Policy Forum

The Third Generation of the Space Age

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We went to the moon, we orbited astronauts in a laboratory in space, and we sent spacecraft to explore the planets. That was the first generation of the Space Age. The second generation, today, is characterized by a proliferation of national players and market-driven commercial space ventures. The authors were deeply involved in the Reagan Administration's attempt to develop a third generation of space policy in the early 1980s. It was premature then. It is timely now. The third generation waits upon launch flexibility and far cheaper access to space, and it will be characterized by many new commercial, military, and scientific applications made possible by relatively inexpensive "smart" satellites launched by rockets matched in size to the satellites. There is an analogy here with what has happened in the world of computers over the past decade. An inexpensive satellite crammed with microelectronics and weighing only a few hundred pounds is the space-borne equivalent of the personal computer; it can be assembled quickly, with readily available hardware, and it can be launched on short notice with little fanfare. The billion-dollar multi-ton satellite is the equivalent of the mainframe computer; it takes a decade to build and is so expensive that only a few can be bought, and launch times must be scheduled years in advance.

The fundamental barrier to reducing the costs of space launch with rockets is technical—the need to carry on board both fuel and oxygen. That imposes an inescapable weight burden on rockets of any kind and a minimum cost of at least $5000 per pound to put something into space. The National Aerospace Plane (NASP), a third-generation launcher, will nearly eliminate that oxygen penalty. NASP, which is a cross between an airplane and a rocket, will be able to scoop enough oxygen out of the air, even at the edge of the atmosphere, to burn the fuel it carries. The fuel-oxygen burden can thus be lightened by a factor of 8, and the NASP offers a path to reducing overall launch costs by a factor of 10 or 100.

No other launch vehicle now in sight offers such an advantage, and no other country can match the United States—at least not yet—in completing the R&D and developing a working model. But it is frustrating that the NASP has not been considered seriously in planning for the U.S. space program. Although development will take some time, and even a prototype could not be available until 1996, the development of the NASP is well enough along for this vehicle to be considered as a critical element in our space future. Developed by the Defense Advanced Research Projects Agency and then transferred to the Air Force, it has never attracted much tangible support from the National Aeronautics and Space Administration (NASA), although the recent "rescue" of the NASP by the National Space Council may finally force some attention to be paid to its potential.

Some who see the NASP as a competitor to other projects, such as an expanded Shuttle fleet, or a new generation of big rockets, or supersonic airplanes, or the Space Station, argue that there are still overwhelming technical problems to be overcome before the NASP can fly. For the past 4 years many of the critics have been saying that the NASP is too big a step, that we need intermediate airplanes first. But we built a plane that could fly at 100,000 feet nearly 25 years ago. The NASP is an airplane that will fly at 200,000 feet, not such a leap for 25 years. Some argue that the extrapolations to hypersonic aerodynamics are too optimistic. Yet both computer simulation and actual tests prove more optimistic than expectations. Others warn that there are serious problems associated with developing the materials needed to withstand the heat generated at the speeds at which the NASP will fly. But several different usable materials have already been made in the laboratory; now the task is to manufacture them in the factory. Twenty-five years ago no one would have predicted our ability to master the immense difficulties of manufacturing silicon devices so quickly, but we did. There seem to be no overpowering technical problems to prevent similar success for these high-temperature materials.

There is a further important point to be made in this regard. Among the major space projects now under way, the NASP is far and away the most important stimulus to new technology. One example of probable long-term importance will be the design of exotic composite materials that are needed to withstand the high temperatures. Over the past half dozen years, the NASP has been the catalyst for significant advances in metal, metal-matrix technologies, among others.

There is also the argument that NASP will repeat the mistake made with the Shuttle of using a manned vehicle to perform tasks that could be done with unmanned vehicles, thus paying the dual penalty of high cost for man-rating (for example, life-support and rescue systems) and possible interruption of availability because of accidents. However, the NASP is an extension of airplane technology, not of rocket technology. In fact, the launch of a man-rated NASP should have a significant cost advantage over the launch of an unmanned expendable launch vehicle. And, second, although they should not be minimized, the dangers of interrupted availability should be modeled after our experience with airplane flight, not rocket flight.

After a fast start, lack of support has slowed NASP's development. NASA continues to concentrate its resources on further extensions of the first-generation launch technology in the form of heavy lift rockets but pays scant attention and takes only a minor role in developing the NASP. One is hard-pressed to find serious consideration in space program planning for the NASP, which is the real differentiator down the road. In this international poker game for space leadership, we seem prepared to lose pot after pot rather than play our ace in the hole.

It is one thing to fail in a competition when you do not have the ability or resources to win. America's history is not characterized by timidity. Our space program has been effective primarily through its boldness. Today's competitive global climate is no time for technocrats to stifle America's ingenuity. How will we explain to our children and grandchildren if we lose this one because we simply did not have the sense to move forward?

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