Return to the Moon: A New Destination for the American Space Program

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NASA has no future plans for human exploration of space beyond completion of the International Space Station (ISS). Yet human space flight makes up the bulk of the agency's budget and is also the source of most of the public support the space program retains. Without a new follow-on goal, human space flight will stagnate and the entire civil space program may be in jeopardy.

Although many claim that only a manned Mars mission will draw the necessary public support, the initiation of such a program is unlikely for two reasons: it's too technically challenging for at least another decade and will cost more money than Congress can be reasonably expected to provide. Although alternative destinations beyond LEO are imaginable (e.g., Lagranian points), in the public mind, they differ little from being simply ISS at a different location.

In contrast, the Moon is a small, nearby planet of immense intellectual and economic value. The Moon is a natural laboratory for planetary science, displaying many of the geological processes that operate on all the terrestrial planets. Moreover, the lunar surface preserves the early history of the Earth-Moon system, a record erased from the dynamic, active surface of the Earth. The Moon is a superb platform for observing the universe, with an airless, stable surface, long night-times, and a far side permanently shielded from the radio static of Earth. By understanding the specifics of the human-machine partnership, a new technique of exploration that maximizes the strengths and minimizes the weaknesses of using people and robots to explore space, we can learn to live and work in space on the Moon. The Moon contains abundant resources of material and energy for use in space and on the lunar surface. The recent discovery of large amounts of hydrogen in the polar regions show that extraction and use of lunar resources may be easier than we had originally thought.

Our return to the Moon can be accomplished using the existing infrastructure that supports Shuttle and ISS. Launch of components can be done with Shuttle or STS-derived cargo vehicles and Delta-IV-H vehicles. Cargo flights can emplace a staging node at Earth-Moon L1, from which lunar surface missions would be staged. Human crews can depart and return from ISS or another LEO location. Lunar landers would descend from the L1 node, delivering both robotic cargo and human crews, land, and conduct the surface mission. After return to L1, the crew could await re-alignment of the orbital plane of ISS, upon which they would return to Earth orbit, using aerocapture. This architecture allows us to return to the Moon with minimal development of new hardware and technology and use the ISS as a staging platform, making that program more directly relevant to future human exploration of space.

The mission of a lunar return should be to learn how to use off-planet resources. Such a mission is technically challenging, but within relatively easy reach. It gives NASA a task that is directly relevant to future American national and commercial interests in space, thus making it politically palatable. Learning how to identify, characterize, extract and use off-planet resources is a task that we must learn if humanity is to have a future in space. By providing the ability to refuel spacecraft in orbit, this mission will establish routine access to cislunar space for both people and machines. Freeing us from the cumbersome logistical bonds of Earth, a return to the Moon will be the first step towards both true space independence and to the planets beyond.