National Oceanic and Atmospheric Administration (NOAA).

In addition to my position at NCAR, I am president-elect of the American Geophysical Union (AGU). With more than 40,000 members, AGU is the largest professional society in the world for Earth and space science. I have an academic background as an experimental space scientist and taught atmospheric, space, and Earth system science for many years at the University of Michigan.

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The topic of this hearing is of tremendous importance to the path we choose from here forward as a modern society. Bertrand Russell once said that, “Almost everything that distinguishes the modern world from earlier centuries is attributable to science…” Indeed, scientific research and resulting technology development have been the major driver in making this country the prosperous and powerful world force it is today. Basic research is a critical economic driver affecting advances in technology development, military applications, the health of the planet, and the quality of scientific education. We simply cannot afford to allow the nation’s scientific enterprise to be diminished. But in nearly every science agency, critical programs are proposed to be cut or eliminated.

Overall, federal funding for R&D in the FY06 request fails to keep pace with inflation for the first time in a decade, at a time when the rest of the developed world is catching up. Of course,
because of the dangerous state of the world since September 11, 2001, our federal dollars must be stretched and difficult funding and prioritization decisions must be made. But it is precisely because of the dangerous state of the world that the United States must remain strong, not just in military might, but in technology development, the discovery of new knowledge, the protection of natural resources, the education of our future work force— all of which are tied directly to research and the application of research for societal purposes.

**National Science Foundation (NSF)**

At a recent hearing of your subcommittee, Congressman Vern Ehlers, chairman of the House Science Subcommittee on Environment, Technology and Standards stated, “In choosing among the important programs in the new Science, Justice, and Commerce Appropriations bill, we must not overlook the fact that scientific research and development forms the foundation of increased innovation, economic vitality, and national security for our nation.” NSF’s Research and Related Activities (R&RA) account supports as much as 50 percent of this country’s civilian basic research in the physical sciences. On the face of it, R&RA receives an increase of 2.7 percent. But the transfer into R&RA of responsibility for covering the expenses of Coast Guard icebreakers reduces this increase dramatically. The R&RA increase over FY05 is $113.0 million. The estimated cost of the icebreaking services is apparently between $48 million and $75 million, reducing the R&RA increase to a sub-inflationary 0.009 percent. This is not acceptable for a nation that wishes to remain the most scientifically and technologically advanced in the world.

The NSF proposal success rate has slipped in recent years from one-in-three to less than one-in-four – the lowest funding ratio in 15 years. NSF requests-for-proposals are so oversubscribed that the NSF director, Dr. Arden Bement, has created a plan that includes attempting to decrease the number of applications. This is in part a staff shortage problem that should be addressed, but it is also a funding shortage issue that thwarts scientific progress and creativity. *I urge the Committee to appropriate a 6 percent increase for NSF’s Research and Related Activities in the FY06 budget. This amount, which would make up for reductions taken last year and provide a modest increase for FY06, would still be far below the level authorized in the enacted NSF Authorization Act.*

Within R&RA, the Geosciences Directorate is described in the budget request as, “…the principal source of federal funding for university-based basic research in the geosciences, providing about 62 percent of the total federal support in these areas. Not only does GEO play a critical role in addressing the nation’s need to understand, predict and respond to environmental events and changes, but [it] also helps to determine the best use of Earth’s resources.” Yet the funding request of $709.1 million for this critical activity is increased by only 2.2 percent over the FY05 current plan amount and is actually down by $4 million from the FY04 actual of $713.4 million.

*I urge the Committee to appropriate a 6 percent increase over FY05, or $735.8 million, for the Geosciences Directorate. This restores the GEO cut taken in FY05 and provides an inflation-adjusted increase for FY06. Within GEO, I urge the Committee to fund at the same 6 percent
increase the Atmospheric Sciences Division (now in the FY06 request at a 2.7 percent increase) which provides resources for the atmospheric sciences community that are critical to the physical safety of our citizens, our economic health, and global issues of national security relevance such as severe weather, climate change, the security of our communications infrastructure, and the environmental health of the planet.

At the hearing mentioned above, Congressman Ehlers declared the 12.4 percent cut to NSF’s Education and Human Resources (EHR) Directorate “dramatic” and “unparalleled in other parts of the science and technology portfolio.” In 2003 the National Science Board said, “…The future strength of the U.S. Science and Engineering (S&E) workforce is imperiled by two long-term trends: Global competition for S&E talent is intensifying, such that the United States may not be able to rely on the international S&E labor market to fill unmet skill needs; and the number of native-born S&E graduates entering the workforce is likely to decline unless the Nation intervenes to improve success in educating S&E students from all demographic groups, especially those that have been underrepresented in S&E careers.”

