

**Statement before the House Science Committee's
Subcommittees on Research & Technology, and Space
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Members of the Subcommittees:

I am honored to appear before you to share both NASA's experience and also my personal experience related to the recent 2017 Total Solar Eclipse. As NASA's Associate Administrator for the Science Mission Directorate (SMD), I represent the thousands of volunteers, partners, grantees, and NASA employees who made this the biggest media event in the modern history of NASA.

I would also like to highlight some of the results of our STEM Activation efforts, and discuss how important Heliophysics is to NASA's overall mission.

On Monday, August 21, 2017, a total solar eclipse across the continental United States occurred for the first time in almost a century. My vantage point was unique in that I was fortunate to welcome the shadow from 45,000 feet over the Pacific Ocean in an aircraft specially outfitted with scientific instruments to capture views before, during, and after the event. After doing research on the Sun for well over 25 years, I saw the solar atmosphere – the corona for the first time: it was breathtaking. NASA had many other vantage points to observe this cosmic event, from space, from high altitude balloons, from airplanes and from the ground.

We look at the Sun everyday using NASA's Heliophysics System Observatory, with 18 active missions comprised of 28 spacecraft. However, nothing can compare to the awe-inspiring experience of witnessing a total solar eclipse for the first time.

I have devoted many years to studying the Sun and its corona, but through the lens of telescopes and NASA's missions like the Mercury Surface, Space Environment, Geochemistry, and Ranging (MESSENGER) probe, Advanced Composition Explorer (ACE), and Solar and Heliospheric Observatory (SOHO). Seeing the spectrum change as the Moon transited the Sun, creating a natural coronagraph, uncovering the inner corona -- the part of the Sun's inner atmosphere that we can only see during total eclipses. When looking at the Sun, I was reminded that the Parker Solar Probe, launching next year, will travel closer to the Sun than any spacecraft, and will dive into the corona to provide the closest-ever observations,

and will revolutionize our understanding of the Sun, our Rosetta Stone for the understanding of stars throughout the Universe.

So how did we successfully engage the Nation's citizens to witness this event, to pause their busy lives, and observe this celestial wonder?

Our NASA team and scientists around the country have been planning for this eclipse for many years. Also supporting this hearing is Dr. Alex Young, our Project Manager. Three years ago, NASA established the priorities for our program as: Safety, Science, Education, Citizen Science, and Public Engagement. To accomplish these priorities, we knew we could not do it alone. Internal to NASA, there was recognition that this was an opportunity to widely engage and disseminate information on our missions and activities. The entire Agency rallied and each of our 10 Centers led major functions and events.

Additionally, last year, the Heliophysics Division solicited experiments to take advantage of the unique opportunities provided by the eclipse to do science. Eleven grantees were selected, three of which are studying the ionosphere – measuring how the Sun's energy effects this region of the Earth's outer atmosphere. Ultimately, these data will improve models and our understanding of the ionosphere and help us understand the relative importance of various inputs of the Solar radiation. Measurements collected through upcoming missions Ionospheric Connection (ICON) and Global-scale Observations of the Limb and Disk (GOLD) will continue to improve our understanding and predictive capabilities for what is happening in this atmospheric region at the edge of space that affects us all.

Safety

Consistent with NASA's number one core value, from the beginning, we required every event or activity to include a Safety Plan. This became increasingly important as more and more locations were contacting NASA for materials and experts to engage with their guests. On the day of the eclipse, there were 120 officially designated events, and I believe by getting the message out early, NASA helped communities to plan out transportation routes, provide community services, and to really think through what it would take to accommodate the anticipated influx of visitors to their communities – up to ten times the normal rates! In addition to NASA, there were almost 400 volunteer experts through our Solar System Ambassador network deployed all with a safety focus.

With Safety a top priority, we published protocols on our website and partnered with the American Astronomical Society, National Science Foundation, and others,

to spread the word about eye safety. This partnering proved critical when it was discovered that uncertified solar glasses were making their way into our markets. We all owe a debt of gratitude to our partners for helping us identify and communicate which glasses were safe. In the end, NASA, Google, and the Moore Foundation distributed over 4.3 million glasses.

Public Engagement

The eclipse was the biggest science outreach event in modern NASA history. Working with our partners, we engaged with citizens across 14 states, in 6,900 libraries, over 200 museums, planetaria and science centers, 40 Challenger Centers, NASA Visitor Centers, 20 national parks, zoos, and even baseball stadiums. More than 50 million unique viewers watched our TV broadcasts across multiple NASA and social media platforms. We had 90 million page views on NASA websites on eclipse day. These numbers exceed previous records many times over, including some pretty major events like landing on Mars and flying past Pluto. I talked to many strangers and friends after the eclipse – the experience touched them whether or not they are scientific experts! That is what nature does – we just have to take time to watch! It is these kinds of moments that help us relate and learn about nature in life-changing ways. That is what NASA Science does each and every day.

Citizen Science

My sincere hope is this eclipse inspires our fellow Americans to become new citizen scientists. For the eclipse, Dr. Matt Penn of the National Science Foundation's National Solar Observatory led the Citizen CATE effort, with 68 teams of citizen scientists, high schoolers, and universities to take the exact same observations using the exact same solar telescopes across the "path of totality." Of the 68 teams, 60 captured the inner corona and polar plumes. The Citizen CATE effort itself was a very successful partnership effort with the National Science Foundation and several corporate sponsors. NASA's role in the Citizen CATE effort was providing support for pre-eclipse training.

In addition, the Global Learning and Observations to benefit the Environment (GLOBE) program created a mobile device application that anyone could download to measure temperature and light changes. Over 107,000 measurements were taken on that day.

Science and Societal Impact

A total solar eclipse provides the unique opportunity of seeing the Sun's gases – called solar wind - streaming from the Sun with your naked eye. This solar wind is the very origin of space weather. We used this event to test our models of space weather, so we can continually improve them.

NASA has the unique capability to monitor the Sun from more than a dozen different locations throughout the solar system and beyond. We work with the National Science Foundation on expanding our scientific understanding of the Sun and space weather, and working together, we help the operational space weather arms of NOAA and DoD, to incorporate that understanding into operational models and space weather predictions that better prepare us for potential impacts on Earth, such as power outages or interruptions of communications.

I am excited about the contributions of upcoming missions, and especially those Parker Solar Probe will make, toward improving our understanding of this challenging phenomena. Better understanding space weather will help protect our electrical grid on the Earth, airline passengers in the air, and astronauts and spacecraft in deep space – providing national security and economic benefits for all. Research continues to develop and improve predictive models through enhanced understanding of the science of space weather; and NASA is at the forefront of that research.

Summary

My hope is that this eclipse creates a new appreciation for and relationship with our nearest star that allows us to learn more about nature. Learning about nature is not only inspiring, it is eminently useful in our daily lives. Our investments in space science/Heliophysics will pay dividends for generations to come. They will result in improved forecasts that affect our lives on all time-scales, they are at the heart of new companies, and they support our economic and national security.

My only suggestion: Start making plans for the next total solar eclipse in the US on April 8, 2024. It is going to be another great opportunity for all of us to learn more about the solar system we live in.

Thank you for the invitation to be here with you today.