Statement of
David C. Schurr
Deputy Director, Planetary Science Division
Science Mission Directorate
National Aeronautics and Space Administration

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Chairman Babin, Ranking Member Bera, and Members of the Subcommittee, thank you for the opportunity to appear today to discuss NASA's Radioisotope Power Systems (RPS) Program. In my opening statement, I would like to explain how radioisotope power is used to enable our planetary exploration portfolio.

NASA Planetary Science pursues NASA's goal to ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere. NASA planetary missions advance the scientific understanding of all parts of the solar system, while pushing the limits of spacecraft and robotic engineering design and operations. For many destinations in the solar system, solar power is not effective for powering our spacecraft due to such long distances from the sun, and we rely on the use of radioisotope power.

NASA, in partnership with the Department of Energy (DOE), has deployed radioisotope power on 22 of our space missions since 1969. Use of radioisotope power has enabled many first-time missions, including the first visits to Jupiter and Saturn with Pioneer 10 and 11, the first landings on Mars with Viking 1 and 2, the first visits to Uranus and Neptune during the Grand Tours of Voyager 1 and 2, the first rovers on Mars with Pathfinder, Spirit, Opportunity and Curiosity, the first mission to orbit Jupiter with Galileo, the first mission to orbit Saturn with the just-completed Cassini, and the first visit to Pluto with New Horizons.

These missions would not have been possible without using the heat generated by the natural radioactive decay of plutonium 238 to generate electrical power. To ensure that NASA is capable of conducting these missions, NASA and DOE work together to sustain and improve the technology to convert heat into electrical power, and the processes for producing plutonium 238 and preparing it for flight.

The United States ceased production of plutonium 238 in 1988. Concerns over the lack of production, and a dwindling inventory led to the start of a new production project in 2012. To meet NASA's long-range planetary exploration requirements, DOE has begun to establish a production capacity that will ultimately support an average production rate of 1.5 kilograms of plutonium dioxide per year. This production rate would satisfy expected NASA Planetary Science mission requirements through 2030.

NASA funds the implementation of this DOE-led plutonium 238 production and the associated infrastructure required to fuel and test radioisotope power systems to fulfill NASA mission requirements. The plutonium project effort consists primarily of developing new procedures and processes, and demonstrating a production capability at the required annual production rate. Based on progress to date, the plutonium project is expected to transition from development to initial operations in 2019, with an initial goal of producing 400 grams of plutonium dioxide annually. The current plan then ramps up to a full-rate production of 1.5 kilograms per year on average by 2025. Progress in re-establishing a plutonium 238 production capability has been good, with initial batches already produced and shipped to Los Alamos National Laboratory, for mixing with existing inventory and pressing into fuel clads for NASA's upcoming Mars 2020 mission.

NASA's mission requirements for plutonium 238 are driven by the mission priorities established in the Planetary Science Decadal Survey, most recently completed in 2011, as well as other potential NASA mission priorities. Additionally, NASA's overall mission cadence is constrained by available budget resources, and radioisotope usage is constrained by the NASA-funded DOE infrastructure available for fuel and mission processing. At this time, the Mars 2020 mission represents the only firm NASA requirement for radioisotope power, with one multi-mission radioisotope thermal generator requiring 4.8 kilograms of plutonium dioxide. NASA's Planetary Science Division has also offered mission proposers the option to use up to 14.4 kilograms of plutonium dioxide for the competitive New Frontiers 4 Announcement of Opportunity, for possible launch in 2025. In addition, NASA has forecast a potential to either offer radioisotope power for New Frontiers 5 or to a potential flagship mission launching around 2030.

Use of radioisotope power must be mission-enabling or enhancing, and missions must evaluate alternative technologies before choosing radioisotope power. Continued improvements of solar array performance when operating further from the Sun are now enabling spacecraft to perform in orbits as far as Jupiter using solar power, where sunlight is only four percent as strong as at Earth. The Juno probe, in a radiation-minimizing orbit at Jupiter, and the Europa Clipper in development, are two such examples of missions that would have historically, such as the Galileo mission, been considered to require radioisotope power but are achieving Decadal-based science objectives through adjustments to mission design. The improvement in alternative power technologies is considered in forecasting future radioisotope power requirements.

With the current allocation to civil space uses of approximately 35 kilograms of plutonium dioxide, and with new production ramping up to 1.5 kilograms per year, DOE will have sufficient RPS material for fabrication into heat sources for NASA Planetary Science missions. In addition to current plans, NASA and DOE have been begun exploring options to increase production rates above 1.5 kilograms per year if necessary to support future mission demand. We will continue to develop options to be able to react to changes in future mission forecasts.

In addition to the DOE-led work, NASA conducts basic and applied energy conversion research and development to advance state-of-the-art performance in heat to electrical energy conversion. Both static and dynamic energy conversion projects are underway at this time. All missions to date have used a static conversion system based upon thermocouples. Dynamic conversion can achieve higher efficiency, but the moving parts introduce reliability challenges that must be addressed before committing to flight development. The goal of these investments is to provide higher conversion efficiency and improve mission performance over the design life for future missions. Increased efficiency would benefit the program by enabling more capable missions or extending the effective use of the plutonium 238 supply.

With the 2016 flyby of the New Horizons spacecraft through the Pluto system, humankind has completed its initial survey of our solar system. Through the use of radioisotope power, the United States remains the first and only nation to reach every major body from Mercury to Pluto with a space probe. With your continued support, we will use these capabilities to continue to explore the solar system through more capable orbiters, landers and sample return missions in the years to come.

Again, thank you for the opportunity to testify today and I look forward to responding to any questions you may have.