Report identifies 16 highest priorities to guide NASA's Technology Development efforts for next 5 years

February 1 2012

During the next five years, NASA technology development efforts should focus on 16 high-priority technologies and their associated top technical challenges, says a new report from the National Research Council. In addition, the report recommends emphasis on flight demonstrations for technologies that are nearly ready and a 10 percent allocation from the existing program budget to advance and refine early emerging technologies.

"It has been years since NASA has had a vigorous, broad-based program in advanced space technology development," said Raymond Colladay, president of RC Space Enterprises Inc., and chair of the committee that wrote the report. "Success in executing future NASA space missions will depend on advanced developments that should already be under way."

The 16 high-priority technologies were selected with input from the external technical community as part of NASA's draft technology roadmaps and include items such as radiation mitigation; guidance, navigation, and control; nuclear systems for both power generation and transportation; and solar power generation (see full table below). These priorities were chosen to align with three main facets of NASA's overall mission: extending and sustaining human activities beyond low Earth orbit; exploring the evolution of the solar system and the potential for life elsewhere; and expanding our understanding of Earth and the universe.

The report sets forth an evaluation framework to prioritize which technologies to emphasize in the next five years of the 20- to 30-year window. NASA's Office of the Chief Technologist (OCT) should establish a rigorous process to select among competing technologies at appropriate milestones in order to ensure that the most promising ones receive sufficient attention and resources. The report also recommends that OCT pursue cooperative development of high-priority technologies with other government agencies and the U.S. commercial space industry to leverage resources.

For technologies deemed closer to implementation, flight demonstrations, while expensive, are sometimes essential to transition a technology to an operational system, the report stipulates. Such technology flight demonstrations should be considered on a case-by-case basis when there is ample support from the user, including a reasonable level of cost-sharing.

To further foster collaboration, OCT should make the scientific and technical data that NASA has acquired from past and present space missions and technology development more readily available to U.S. industry, the report adds. This should include companies that do not have an ongoing working relationship with NASA and that are pursuing their own commercial goals, which may differ from NASA's science and exploration missions.

"If NASA can sustain implementation of its technology roadmaps -- shaped by the priorities recommended in this study -- they will form a solid foundation," said Colladay. "This foundation will support a breadth of NASA missions, as well as commercial and national needs, and provide the agency with the means to achieve its long-term goals."

The following table identifies NASA's highest-priority technologies for research and development over the next five years:

Objective A

Extend and sustain human activities beyond low Earth orbit

Objective B

Explore the evolution of the solar system and the potential for life elsewhere

Objective C

Expand understanding of Earth and the universe

Radiation Mitigation for Human Spaceflight

Guidance, Navigation, and Control

Optical Systems (Instruments and Sensors)

Long-Duration Crew Health

Solar Power Generation (Photovoltaic and Thermal)

High-Contrast Imaging and Spectroscopy Technologies

Environmental Control and Life Support Systems

Electric Propulsion

Detectors and Focal Planes

Guidance, Navigation, and Control

Fission Power Generation

Lightweight and Multifunctional Materials and Structures

(Nuclear) Thermal Propulsion

Entry, Descent and Landing Thermal Protection Systems

Active Thermal Control of Cryogenic Systems

Lightweight and Multifunctional Materials and Structures

In-Situ Instruments and Sensors

Electric Propulsion

Fission Power Generation

Lightweight and Multifunctional Materials and Structures

Solar Power Generation (Photovoltaic and Thermal)

Entry, Descent, and Landing Thermal Protection Systems

Extreme Terrain Mobility

Provided by National Academy of Sciences