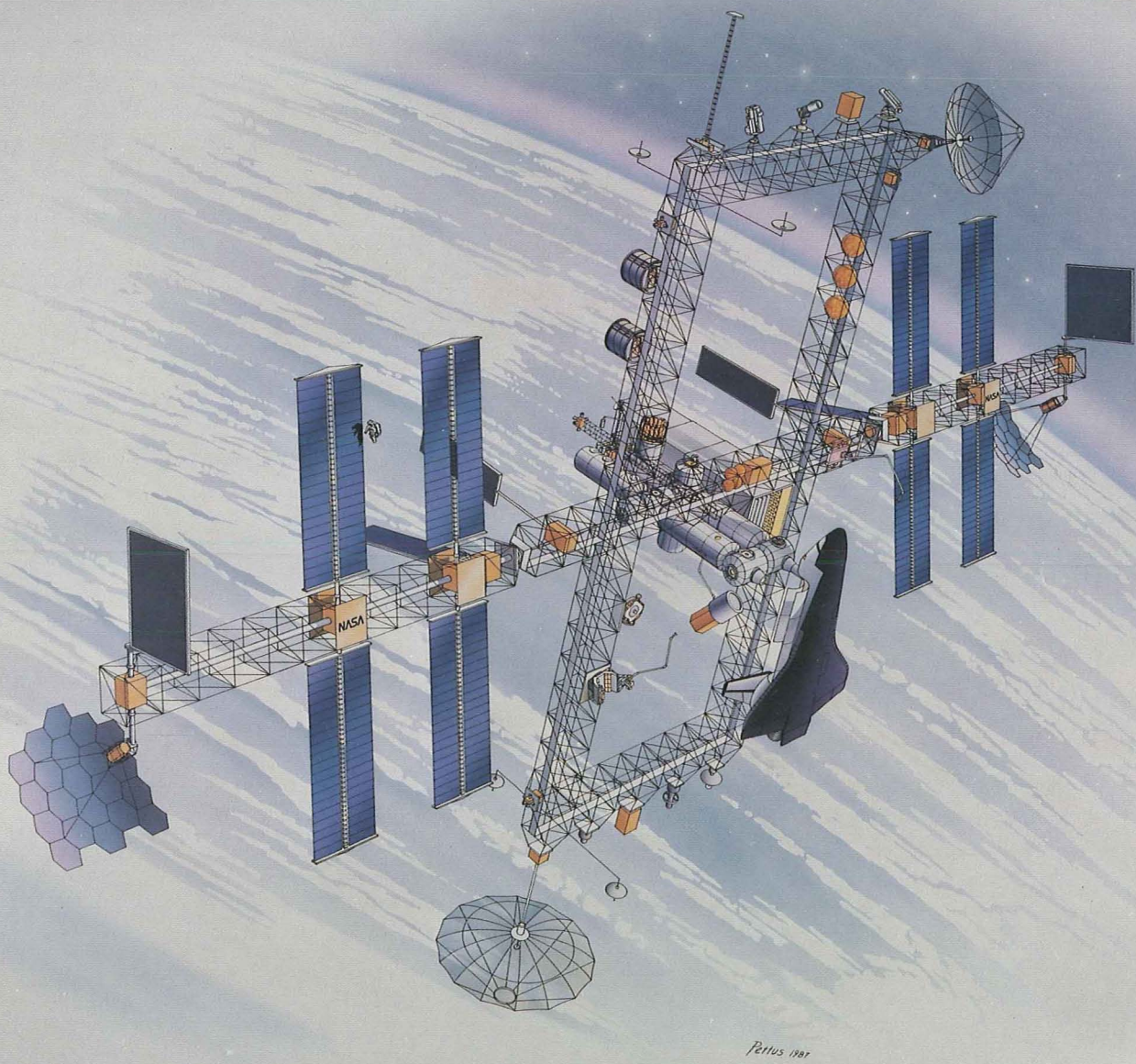


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Space Station:

Leadership for the Future

by
Franklin D. Martin and
Terence T. Finn



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“The Space Station offers a unique and challenging opportunity for international cooperation in space. Europe, Japan and Canada are our partners in the Space Station program. Their participation will mean a more capable Space Station, and a tangible demonstration of our desire and ability to work together.”