Mr. Chairman, you’ve taken the lead in the education and workforce areas recently with the introduction of legislation that would forgive student loan interest to encourage careers in math, science, and engineering. NSF’s education programs make a fundamental difference in the scientific knowledge and skills of our future workforce. We must support science and math education at all levels. I urge the Committee to reverse the funding reductions in the Education and Human Resources account, down 21.5 percent from the FY04 level in the FY06 request.

National Aeronautics and Space Administration (NASA)

One of the most significant issues facing the country’s scientific research enterprise is the rapid and unprecedented diminishment of NASA’s Earth, solar, and space sciences programs. I would like to discuss the need for Congress to continue support for them at a sustenance level at the very least.

Understanding the Sun and the complex, changing planet upon which we live, how it supports life, and how human activities will affect its ability to support life in the future is one of the greatest intellectual and practical challenges facing humanity. NASA’s new Moon/Mars Mission is exciting and should produce much useful information, but the agency’s dramatic refocusing towards Moon-Mars has the potential to draw resources from other science programs that contribute extraordinary data.

Unmanned Solar System Missions extend human knowledge to the farthest edges of the Solar System and beyond, where the secrets of the origin and destiny of our planet lie. Universe Missions give us vastly expanded knowledge of the system of galaxies and will lead to our understanding of the origins of galaxies, stars, planets, and life itself. NASA’s unmanned space science programs provide a wealth of information about space weather, solar radiation storms that affect communications and the lives of astronauts, the atmosphere of other planets – all information that will be of great value as the Moon/Mars Mission is developed.
Not only are unmanned missions in the development phase being terminated before they are launched, but missions that have been launched and are returning useful data that cannot be acquired through any other means in the foreseeable future, are scheduled to be turned off because of budget pressures. These missions cost billions of dollars to develop and launch originally, and are producing now, at very low cost, vital knowledge about space and solar impacts on Earth. Sacrificing this sort of knowledge is detrimental to the advancement of human civilization and saves very little money in the overall funding scheme.

The agency’s Earth-Sun System Missions advance our understanding of the Earth-Sun system and also lead directly to major societal benefits to the country, including improved national security, weather forecasts and warnings; climate outlooks; management of natural resources including water, agriculture, and energy; an improved understanding of space weather and its impact on communications; and mitigation of natural disasters such as drought, floods, landslides, and volcanic eruptions. Rapid advances in NASA Earth observing capabilities, coupled with revolutionary advances in information technology, have positioned us for an extraordinary new era in Earth science – one in which we can understand and predict the Earth as a system. Improved Earth system models will be used by governmental and industry decision makers across a host of domains in the foreseeable future, which will drive new economies and efficiencies within our society. [For critical information on the future requirements and direction of NASA’s Earth science program, please see the national Research Council’s prepublication version of the decadal report, Earth and Science Applications from Space: Urgent Needs and Opportunities to Serve the Nation -- http://www.nap.edu/catalog/11281.html.]

Not only are the data that the space and Earth-sun system missions produce of great value, but so is the support the missions provide to young scientists. Today’s graduate and postdoctoral students are the scientists who will support the exploration of Earth and the solar system in the future. If their education and training are interrupted now, this country will not have the expertise it needs to implement three of the Administration’s top scientific initiatives in which NASA figures prominently: the new Exploration Vision, the U.S. Climate Change Science Program, and the Global Earth Observation System of Systems.

The importance of Earth, space and solar science and the central role of NASA in these fields argue for careful, thorough, and deliberative assessment to inform program planning, especially when major changes are being considered. In my opinion, the current pace of budgetary and program change in NASA is inconsistent with such an approach and could result in irrevocable damage to programs and scientific teams that have taken decades and billions of dollars to build – programs that have proven their worth many times over.

I urge the Committee to protect NASA unmanned science missions and to reaffirm the critical role that the agency plays in gathering knowledge about our own planet and our universe -- a role cannot be duplicated now by any other agency -- by providing NASA Science, which is in the FY06 budget request at a 0.9 percent cut, with an inflationary increase of 3 percent at the very least.

