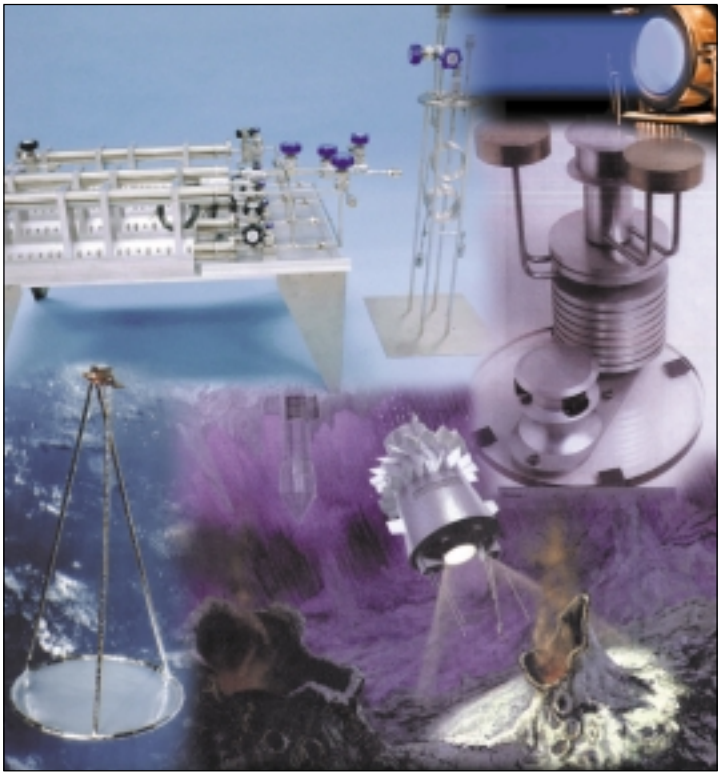
Section I-3 the role of technology

The space science technology development program develops and makes available new space technologies needed to enable or enhance exploration, expand our knowledge of the universe, and ensure continued national scientific, technical, and economic leadership. It strives to improve reliability and mission safety, and to accelerate mission development. Since the early 1990's, the average space science mission development time has been reduced from over nine years to five years or less, partly by integration and early infusion of advanced technologies into missions. For missions planned in the years 2000 to 2004, we hope to further reduce development time to less than four years.

Our technology program encompasses three key objectives. First, we strive to develop new and better technical approaches and capabilities. Where necessary, we then validate these capabilities in space so that they can be confidently applied to science flight projects. Finally, we use these improved and demonstrated capabilities in the science programs and ultimately transfer them to U.S. industry for public use.

To achieve the technology goals for meeting future space science missions capability requirements for-

Enterprise Technology Objectives	Enterprise Technology Activities
Acquire new technical approaches and capabilities	• Focus technology development on a well-defined set of performance requirements covering the needs of near-term to mid-term strategic plan missions ("mission pull") • Guide basic technology research to meet projected long-range needs ("vision pull") • Promote partnerships with other agencies, industry, academia, and foreign collaborators to take advantage of capabilities developed elsewhere
Validate new technologies in space	• Identify technologies of high value to future Enterprise missions and fund their development to the point that they are ready for ground or space demonstration • Formulate, develop, and implement cost-effective space demonstrations of selected technologies on suitable carriers
Apply and transfer technology	• Use new technologies, in multiple missions where possible, to reduce costs and shorten mission development time across the program • Maximize benefits to the Nation by stimulating cooperation with industry, other Government agencies, and academia



The Space Science Enterprise provides requirements to, and in turn benefits from, a broad spectrum of Agencywide technology programs.

mulated in science roadmaps, the Enterprise technology strategy is to:

Focus technology development on science program requirements. When near-term Enterprise mission concepts are defined sufficiently to begin detailed scoping of their instrumentation, systems, and infrastructure, performance requirements are derived. Technology development is focused on meeting the identified requirements ("mission pull" technologies). Basic technology research is focused on perceived longer range technology needs (they are characterized with less precision than near-term requirements). These longer range needs are generated from advanced mission concepts developed by mission study groups working with science advisory groups. Identified needs are then used to allocate support for maturation of more revolutionary technical approaches ("vision pull" technologies). The balance between "mission pull" and "vision pull" contributes to program agility and results in long-term continuing progress of the overall program notwithstanding short-term changes in circumstances.

Fund technologies of high value to future Enterprise missions to the point that they are ready for ground or space demonstration. A large number of technology concepts are given the benefit of exploratory research in the expectation that a fraction of these will emerge as promising. It is critical that these promising candidates for use in missions are identified and funded to the point where they are tested in a relevant environment on the ground, adopted by a flight project for further maturation, or are proposed as a candidate for space flight validation.

Formulate and implement cost-effective space demonstrations of selected technologies on suitable carriers. Project managers need assurance that adopted new technology will perform in the relevant space environment. In many cases this environment can be simulated on the ground in a satisfactory manner. Often this is not the

case, however. It is necessary to identify those technologies that require space flight demonstration and perform these demonstrations.

Use these technologies in multiple missions to reduce costs and shorten mission development time across the program. Since the early 1990's, the average science mission development time has been reduced from over nine years to five years. Although many factors can compress mission development time, infusion of validated new technology in the early mission phases can facilitate this. We compare requirements for future missions to look for common needs that can be met through a coordinated technology development effort. Where possible, we sequence missions so that later projects build on technology developed and successfully demonstrated for earlier ones.

Promote partnerships with other agencies, industry, and academia to take advantage of external capabilities. Technology infusion succeeds best through formal and informal interactions between mission developers, scientific principal investigators, and technology providers. In the early phases of development, detailed analyses and trade-off studies are conducted to determine technical feasibility and to establish technology priorities.

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Joint activities and partnerships with universities, industry, and other Government agencies can be particularly important in speeding identification and realization of the most attractive technology for specific needs. Technical capabilities can sometimes be efficiently acquired through cooperation with international partners. In conducting cooperative activities in technology, the Enterprise protects proprietary data and intellectual property.

Maintain excellence by engaging the outside community in technology development and evaluation. The Enterprise integrates industry, academia, and other Federal agencies' laboratories into the program. Industry, for example, develops valuable technology by using internal resources (IR&D and profit dollars), and through service to non-NASA customers. Similarly, the university community holds a vast and unique technological resource. University groups, receiving significant funding from other sources, are often leaders in essential technology areas. This approach—of using a mix of dedicated peer-reviewed efforts at NASA Centers, other Government agencies, industry, and universities—ensures that the "best and brightest" are tapped for the required developments. This approach dovetails with the practices of following parallel paths in early development followed by descoping and down-selecting. Independent merit review will be used to assure excellence in both internal NASA and external technology development efforts. These reviews will consider whether work is "best-in-class," contributes to specific, documented, and otherwise unaddressed Enterprise requirements, and is advancing significantly the state-of-the-art.