Andrew J. Stofan
NASA Association Administrator
for Space Station

Space Station: Leadership for the Future

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Terence T. Finn*

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Space Station and the Future

No longer limited to occasional spectaculars, space has become an essential, almost commonplace dimension of national life. Among other things, space today is an arena of competition with our allies and our adversaries. It is a place of business, where private companies can and do profit. It is a field of research, for developing technology and conducting science. It is also an avenue of cooperation with our allies, demonstrating the peaceful use of space for the benefit of all.

The Space Station will play a critical role in each of these endeavors. A unique and versatile concept, the Space Station will shape what we do in space and how we do it. And by doing so, it will be the centerpiece of our nation's future in space.

The Space Station will be unique because it will provide the United States with a permanently manned presence in space. It will be versatile because its capabilities will be remarkably diverse. This diversity is reflected in the station's design, which features pressurized laboratories, accommodations for attached payloads, and free-flying unmanned platforms. NASA is developing a new national laboratory, a research center in space. This laboratory will stimulate new technologies, in both the civil and military sectors, and enhance industrial competitiveness. It will further commercial space enterprises, and add greatly to our storehouse of scientific knowledge. The Space Station will also assure American pre-eminence in space at a time when other nations are increasingly self-reliant in space technologies. And, it will support a universal vision that, ultimately, mankind will move beyond the confines of Earth.

Dr. Franklin D. Martin is the NASA Deputy Associate Administrator for Space Station. Dr. Terence T. Finn is the Deputy Director, Policy Division at the Space Station Office at NASA Headquarters.

A Permanently Manned Presence

Perhaps the most significant feature of the Space Station, essential to its utility for science, commerce, and technology, is the permanent nature of its crew. Men and women will be aboard the station base full-time, 24 hours a day, 365 days a year. This makes the Space Station different from what we have done in the past. It makes it a system of enormous capabilities. Humans are the most sophisticated machines of all. Their creativity, their dexterity, their ability to perceive, to interact with instruments and to respond to the unexpected are unique and essential. The Space Station will be designed to exploit these human capabilities. And by providing a permanent presence, the station will enable these capabilities to realize their fullest potential.

