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November 27, 2013

Administrator Charles Bolden  
Associate Administrator John Grunsfeld  
Heliophysics-Division Director David Chenette  
NASA Headquarters  
Suite 2R40  
Washington, DC 20546-000

Dear Administrator Bolden, Associate Administrator Grunsfeld, and Director Chenette,

We are writing as representatives of “SHINE,” a broad affiliation of scientists within the solar and heliospheric physics communities dedicated to the understanding of how the Sun influences Earth’s near-space environment (<http://shinecon.org>). Our purpose in writing is to convey our grave concern over projected cuts to the budget of NASA’s Heliophysics Division and to stress the importance of this Division and its activities to the nation.

Under NASA leadership, the United States has matured into a world leader in space science. NASA missions and the supporting efforts of the space-science community have revolutionized our understanding of the Sun, the interplanetary medium, and the ways that the Sun affects the Earth. Research supported by NASA’s Heliophysics Division has led to tremendous progress in our understanding of energy release in the solar atmosphere, particle acceleration at shocks and in solar flares, and the radiation environment within the solar system. Scientific advances within the fields of solar and heliospheric physics have also led to a better understanding of more distant astrophysical systems as well as the fundamental physical processes that control Earth’s space weather.

NASA’s fostering of space science has benefited society in many ways. Heliophysics space exploration has led to the development of new materials and robust, low-power technologies that have been utilized in different sectors of the economy, including the medical and defense industries. NASA programs have inspired students to pursue careers in science, engineering, computer science, and mathematics and have provided vital training for undergraduate and graduate students and young post-graduate researchers. The high standard of living and the safety and prosperity of our nation are unquestionably linked to a strong scientific and technological workforce.

The activities of NASA’s Heliophysics Division have also helped to develop our nation’s ability to predict and protect against severe space-weather events. Space weather can damage satellites, disrupt the global positioning system, and permanently disable extra-high-voltage transformers in power stations. Because of the slow rate at which such transformers can be manufactured and replaced, a severe space-weather event could lead to lasting power outages affecting highly populated areas. This risk is highlighted in a 2013 report by Lloyd’s entitled “Solar Storm Risk to the North American Electric Grid” (<http://www.lloyds.com/news-and-insight/risk-insight/>

reports/space/space-weather). This report estimated that an extreme space-weather event (occurring once per  $\sim 150$  years) would lead to power outages lasting between 16 days and 2 years that would affect between 20 and 40 million people in the US. The authors of this report estimated that the total economic costs of such an event would be between 600 billion and 2.6 trillion dollars.

NASA missions and NASA science are essential to developing our nation's ability to protect against this type of natural disaster. NASA spacecraft, along with NOAA spacecraft, monitor the Sun and the conditions between the Earth and Sun, providing advance warning of solar storms that will affect Earth. NASA-supported science is also continually improving our ability to predict space weather. With enough advanced warning, we can protect extra-high-voltage transformers against extreme space-weather events by disconnecting these transformers from the electrical grid.

However, the budget cuts that are projected for NASA's Heliophysics Division will jeopardize our ability to address this threat by decreasing the number of spacecraft missions, diminishing our capacity to train new scientists, and reducing our capability to carry out state-of-the-art research. The success rate for proposals to NASA Heliophysics research programs is small and dropping. This dangerous trend is beginning to force scientists from the field and is discouraging students and young scientists from pursuing careers in space science. If this trend continues, it will cause lasting damage to the US space-science community and America's decades-long position of leadership in space, with potentially far-reaching economic and technological consequences.

The recent National Research Council Decadal Survey for Heliophysics (Solar and Space Physics: A Science for a Technological Society, NRC, 2013) outlined a series of recommendations to NASA for achieving the highest-priority objectives in heliophysics. Because of the many contributions that NASA's Heliophysics Division makes to society and US national interests, we urge you not to cut the Heliophysics Division budget, but to fund this Division at a level that will enable it to act on the recommendations laid out in the NRC Decadal Survey.

Sincerely,

The 2013 SHINE Steering Committee:

Stuart D. Bale, University of California, Berkeley  
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Joan Burkepile, University Corporation for Atmospheric Research  
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