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Author: Dr. George Schmidt
National Aeronautics and Space Administration (NASA), United States

RATIONALE FOR FLEXIBLE PATH: A HUMAN EXPLORATION STRATEGY FOCUSED ON ORBITAL AND LOW-GRAVITY WELL DESTINATIONS

Abstract

In 2009, the new U.S. Presidential Administration convened a special committee, led by former aerospace executive Norman Augustine, to recommend options for the future direction of human space flight. It was assumed that the U.S. President would select one of these options or a combination thereof, and use it as a basis for a new national space policy. One option preferred by the committee – the so-called "Flexible Path" strategy – represents a considerable departure from the Moon and Mars-oriented paradigm that has driven U.S. investment in the past. The strategy combines the best features of human and robotic spaceflight, and achieves the dual benefit of advancing capabilities in planetary science, while facilitating crewed voyages to exciting new destinations within the solar system.

Flexible Path differs from traditional exploration approaches by refraining from placing humans on planetary surfaces at the bottom of large gravity wells. It instead concentrates on sending piloted spacecraft to in-space locations and to the surfaces of small planetary bodies. One potential near-term destination is lunar orbit, which is well within the capability of systems currently under development. With more sophisticated systems, it would be possible to send human explorers to several Near Earth Asteroids (NEAs), Mars orbit, Mars' two moons Phobos and Deimos, and conceivably Venus orbit.

For small planetary bodies and in-space locations, the spacecraft would rendezvous directly with the object of study. Operations would be conducted immediately from the spacecraft, without the need for dedicated landers and ascent vehicles. For orbital destinations, the crew would explore via teleoperation of robotic vehicles and systems pre-deployed on the surface. This closely approximates the cognitive and decision-making advantages of having humans at the site of study, and unlike today's autonomous robotic missions, provides real-time command and control of operations and experiments. It is very similar to how oceanographers and other explorers use telerobotic submersibles to work in inaccessible areas of the ocean.

This paper lays out the rationale for Flexible Path, and explains its chief advantages as the exploration strategy for the 21st Century, namely:

- Broadening the range of destinations for near-term human missions;
- Reducing cost and risk through fewer man-rated elements and less complexity;
- Offering benefits of human-equivalent in-situ cognition, decision-making and field-work on other planetary bodies;
- Providing a simpler approach to returning samples from the Mars and Venus surface.
- Facilitating opportunities for international collaboration through contribution of robotic systems.