

The New Millennium Program: Serving Earth and Space Sciences
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NASA has exciting plans for space science and Earth observations during the next decade. A broad range of advanced spacecraft and measurement technologies will be needed to support these plans within the existing budget and schedule constraints. Many of these technology needs are common to both NASA's Office of Earth Science (OES) and Office of Space Sciences (OSS). Even though some breakthrough technologies have been identified to address these needs, project managers have traditionally been reluctant to incorporate them into flight programs because their inherent development risk. To accelerate the infusion of new technologies into its OES and OSS missions, NASA established the New Millennium Program (NMP). This program analyzes the capability needs of these enterprises, identifies candidate technologies to address these needs, incorporates advanced technology suites into validation flights, validates them in the relevant space environment, and then proactively infuses the validated technologies into future missions to enhance their capabilities while reducing their life cycle cost.

The NMP employs a cross-enterprise Science Working Group, the NASA Enterprise science and technology roadmaps to define the capabilities needed by future Earth and Space science missions. Additional input from the science community is gathered through open workshops and peer-reviewed NASA Research Announcements (NRAs) for advanced measurement concepts. Technology development inputs from the technology organizations within NASA, other government agencies, federally funded research and development centers (FFRDC's), U.S. industry, and academia are sought to identify breakthrough technologies that might address these needs. This approach significantly extends NASA's technology infrastructure.

To complement other flight test programs that develop or validate of individual components, the NMP places its highest priority on system-level validations of technology suites in the relevant space environment. This approach is not needed for all technologies, but it is usually essential to validate advanced system architectures or new measurement concepts. The NMP has recently revised its processes for defining candidate validation flights, and selecting technologies for these flights. The NMP now employs integrated project formulation teams, which include scientists, technologists, and mission planners, to incorporate technology suites into candidate validation flights. These teams develop competing concepts, which can be rigorously evaluated prior to selection for flight. The technology providers for each concept are selected through an open, competitive, process during the project formulation phase. If their concept is selected for flight, they are incorporated into the Project Implementation Team, which develops, integrates, tests, launches, and operates the technology validation flight. Throughout the project implementation phase, the Implementation Team will document and disseminate their validation results to facilitate the infusion of their validated technologies into future OSS and OES science missions.

The NMP has successfully launched its first two Deep Space flights for the OSS, and is currently implementing its first two Earth Orbiting flights for the OES. The next OSS and OES flights are currently being defined. Even though these flights are focused on specific Space Science and Earth Science themes, they are designed to validate a range of technologies that could benefit both enterprises, including advanced propulsion, communications, autonomous operations and navigation, multifunctional structures, micro-electronics, and advanced instruments. Specific examples of these technologies will be provided in our presentation.

The processes developed by the NMP also provide benefits across the Space and Earth Science enterprises. In particular, the extensive, nation-wide technology infrastructure developed by the NMP enhances the access to breakthrough technologies for both

enterprises. The database of validated technologies being developed as part of the NMP technology infusion strategy should facilitate both future missions in the Enterprise Strategic Plans, and future Principal Investigator-led missions in the Earth System Science Pathfinder, Discovery, and Explorer Programs. To exploit these capabilities, validated NMP technologies are being referenced in the Announcements of Opportunity for these programs.

The NMP is currently evolving to address the changing environment in OSS and OES. Efforts to further reduce the cost and increase the frequency of NMP flights are being pursued to optimize the cost effectiveness of the technology validation activities. We are also working to enhance the coordination between NMP validation flights and other technology development efforts with NASA's cross-enterprise technology programs. Finally, NMP processes are being revised to make them more accessible to the science and technology communities, and to make greater use of open, peer-reviewed competitions for their participation.