In the early days of the Space Station program and continuing up until last year, separate appropriations accounts were established to make sure that Space Station budget overruns did
not undermine NASA's science programs. That safeguard is no longer in place. This “firewall” should be instituted again in order to protect NASA’s science programs including these smaller, unmanned missions. I urge the Committee to reinstate separate appropriations accounts in order to protect NASA’s science programs so that they may continue to benefit this country.

National Oceanic and Atmospheric Administration (NOAA)

Within NOAA’s Office of Oceanic and Atmospheric Research (OAR), I am pleased to see that NOAA’s key role in the interagency U.S. Climate Change Science Program (CCSP) is enhanced with increases in the budget request for Climate Observations and Services. An important example of the benefits of these increases is the continued maintenance and construction of a global ocean observing system that is critical to the documentation of climate-scale changes in ocean heat, carbon, and sea level. This progress will help meet the country’s international commitment to complete the ocean climate observing system by 2010. I urge the Committee to maintain the FY06 funding of $16.1 million requested for OAR’s Climate Observations and Services.

Unfortunately, the national commitment to CCSP has been weakened with the proposed cut to OAR’s Climate and Global Change Program. Proposed to be cut by 13 percent, or $8.6 million, these funds support programming that has much to do with the nation’s basic climate research and the future of the atmospheric sciences in this country. Targeted programs include U.S. participation in international field campaigns in support of climate and global change research, critical research programs in several areas of global climate change, and education program funding including support for underrepresented students through the award-winning and proven Significant Opportunities in Atmospheric Research and Science (SOARS®).

Climate and Global Change funding was proposed to be cut in the FY05 budget request, but was restored by the Congress. The NOAA/external community partnerships represented by this program leverage the country’s research and research applications expertise, bring the best talent to bear in addressing high priority technology development requirements, enable the country to keep international field program participation commitments, and contribute to the training of a new generation of scientists that NOAA and the rest of the scientific community will need desperately as present employees retire. I urge the Committee to restore the FY06 Climate and Global Change Program base funding, to the FY05 level of $66.0 million without harming NOAA’s other commitments to the Administration’s interagency initiative, the U.S. Climate Change Science Program.

Global Earth Observation System of Systems (GEOSS)

Even with the increase mentioned above for NOAA’s Climate Observations and Services, the effect of significant redirections and funding reductions in NASA, combined with little or no growth in NOAA programs, is worrisome in the case of the Administration’s Global Earth Observation System of Systems (GEOSS) initiative, a major priority of the White House that is
focused on improving the international coordination and coverage of environmental observing systems.

Both NASA and NOAA satellite programs are vital to this effort. The international science community is very supportive of the GEOSS concept and goals. There are over 100 space-based remote-sensing systems that are either operating or planned by various nations for the next decade. Collaboration among space systems, between space- and ground-based systems, and between suppliers and users of observational data is critical to avoiding duplication of effort and to getting the most out of the investments in observing technology. The tragic example of the Indian Ocean Tsunami demonstrates the need for such coordination. The tsunami was detected and observed before hitting land, but the absence of effective communication links prevented warnings from reaching those who needed them in time. A functioning GEOSS could lead to major improvements in the rapid availability of data and warnings, and the U.S. is right to make development of such a system a priority.

But U.S. credibility and leadership of this initiative will be called into question if our nation is unable or unwilling to coordinate and maintain the U.S. programs that make up the core of our proposed contribution. NASA and NOAA should be playing a significant role in this effort, and NOAA Administrator Lautenbacher has provided extraordinary leadership in assembling the international effort. However, the funding commitment from this country has yet to be realized. **I urge the Committee to take full advantage of your new jurisdiction to fulfill the U.S. commitment to GEOSS in FY06 and future years science appropriations within the budgets of both NASA and NOAA.**

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On behalf of the UCAR community, I want to thank the Committee in advance for your stewardship of the nation’s scientific enterprise and your understanding that the future strength of the nation depends on the investments we make in science and technology today. The establishment of the Science State Justice and Commerce Subcommittee gives you the unique opportunity of ensuring that three of the nation’s most important scientific and operational agencies continue to provide knowledge about our planet and universe that will advance civilization and provide tremendous societal benefits for our country. It is a grave responsibility and great opportunity. Thank you again for the opportunity to appear before you.

*This testimony is expanded from that submitted for the record by Richard A. Anthes, president of UCAR, on April 8, 2005*