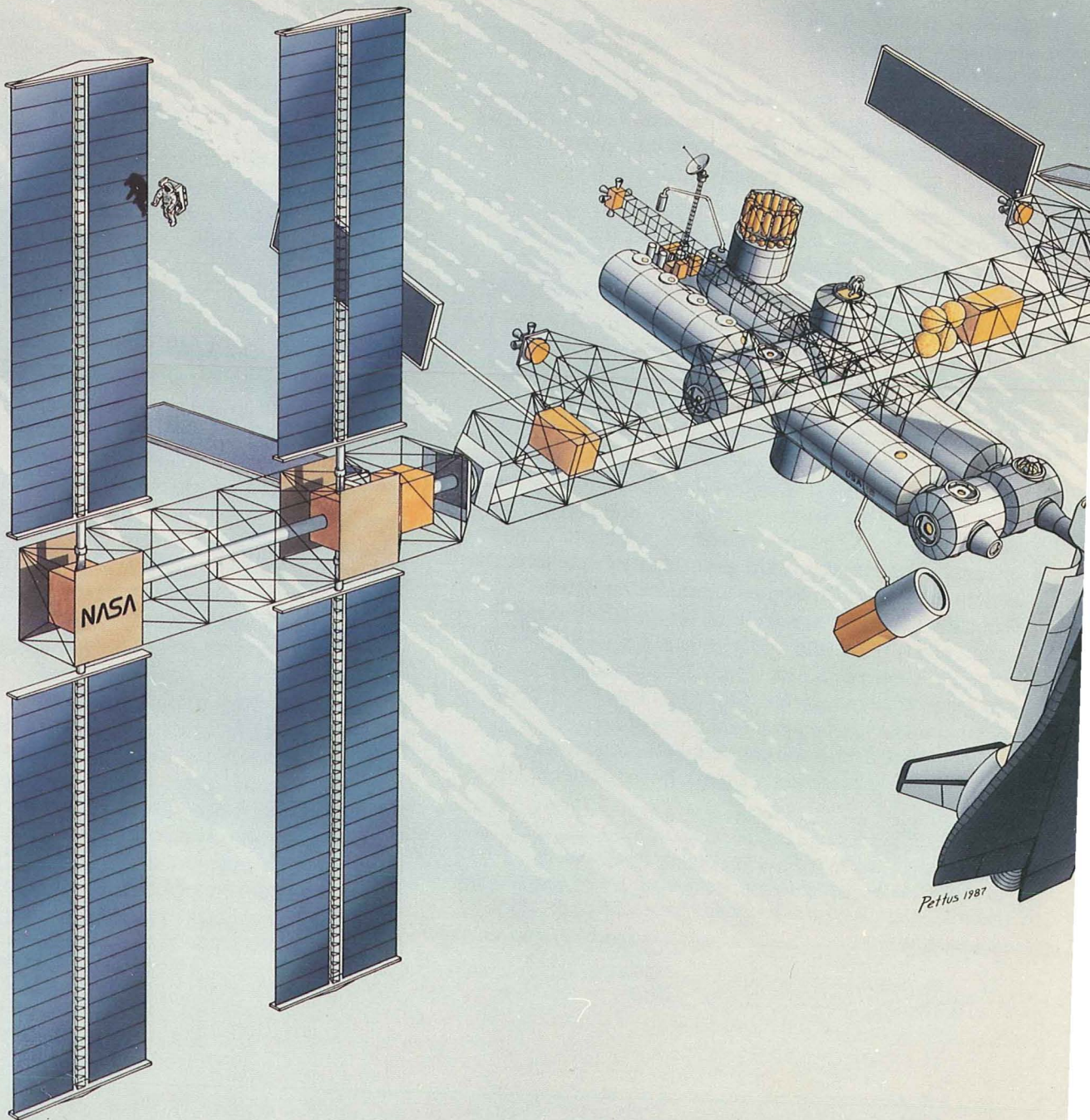
A New National Laboratory

As a laboratory in space, the station will support research of fundamental importance. Such research, of course, does not require space-based capabilities. But space provides such a remarkably rich environment for the advancement of knowledge that science and technology now have a core dimension rooted in space. The Space Station will focus and expand this dimension. It will build upon the tradition of employing new capabilities to explore further and question deeper. And by providing a permanent presence, the station should significantly increase the opportunities for conducting research in space.

