Written Testimony for the Science, Space, and Technology Committee
Member's Day Hearing
Congressman Bill Foster (IL-11)
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Thank you, Chairwoman Johnson, for the opportunity to submit written testimony for the Member's Day Hearing for the Science, Space, and Technology Committee. My written testimony will touch on five topics that I hope the Committee will consider: the importance of our National Laboratories in maintaining a strong U.S. science and technology enterprise; the promise, peril, and need for international regulation of human genetic engineering; accelerating investments in Artificial Intelligence; examining the potential of advanced nuclear technology, including reactors which are "walk-away safe" and have the potential to burn existing nuclear waste; the need to rebalance NASA's efforts between repetitive demonstration projects using already-proven technology versus the development of transformational technologies which would dramatically lower the cost of space exploration; the need for detailed cost estimates and a coherent plan for returning to the Moon by 2024 and traveling to Mars by 2030; the importance of NASA establishing an R&D program space power reactors that do not use weapons-grade uranium.

1. **The Importance of our National Laboratories in the U.S. S&T Enterprise**

Despite the fact that over half of U.S. economic growth since World War II has been driven by science and technology, federal investments in R&D are at a historic low, comprising less than four percent of the federal budget. I believe that scientific research is the foundation for the innovative solutions that will enable us to overcome many of our greatest challenges, from economic stagnation and dependence on foreign energy to curing diseases and addressing threats to our national security.

In particular, our National Laboratories tackle the critical scientific challenges of our time, allowing the U.S. to maintain its position as the global leader in science and technology. The labs possess unique instruments and facilities, many of which are found nowhere else in the world. Without these critical facilities, tens of thousands of users could be forced to move their job-creating research activities overseas or terminate their research altogether. In addition, the National Labs employ over 55,000 scientists, engineers, and support staff and are critical components of regional economies, having forged strong partnerships with universities and industry. Continued investment in these vital capabilities will help the U.S. maintain our competitive advantage as the global leader in science and technology and grow our economy.

2. **The Promise, Peril, and Need for International Control of Human Genetic Engineering**

Early hearings of the House Science Committee played a significant role as prominent members of the scientific community came together to warn our leaders that our legal system and society are not prepared for the discovery of CRIPSR and related gene-editing tools. This technology – discovered in 2012 – is the already providing benefits by accelerating scientific research and treating genetic diseases. For example, sickle-cell disease is now being cured by replacing the bone marrow of someone suffering from this disease a with a genetically-modified version of their own marrow with the genetic defect removed.

The dangers of uncontrolled use of this technology were revealed last year as a rogue scientist in China announced that he had used this technology to genetically modify a human child. Other applications of this technology such as Gene Drives to control invasive and nuisance species must be carefully regulated and controlled before use. It is my hope that we can work together to ensure safety without erecting barriers to research that would prevent us from curing disease. Just as the advancement of science does not respect international borders, our conversations about what we do with those breakthroughs must be expansive and inclusive. This is a conversation that needs to happen domestically and internationally.

For this to succeed, I feel it is important that the beneficial side of CRISPR be the first that the public and especially those in government hear. Continued hearings of the House Science Committee on this subject could play an important role in that discussion. Lawmakers have a tendency to be short-term thinkers and we need to avoid a political over-reaction that could jeopardize the research that is still needed to bring this technology from breakthrough to treatment. In particular, we need to ensure that, should we agree that a legal moratorium on germline editing is the necessary step forward, that things like in vivo treatments do not get caught up in that ban. With the increasingly real possibility that CRISPR and tools like it could yield cures to multiple diseases within our lifetime, we also must guarantee that treatments are not reserved only for the rich and the privileged in our world.

3. **Accelerating investments in Artificial Intelligence**

Recent breakthroughs in the performance of Artificial Intelligence (AI) algorithms based on neural networks are leading to wide ranging applications across science and technology. They are being applied to fields as diverse as social sciences, signal processing in astronomy, to the discovery of new chemical catalysts. It is important that the House Science Committee highlight the importance of this work and support the development of this field, both by supporting workforce development and access to state-of-the-art AI data processing facilities by researchers.

