

The Moon is on the Path to get to Mars and Beyond

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Mr. Chairman and Members of the Subcommittee,

I am an explorer. Freedom in America uniquely enhances the human drive to explore beyond familiar or unknown boundaries.

Exploration is in our blood, from the Founders' foray into constitutional government; to entrepreneurial enhancement of our pursuit of happiness; to Jefferson and Lewis and Clark's opening of the American West; and, yes, to Eisenhower and Kennedy's bold initiatives leading to Armstrong's first small step on the Moon.

Now, the Moon, Mars and Deep Space beckon new generations of young Americans. We would ignore their call at our peril.

A program for Americans to land on Mars would be a remarkable and historic answer to that call. Such a landing, however, will not be easy.

Mars has just enough atmosphere to cause trouble on entry and not enough to help.

The great distance between Earth and Mars means crews will not have Mission Control to help in critical operations.

Gravity on Mars may or may not help astronauts re-adapt, physiologically.

Long transits to Mars may require artificial gravity and/or fusion propulsion and definitely will require heavy shields of water for radiation protection.

The capability to launch 100 metric tonnes to Earth escape velocity may be required.

At least two generations of young engineers, scientists and skilled workers must relearn how to deal with the challenges and risks of deep space.

To meet these challenges, I am convinced that the Moon is a necessary stepping-stone to Mars, with great geopolitical and scientific value in its own right.

Only three days away, rather than many months, the Moon provides necessary resources, engineering verification, operational training, physiological insights, private sector partnerships, and the immediate geopolitical high ground.

If the United States returns to Deep Space, Congress can gain valuable lessons from the Apollo Cold War space effort. The keys to the success of the Apollo Program were:

- A sufficient base of technology and aircraft and space flight experience to begin,
- A large reservoir of patriotic young engineers and skilled workers,
- A pervasive environment of national unease,
- The catalytic events of Sputnik and Yuri Gagarin's orbital flight,
- An articulate, persuasive and patriotic President and Congress,
- A Congressional and White House commitment to a ~100% management reserve of funding so schedule could be maintained in the face of unknown and unknown-unknown problems,
- Tough, competent, disciplined and courageous managers,
- A working environment of liberty.

All these keys must accompany a Moon-Mars-Deep Space initiative but also include:

- Improved education in STEM skills and critical thinking,
- Substitution of China's ambitions for the Cold War stimulus of the 60s,
- A permanent national commitment to deep space exploration,
- Maintenance of an average workforce age of less than 30 years, and

- Elimination of an aversion to taking necessary risks.

As detailed in my submitted testimony and on the Americans Uncommon Sense.com web site, a focused Apollo-style management system will be needed. This system must “stay young -stay lean -stay risk takers.” Once the decision to go back to the Moon and on to Mars is made, the sole focus of civil space management should be to do just that.

With a well-managed Moon-Mars-Deep Space Program, having sustained annual public funding level of about \$20 billion per year (2017 dollars), including a 30% management reserve, the following milestones should be possible:

- Return of Americans to the Moon’s Surface by 2025.
- Lunar Settlement by 2030 (with Public / Private Capital Funding partnership).
- Lunar Resource Production by 2035 (with Private Capital Funding and Management).
- Fusion-powered interplanetary booster by 2035 (with Public / Private Capital Funding for helium-3 fusion power development).
- Mars Crew Landing by 2040.
- Mars settlement by 2045.

In conclusion, Returning to the Moon will increase significantly the probability of success of a Mars landing and exploration program and to maximizing its scientific returns. Because of the multi-decadal nature of the effort, such a return to deep space exploration requires the unequivocal and sustained commitment of the Nation, even more so than was required for the Apollo Program.

Finally, if the decision is to move quickly to re-assert American dominance in space, we are well positioned to do so. The geopolitical environment facing freedom today is as critical as that which faced Congress and the Eisenhower and Kennedy Administrations prior to Apollo. Our current technological foundations actually greatly exceed those of May 1961, having been vastly expanded by the Nation’s public and private sectors. Development of the Space Launch System is well ahead of Saturn V

development at a comparable time, thanks to leaders in Congress and NASA. The Orion spacecraft is in test rather than just being a sketch on a blackboard. Constellation's Altair Lunar Lander design progressed well beyond early concepts for the Apollo Lunar Module. Understanding of human physiology in space has greatly advanced by use of Skylab, the Shuttle, and ISS. Unlike the 1960s, the private sector is well positioned to support as well as partner with the federal government.

I believe, Mr. Chairman, Congress and the Administration should move America back into Deep Space, sooner rather than later.

Thank you for your attention. I look forward to the comments of my colleagues, and I would be happy to answer any questions you or the Committee may have.
