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REPORT IN BRIEF

An Interim Report on NASA's Draft Space Technology Roadmaps

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For the National Aeronautics and Space Administration (NASA) to achieve many of its space science and exploration goals over the next several decades, dramatic advances in space technology will be necessary. NASA has developed a set of 14 draft roadmaps to guide the development of such technologies under the leadership of the NASA Office of the Chief Technologist (OCT). In this interim report, the NRC provides several initial observations—provided below—that will be expanded on in the final report to be released in 2012.

Background

Technological breakthroughs have been the foundation of NASA's past success. For example, the Apollo landings on the Moon, once regarded as a distant dream, now serve as an icon for technological success in space initiatives. The technologies needed for the Apollo program were generally self-evident, driven by a clear and well-defined goal. In the modern era, more effort is required to develop the best path for a forward-looking technology development program because the goals of space exploration have expanded beyond a single target, because the necessary technological developments have become less clear, and because NASA's technology base is largely depleted.

NASA's 14 Roadmaps

Future U.S. leadership in space requires a foundation of sustained technology advances. Accordingly, NASA has created a set of 14 draft roadmaps to guide the development of space technologies under the leadership of the NASA Office of the Chief Technologist (OCT). OCT requested that the National Research Council (NRC) conduct a study to review the draft roadmaps, gather and assess relevant community input and make recommendations and suggest priorities to inform NASA's decisions throughout the process. The NRC has grouped these 14 roadmaps into six panels to provide more in-depth analyses of these broader topics: propulsion and power; robotics, communications and navigation; instruments and computing; human health and surface exploration; materials; and entry descent and landing.

Initial Observations

In this interim report, the NRC provides several initial observations that will be expanded on in the final report set to be released in 2012.

- The effectiveness of the NASA space technology program can be enhanced by employing proven management practices and principles, particularly with regard to increasing program stability, pursuing evolutionary improvements and adopting intermediate goals, maintaining a balance between the focus and flexibility of the roadmaps in establishing technical approaches, supporting adequate flight tests of new technologies, addressing facility issues (to the extent appropriate in a technology development program) and continuing NASA's tradition of cooperative development of new technologies.

- The draft technology roadmaps would benefit from being updated in light of the contents of two NRC decadal surveys on life and physical sciences and planetary science research that were released after the current draft of the roadmaps was issued.
- Because many of the capabilities critical to the future of space science and exploration require the successful development of diverse technologies, in many cases an integrated approach to the development of technologies would be preferable.
- Advanced modeling and simulation capabilities are critical to the successful development of many technologies, but predictive modeling capabilities for many technologies are at a low level of maturity or they are outdated. In some cases, new testing technologies may be needed to enable adequate assessment of important technologies in a reasonable time frame and at an affordable cost.
- Developers of space technology could more easily access and understand relevant human factors considerations if consolidated crew comments from prior missions were integrated into an existing electronic International Space Station database and made accessible to all U.S. developers of exploration technology.

Looking Ahead

Success in executing future NASA space missions will depend on advanced technology developments that should already be underway. Currently available technology is insufficient to accomplish many intended space missions—this includes mitigating the effects of space radiation from both the cosmic ray background and from solar flares, developing advanced fail-safe mobile pressure suits, building robotic vehicles that can maneuver over a wider range of gravitational, environmental, surface and subsurface conditions. In addition, future space science missions capable of addressing the highest-priority goals in astrophysics will need a new generation of lower-cost astronomical telescopes.

The steering committee's final report will be completed early in 2012. That report will prioritize the technologies that span the entire scope of the 14 roadmaps and provide additional guidance on crosscutting themes and other relevant topics.

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