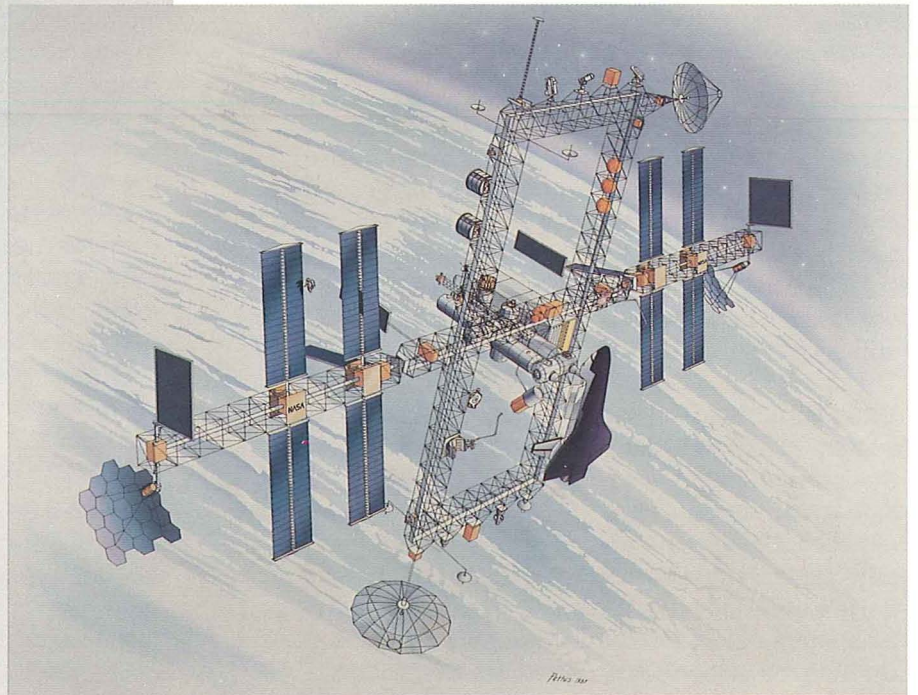
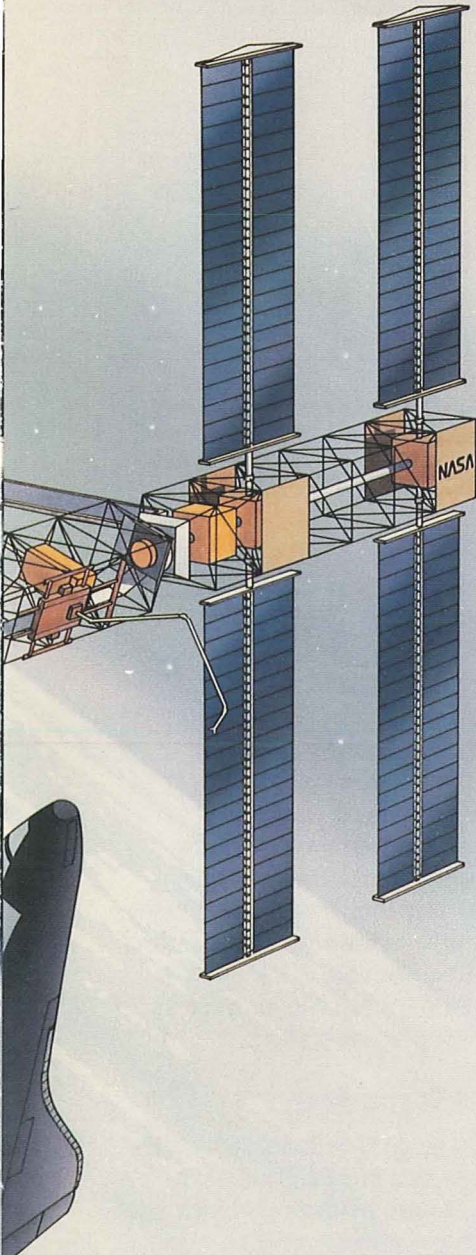
The Space Station's microgravity environment, high levels of power, and extended time in orbit, will enable scientists to make new discoveries in materials research and life sciences. Space Station scientists, working within pressurized modules, will be able to fabricate large, defect-free crystals, such as gallium arsenide, for use in the development of computers. They will be able to produce pure biological crystals necessary for the identification of basic molecular structure. Other scientists will be able to study the fundamental behavior

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Derived from the Enhanced Configuration portrayed on the cover, this Revised Baseline Configuration effectively balances the need to reduce federal spending with the necessity of achieving a permanently manned presence in space. With 75 kw of power, accommodations for attached payloads, international participation and two polar platforms (not shown) this configuration will provide a diverse and extremely useful set of capabilities. Note the astronaut inspecting the upper left solar array.



The Space Station is being designed to be able to evolve as new requirements emerge and new capabilities come on line. The configuration illustrated here, termed Enhanced Capabilities, features additional structure for the accommodation of attached payloads and a greater level of power. Additional power will be provided by an advanced solar dynamics system located at each end of the horizontal boom.

The Space Station

For Science and Technology

- A research laboratory in space that is permanently manned

For Space Exploration

- A point of departure, an enabling capability for future missions

For NASA

- A means in the future to conduct business

For the United States

- An essential element of civil space policy
- A symbol of our commitment to leadership in space

For Mankind

- A first step toward living and working beyond Earth

of living cells and help characterize and understand the human body as a self-contained, complex, ecological system. They also will be able to penetrate further the mysteries of human physiology as it is affected by extended space flight.

