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Statement of

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Committee on Science, Space and Technology
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Chairman Babin, Ranking Member Sorensen and Members of the subcommittee,

Thank you for the opportunity to present my views on the status of NASA's Science Mission Directorate. When I entered elementary school nearly 60 years ago, I was barely aware of the first tentative steps being taken toward exploring the planets—a time when success was measured by the mere survival of the Mariner 2 Venus flyby mission after 5 months in space, or the 21 blurry images Mariner 4 sent back during the first successful flyby of Mars. With the passing of the decades, the perseverance and ingenuity of this nation's engineering talent paid off, as the United States emerged the unparalleled leader in the scientific exploration of the cosmos: sending probes to all the planets of our solar system and to the outer atmosphere of the Sun, building giant space telescopes that are unveiling the earliest history of the universe, and deploying fleets of spacecraft to monitor the space environment around, and the health of, our home world. Our international partners look to us to enable them to do what they cannot do alone, and our competitors measure their success against the standard established by the United States of America.

It is difficult not to feel passionately patriotic and proud of what our nation has accomplished in space science. As a scientist and academic whose entire career has been spent working on NASA programs, I am grateful to have participated in the development and execution of some of the greatest space science odysseys ever undertaken: the Voyager flyby of distant Neptune and its cryogenic moon Triton, the Cassini exploration of Saturn, the ongoing Juno mission at Jupiter, the Europa Clipper mission set to launch this October to the Jovian moon with a vast underground ocean, and the James Webb Space Telescope, daily making discoveries from our solar system to the edge of the universe.

Before talking about the science of these missions I want to pay homage to the engineers and fabricators who design and build the hardware that make these amazing missions possible. Too often we see the scientist in front of the camera describing the latest discoveries made in a distant galaxy, on the surface of Mars, or in the atmosphere of the Sun. But behind that individual is an army of engineers who overcome enormous technical challenges to make those discoveries possible. The scientists and their proposed measurements give purpose to, and define, the missions that are then realized by the nation's very best engineers, fabricators, and assemblers. These people exemplify why this nation can do truly extraordinary things.

The accomplishments of the nation's space science program even in just the past twenty years are too numerous to fully recount. A few examples: the Cassini mission revealed vast hydrocarbon seas on the surface of Saturn's giant moon Titan, discovered and then penetrated deep into the icy plume of another Saturnian moon Enceladus, finding salt water and the basic ingredients of life sourced from an underground ocean. The samples that OSIRIS-Rex just returned to Earth are telling us an unexpected story: that the asteroid from which those samples came was once part of a larger world with liquid water. The James Webb Space Telescope has probed deep into the earliest 5% of the history of our universe, finding galaxies that are surprisingly well organized and mature—like walking into a kindergarten class and finding the students already look like adults. Parker Solar Probe has swooped into the intensely hot corona of the Sun –the hot glowing gas you can see in a total solar eclipse. In 1953 Ray Bradbury wrote a short science fiction story about a spaceship scooping up a piece of the Sun—now it's come true.

I want to turn now to Mars, where the nation's prowess in space technology will be most on display in the coming decade. Two incredibly capable rovers, designed and built with American technology by NASA's Jet Propulsion Laboratory, have been roaming the Martian surface over the past decade in search of the answers to how Mars went from being, at least in places, a very Earth-like world, to one that today has an inhospitable, indeed sterilizing, surface. This is a profound question because we are here in this room today thanks to the fact that our planet's environment has remained hospitable to life for over four billion years, despite drastic environmental changes inside and out…changes that are recorded in Earth geology and the record of planetary bodies throughout the solar system. As the only self-aware, technological species on Earth, we might want to find out how planets work, and how things can go wrong on a planet-wide scale. Where can we go to find out?

The answer is Mars. The earlier of the two NASA rovers, Curiosity, following in the stead of preceding missions, has set the stage by documenting extensive geologic evidence that water flowed across an ancient Martian landscape that was warmer and more benign than the Mars of today. And it found traces of organic molecules—the stuff of life-- that appear chemically to be the remnants of a more Earth-world in the distant past. But did life begin on Mars? How did Mars dry up? Exactly when did it dry up? As articulated by NASA advisory groups and two successive Decadal Surveys of the US National Academy of Science, answering these questions will require bringing samples back to the Earth. Indeed, both planetary science Decadal Surveys identified Mars Sample Return as their highest priority[1].