4. **Examining the Potential of Advanced Nuclear Technology**

There is bipartisan and bicameral interest in accelerating investment in advanced nuclear reactors which are "walk-away safe", promise lower cost, are proliferation resistant, and have the potential to burn or minimize nuclear waste. These may be essential to provide carbon-free low-cost electrical power in the U.S. and in countries where renewable wind and solar is not a realistic possibility. The House Science Committee should continue its role in supporting the development of these technologies. One specific useful step would be to provide a platform for proponents to discuss the potential advantages of each technology, in terms of cost, safety, proliferation resistance, and residual nuclear waste.

5. **Rebalancing NASA's R&D Portfolio**

Over time, a large fraction of NASA's efforts and budget have shifted towards repetitive demonstration projects using already-proven technology. The chemical rockets being proposed for return trips to the Moon and voyages to Mars would be completely understandable to Wernher von Braun. I believe that it is crucial that a larger part of NASA's budget be devoted to the development of transformational technologies which would dramatically lower the cost of space exploration. Examples of this include electromagnetic launch systems, material development for Space Elevators, laser-assisted rocket propulsions, and other such innovative concepts. The country that first succeeds at proving a technology to dramatically lower the cost of launching objects into Low Earth Orbit will own the future of space travel.

Autonomous robotics will play a larger and larger role in lowering the cost of both manned and unmanned space exploration. NASA should accelerate its efforts to remain at the forefront of these developments, which will have large spin-off benefits to the terrestrial economy and the possibility of exciting the next generations of space enthusiasts. The House Science Committee should support NASA in expanding its efforts in this area.

6. **The Need for Detailed Cost Estimates and a Coherent Plan for Returning to the Moon by 2024 and Traveling to Mars by 2030**

Rational planning of the space program by Congress requires at least rough estimates of the cost of potential alternatives. Just after the FY20 President's Budget Request was released, NASA changed its plans to accelerate the planned return to the Moon by four years to 2024. NASA finally released its updated budget request this week, which calls for nearly $1.9 billion in additional funding for developing lunar landers and accelerating work on the Space Launch System and Orion, exploration technology development, and additional science missions to the moon. That increase would be offset by cutting funding for the lunar Gateway by $321 million and other Federal programs, most notably, Pell Grants. Moving past the absurdity of cutting

education funding that could produce our future NASA scientists and engineers in order to move up the landing to an arbitrary date, I want to focus on the lack of transparency associated with NASA's plan. Administrator Bridenstine has said the additional $1.9 billion is a "down payment", [1] meaning we do not know how much it will ultimately cost and how exactly NASA plans to accomplish it. This is why I am asking the Committee to direct NASA to release a detailed plan and cost estimate for their 2024 return to the Moon, as well as rough cost estimates for future trips to Mars.

7. **The Importance of NASA Establishing an R&D Program for Space Power Reactors that do not use Weapons-Grade Uranium.**

NASA has primarily powered its deep space probes with radioisotope thermoelectric generators (RTGs) using Pu-238. It has recently been increasing efforts to develop fission reactors, which can provide both propulsion and power. NASA is currently developing nuclear thermal propulsion (NTP) systems using low-enriched uranium (LEU), and nuclear reactor power systems using highly-enriched weapons-grade uranium (HEU).

If all the spacefaring nations start using HEU reactors, then it would involve the utilization of a significant amount of weapons-grade material. Also, no plan has been developed on what will happen to the reactor once it is placed in orbit or on the Moon or another planet – will it be kept secure? How? Is there a plan for its deactivation and decommissioning? These are a few of the many issues the agency needs to address before it moves forward to the deployment stage of its HEU power reactor.

NASA has been lagging in its efforts to develop space-qualified reactor power system designs using LEU. If the U.S. develops such a design, it is reasonable to believe it would be adopted as a de facto standard by other spacefaring nations. There is also significant commercial interest in LEU reactors. At this time, it does not appear that NASA is devoting any resources to developing a power reactor using LEU, despite available appropriations. I urge the Committee to shed light on this important issue.

[1] https://spacenews.com/nasa-seeks-additional-1-6-billion-for-2024-moon-plan/