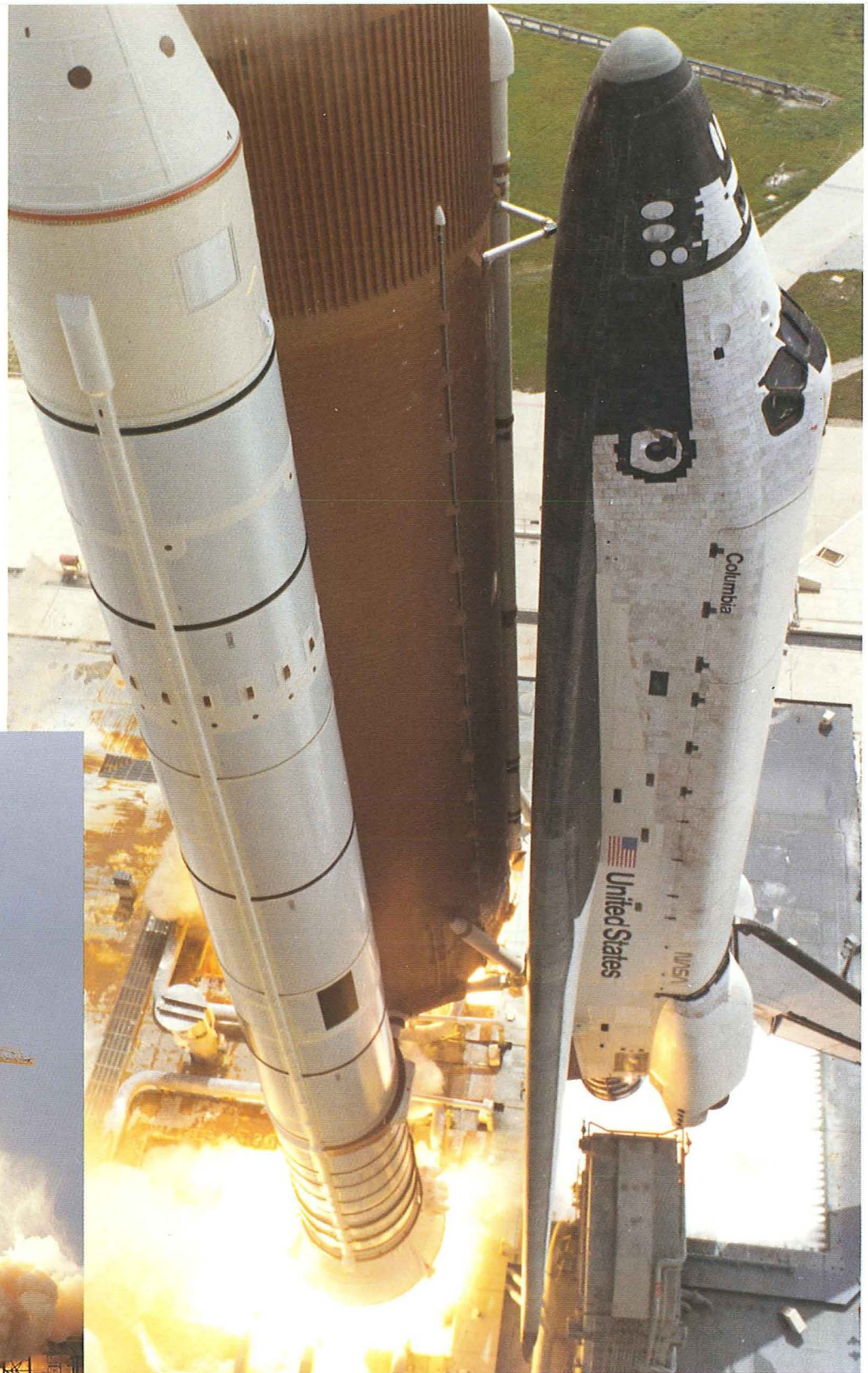
Yet the Space Station's substantive research capabilities include far more than its pressurized volume. Its free-flying platforms will enhance astrophysics and enable truly synergistic studies of Earth's atmosphere, land masses, and oceans referred to as Earth system science. Moreover, the station's external structure is designed to be stable platforms that will be available for a number of specialized instruments and telescopes. These will look out to the stars and down upon Earth. Other upper-boom instruments might focus upon the centerpiece of our solar environment: the Sun. Space Station instruments will be able to conduct long-term, high-resolution studies of the Sun's surface and of solar radiation. Besides enhancing our understanding of basic physics, such studies will contribute to our knowledge of Earth's environment and climate. The Space Station's structure is also a platform for scientific observation. Utilizing the station's orbit, scientists will be able to monitor and examine phenomenon such as tropical rainfall. This rainfall is a dominant factor in understanding Earth's hydrological cycle, which is a critical element in understanding the periodic variability in Earth's weather patterns.