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[1] National Research Council. 2011. Vision and Voyages for Planetary Science in the Decade 2013-2022. Washington, DC: NAP. https://doi.org/10.17226/13117; National Academies of Sciences, Engineering, and Medicine. 2023. Origins, Worlds, and Life: A Decadal Strategy for Planetary Science and Astrobiology 2023-2032. Washington, DC: NAP. https://doi.org/10.17226/26522.

Why so? In science, as one learns more and more about whatever phenomenon is being studied, instruments of increasing sensitivity, resolution and hence sophistication are generally required. In the geological sciences, initial investigations begin in the field, but sooner or later samples have to be brought back to laboratories where instruments that are too large, too power hungry, or even too delicate to bring to the field are located. Geoscience laboratories at universities around the world are equipped with such sophisticated instruments.

And we are now at the stage of Mars exploration where samples must be brought back to these laboratories to answer the questions I've outlined above. In such laboratories chemical clues to the early history of Mars, at concentrations well below what can be detected with onboard instruments, can be measured. Finding evidence of past Martian life, whether chemical or physical, requires very powerful and bulky microprobes, as searches for life in the most ancient sediments on Earth have shown. And to put the chronology of Martian history on an absolute timetable requires precise radiometric dating techniques possible only in a terrestrial laboratory. Such techniques were applied to the samples brought back by astronauts from the Moon, establishing an absolute chronology for the earliest history of the Earth-moon system and tying it to what was happening at the end of planet formation—the most important and a truly profound scientific outcome of the Apollo program.

But it is not enough to have these sophisticated geochemical tools in the lab. The samples themselves must come from the right place on Mars—a place self-evidently once Earthlike. Enter NASA's Perseverance rover, which landed in 2021 in a medium-sized crater named Jezero. At the crater's western end is a river channel and a huge pile of sediments that are like "delta fans" on Earth, deposited where rivers meet the sea. Today Jezero's river channel holds no water and the delta fan sits on a dry and barren crater floor. Perseverance is collecting samples of the crater floor, the delta fan, the hills above it, and soon the rim of the crater, where material from deep in Mars -- excavated by the impact that formed the crater-- may have been deposited. Beyond the crater itself, orbital data suggest that the surrounding area may have once hosted ancient hydrothermal systems, places where water reacted with hot rock. This single complex region on Mars holds the potential for answering a host of questions about geologic and climate evolution of Mars—what happened, and equally importantly, when. But to realize that potential requires getting those tubes off Perseverance and delivering them to Earth. That is the goal of Mars Sample Return, of which the Perseverance mission is step one.

Mars Sample Return is the most ambitious robotic program ever attempted by the United States, and of course by any other nation. It involves multiple NASA centers and the European Space Agency. Much of the technology is new and challenging. Having served as a member of the Standing Review Board, and then the second Independent Review Board last year, I am supremely confident that it can and will be done. It *can* be done because American engineering prowess is up to the task. It *will* be done because as a nation we will not simply walk away from a daring, highly visible, and scientifically important challenge. I understand that there are severe budget pressures, and that choices must be made. But the benefit of succeeding in bringing back rock and soil from an ancient riverbed on a planet 140 million miles away is that it will tell the world that this nation has the imagination, will and courage to accomplish just about anything. And that message is priceless. To not complete Mars Sample Return—to leave the samples stranded on Mars—would be, as I wrote in a recent op-ed on CNN.com, a national disgrace.

In closing, let me point out that, more than a half century after the first Moon rocks were returned by the Apollo astronauts, science is still being done on them. And the instruments available today are far more capable than those available in 1969, allowing new information to be gleaned. The samples returned from Mars in the coming decade will be analyzed, not only by scientists active today, but by scientists who are not yet born, using laboratory techniques not yet invented. They will be a lasting legacy of American ingenuity.

Thank you.