

Belton Space Exploration Initiatives, LLC

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Mr. Gary L. Martin
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Room 9F44
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Dear Mr. Martin,

The Columbia tragedy has triggered a public discussion of the future of the space station, space station science, and the utilization of humans in space. The outcome that we expect from this activity is an endorsement of a program of human space flight at NASA – perhaps returning to the goal enunciated by President Reagan in 1988: “To expand human presence and activity beyond Earth-orbit into the solar system” - accompanied by a prolonged and, possibly, divisive debate on the utility of the space station for science. As space scientists, we believe the latter can be avoided by adding a new, exciting, and affordable goal for human spaceflight and the use of the space station. This is the inclusion of “mitigation” or “NEO deflection studies” (i.e., how to *prepare* for a comet or asteroid that is found on an Earth-threatening path), as one of NASA’s primary goals. This goal, which we believe can combine the best of robotic and human space capabilities, can also be thought of as a precursor to another future endeavor (e.g., see the discussion in *Scientific Requirements for Human Exploration, Space Studies Board, 1993*) – that of a manned mission to explore Mars. Also, such a goal can be thought of as logical extension of the congressionally mandated survey, currently being conducted in the Office of Space Science, to find any potentially hazardous near-Earth objects (NEOs) larger than one kilometer.

In a recent workshop for NASA’s Office of Space Science, we developed a roadmap for attaining the “Scientific Requirements for Mitigation of Hazardous Comets and Asteroids” (www.noao.edu/meetings/mitigation/report.html). This roadmap shows that to gain the basic knowledge needed for some future mitigation technology, a new NASA program is needed consisting of many novel robotic missions to acquire detailed geophysical information on the physical diversity, the subsurface, and the deep interiors of a variety of near-Earth objects. In addition, NASA and DoD will need to work together to “learn” how to apply deflection technologies including the application of low thrust devices, the application of novel in-space power sources, and/or the rapid application of large amounts of energy on small solar system bodies. We expect that a mix of both human and robotic missions to objects in near-Earth space and new uses for the space station will be required to test these technologies. The Space Science Board has already noted that there is a need

for an optimal mix of human and robotic activities in such endeavors in their *Scientific Opportunities in the Human Exploration of Space* (Space Studies Board, 1993).

All of this leads us to propose a new goal for human and robotic space flight: ***Show how humans and robots can work together on small objects in near-Earth interplanetary space to: 1) accomplish new fundamental science on planetary objects; 2) aspire to previously unimaginable technical achievements on objects in interplanetary space; and, 3) protect the Earth from the future possibility of a catastrophic collision with a hazardous object from space.*** Since these activities would allow human spaceflight to cross the threshold into interplanetary space, they could also be thought of as a precursor activity to provide the essential technical and medical experience for that more distant, but even more challenging, goal - a ***human*** exploratory mission to Mars.

We also note that among the recent NRC Solar System Exploration “Decadal” Survey recommendations is one that exhorts NASA “...to make significant new investments in advanced technology in order that future high priority flight missions can succeed.” Particular stress was put on in-space power and propulsion systems such as advanced RTG’s, in-space fission reactor power sources, nuclear electric propulsion (NEP) and advanced ion engines. In the President’s 2004 budget proposal, NEP figures strongly in connection with a future mission to the icy satellites of Jupiter as part of the goal to understand the origins and extent of life in the solar system. “Mitigation,” or even the gathering of the specific knowledge that will be needed as a prerequisite for such an activity, was not dealt with in the Survey, since it is a technical goal and not an exploration or scientific goal. But it is now clear, as a result of the mitigation workshop, that low thrust propulsion and the application of in-space power systems to collision avoidance may now be the best way to proceed. It is a small leap to imagine ***an experiment to deflect a small near-Earth asteroid through the application of thrust from a NEP system (or an advanced SEP) fueled by an advanced power source.*** Moreover it is an objective that resonates with your agency’s newly stated objective of “...Protecting the Home Planet... As only NASA can!” In short, we see an important coupling between the requirements for the long-term future of solar system scientific exploration, as expressed by the Decadal survey, the needs of planetary protection, and a worthwhile program that utilizes humans, the space station, and robots in near-Earth interplanetary space.

In public discussions of the President’s in-space nuclear power and propulsion system initiative, the issue of environmental safety can be expected to arise even though extensive past experience has shown that such systems are extremely safe. Nuclear safety is a matter of great public concern that we share. However, we would also like to point out that the likely application of these kinds of technologies to a future NEO deflection system will also mitigate against the possibility of a much greater environmental hazard: that of a NEO impact itself. Thus, from an environmental perspective, there may be much to be gained in the application of these systems to the NEO collision problem.

A cogent new goal is needed for human space flight and significant investments and experimentation are required to develop in-flight power and propulsion systems for future solar system exploration. In addition, a new program needs to be started at NASA to create an adequate scientific basis for a future mitigation system and, simultaneously, to learn how to apply future collision mitigation technologies. There is a nexus between these goals and objectives that we believe should become the basis of a new thrust for NASA as it emerges from the analysis and public discussion surrounding the Columbia tragedy. We advocate, and strongly believe, that by adopting this goal the United States can go forward with human spaceflight utilizing the space station with productive, well-supported and meaningful objectives.

We are, sincerely yours,

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