However, the Space Station's value extends beyond the experimental and observational sciences. Scientific instruments, be they in a laboratory or on a boom, require maintenance, upgrading, repair, and replacement. The Space Station we are designing will accommodate these functions. The station will be not only a research laboratory of unparalleled capability, it will, because of the manned presence, be a servicing center of considerable practicality. Our experience in space confirms the importance of accommodating these functions. Things do break and they don't always work exactly right. They need "time in the shop." The Space Station will be that shop. It will be able to service the scientific instruments it carries, as well as provide for extended service of free-flying spacecraft.

Competitiveness and Technology

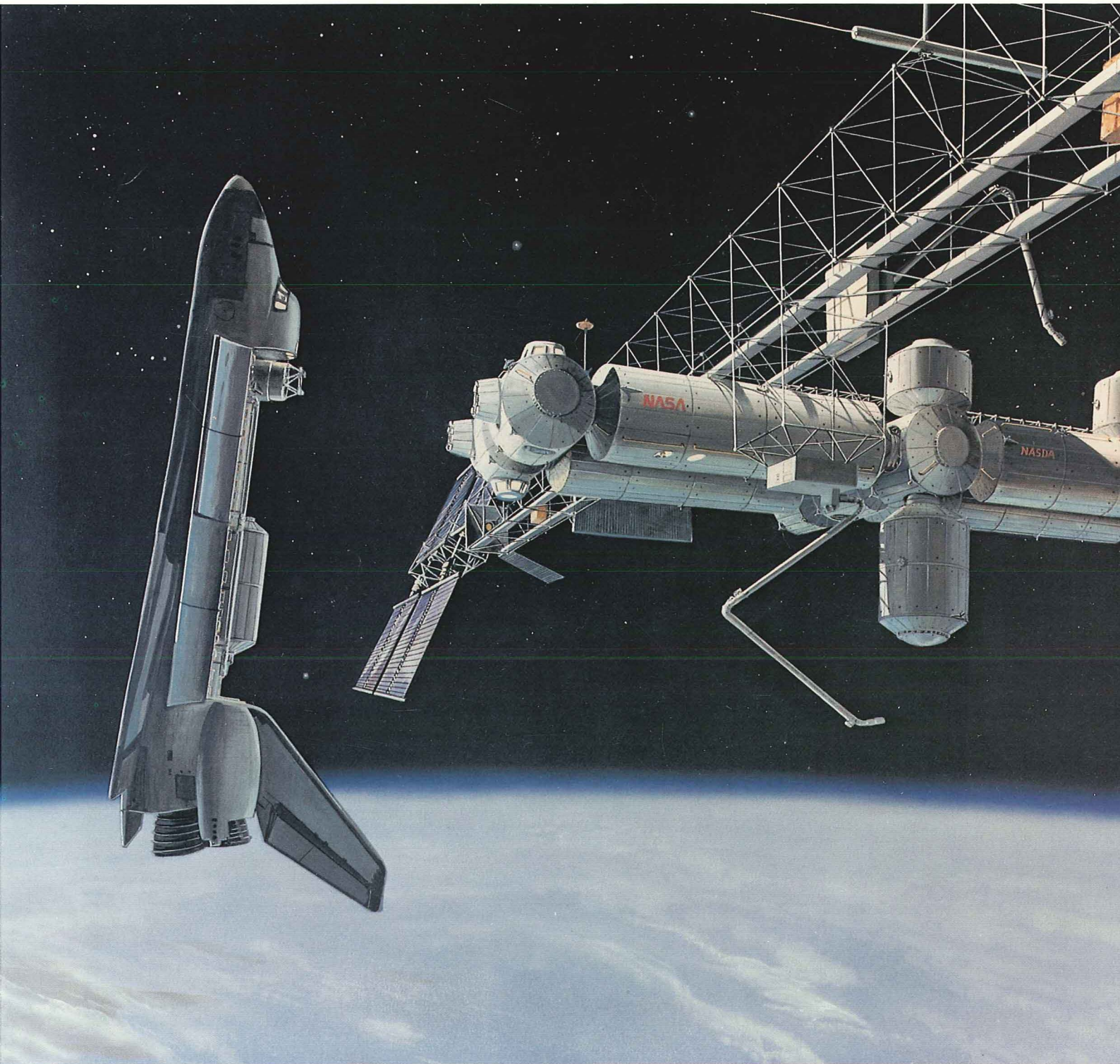
President Reagan's message on U.S. competitiveness identifies the Space Station as a key R&D initiative. Economic productivity is, in part, a function of technical innovation. The Space Station will contribute significantly to growth in technology, via both its development and utilization. A major thrust of the Space Station design effort is devoted to enhancing performance through advanced technology. Propulsion, structures, and materials are areas where Space Station technology is likely to be spun off to the private sector. So too, are automation and robotics. The Space Station's

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The Space Shuttle will be the principal transportation system for the Space Station. Shuttle's unique ability to carry men and women aloft and to return from orbit makes it an indispensable element of the nation's space program and of the Space Station endeavor. For Space Station logistics and payload flights, the Space Shuttle will be complemented by expendable launch vehicles.

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flight telerobotic servicer is expected to enhance technology in these two critical fields. In addition, NASA, through the Space Station program, is pioneering the development of an integrated capability for the cost-effective production and long-term maintenance of complex applications software. The capability, called the Software Support Environment (SSE), will provide the software and policies for a wide range of uses. The SSE has prompted major strides in industry in defining and making operationally available integrated development systems. The SSE is expected to have a dramatic impact on the technical competitiveness of U.S. industry in the rapidly growing software development field.

Symbol of Greatness

Symbolic values of the Space Station, however, may exceed its considerable practicality. The Space Station represents the commitment of the United States to a future in space. This future will be intellectually rigorous, technically demanding, and commercially profitable. The station demonstrates that America's greatness in space is ahead of us, not behind us, and that this nation does not intend to rest on its laurels. With the positive response to President Reagan's invitation to friends and allies of the United States to participate in the program, the station symbolizes our nation's desire to cooperate with others in mutually beneficial civil space activities. With the Soviet Union operating the MIR orbiting station, the Space Station symbolizes the intent of the United States to be second to none in utilizing the diverse capabilities of a permanent human presence in space. Perhaps most importantly, as we steadfastly recover from the loss of *Challenger* and its crew, the Space Station symbolizes our national determination shared by the President, the Congress, and the American public to remain undeterred by tragedy and to continue exploring the frontiers of space.



With the Shuttle on its way back to flight operations, the Space Station represents the next logical step in our efforts to explore and utilize the environment of space. With the Space Station operational in the mid-1990's we will no longer visit space, we will be there, living and working in an outpost that silently glides above Earth.

Reasons Why

- Enhance capabilities for space science and applications
- Stimulate advanced technologies
- Promote international cooperation
- Develop the further commercial potential of space
- Challenge the Soviet lead in space stations
- Contribute to American pride and prestige
- Stimulate interest in science and engineering education
- Provide options for future endeavors in space

Assure Free World Leadership in Space During the 1990s and Beyond

Future Expeditions

The frontiers of space eventually will beckon us again to leave the confines of Earth and explore once more the lunar surface or land upon Mars, that planet most like our own. When this will occur is uncertain. That it will occur is not at issue, for the intangible imperative of human exploration will not, in the long run, be denied. While such exploration may not be carried out by American astronauts, it appears likely that man will journey back to the Moon or to Mars within the next forty years. Much technology development needs to occur before such an expedition could be mounted. Much research needs to be conducted about the biological effects of long-duration space flight. A Space Station is the only place where such activity can be accomplished. The Space Station will be a laboratory for preparatory work essential to any future manned space exploration. In addition, the station would serve as a point of departure for such a mission, the energy requirements being such that assembling the mission components in orbit is far easier than attempting a mission directly from the surface of Earth. The Space Station is thus an enabling capability for the future. By itself, it does not lead to a Moon or Mars mission, but such a mission will not take place without it.

Leadership

The Space Station represents a commitment to leadership in the future. Today, United States leadership in space is being challenged. Spacecraft and launch vehicles of considerable sophistication and proven reliability have been developed and flown in Europe, Japan, China, and the Soviet Union. These countries understand the utility and value of space systems. They understand that profit, productivity, prestige, and national strength are the products of a space program. They are committed to an extensive and visible presence in space. Our response must be to press forward with projects that are significant, demanding, and genuinely useful. Often, we will do this together with our friends and allies, in cooperative endeavors. Sometimes we will do it by ourselves. No nation can match our experience in space or our technical capabilities. If we apply these with vision and imagination, if we chart the future with the Space Station—with its range of capabilities unlike any other—then leadership in space will again belong to the United States.

