Space Station

The Next Logical Step to National Distress

James A. Van Allen

It is no news that the civilian space program of the United States is now in a state of massive disarray. The program has the professional obligation to "get its act back together." My position is that undertaking development of a space station *at this time* will impede rather than advance this effort. Let me explain.

In 1946, the United States began high altitude research using scientific equipment carried by rocket-propelled vehicles through and above the atmosphere of the earth. This early work laid the foundations, both technical and scientific, for the effective utilization of earth satellites and spacecraft on deep space missions. The birth of the space age, following a gestation period of some eleven years, is usually said to have occurred on October 4, 1957 with the launch of Sputnik I. The United States has now passed through a very difficult and expensive adolescence and has reached a level of substantial maturity in understanding the great potential of space techniques. But, as a nation, it is continuing to behave like an adolescent in the sense that it is not really using its experience thoughtfully and effectively.

I listened very carefully to President Reagan's State of the Union address on January 25, 1984 and later got a transcript of it. It was very pleasant to hear his endorsement of our civilian space program, but I was appalled by its emphasis, which is represented in the following quotation:

> We can follow our dreams to distant stars, living and working in space for peaceful, economic and scientific gain. Tonight, I am directing NASA to develop a permanently manned space station and to do it within a decade.
>
> A space station will permit quantum leaps in our research in science, communications, and in metals and life-saving medicines which can be manufactured only in space.

He continued with remarks on the enormous potential for commerce in space.

A year later the President reiterated his enthusiasm for space as the "next frontier" and emphasized "man's permanent presence in space" and the

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bright prospects for manufacturing large quantities of medicines for curing disease and extraordinary crystals for revolutionizing electronics—all in the proposed space station.

As a basis for national policy, these statements were hyperbolic and poorly grounded in experience. Indeed, such statements do the entire U.S. space effort a substantial disservice by creating quite unrealistic expectations.

In the following discussion, some of the basic elements of forty years of U.S. experience in space are described.

Despite much speculation, only one truly commercial application of space technology has emerged thus far: the great global network of communication satellites and the associated industry, including launch vehicles. Private companies have, of course, a central role in providing space equipment and services to the federal government. But these functions do not qualify for the usual understanding of the term "commercialization," that is, developing products and/or services that pay their own way in the nongovernmental marketplace.

There are many other important utilitarian applications of space technology: weather observation and forecasting; remote sensing of the earth's surface resources; marine and aircraft navigation; the applied sciences of the sun and of the earth's ionosphere, magnetosphere, atmosphere, and oceans; and reconnaissance, surveillance, and other military applications that are technically similar to those for civil purposes. But all of these applications remain wholly or principally in the area of governmental services.

Nearly all of the above-mentioned applications of space technology and nearly all of the spectacular advances in the space sciences, including space astronomy, have been, are being, and will continue to be accomplished by unmanned, automated, commandable spacecraft. Moreover, most such spacecraft have been and can be launched by expendable launch vehicles and at considerably less cost than by the Space Shuttle, despite grossly optimistic predictions to the contrary in the early 1970s.

Materials-processing in space is still an embryonic science. It has significant research interest, but, as of the present date, its demonstrated commercial potential is wildly incommensurate with the cost of a space station having materials-processing as one of its principal declared purposes.

In September 1983, the Space Science Board of the National Academy of Sciences concluded a preliminary assessment of the prospective usefulness of a manned space station for scientific purposes. The following is quoted from its report:

The Board has also examined the set of specific missions proposed for implementation from the Space Station system during the years 1991–2000. It has found that few of these missions would acquire significant scientific or technical enhancement by virtue of being implemented from this space station. In view of this and the adequacy of the present space transportation system for the purposes of space science, the Board sees no scientific need for this space station during the next twenty years.

A much more massive two-year study entitled "Space Science in the Twenty-First Century: Imperatives for Two Decades (1995–2015)," also conducted by the Space Science Board, is now approaching completion. Apart from biomedical research on human subjects, this study has again found few first-order scientific objectives that *require* human crews in space, much less a permanently manned space station, during the adopted time frame.

The cost/benefit ratio of secondary purposes such as repair, refurbishment, and replacement of equipment in earth orbit is, I think, greatly underestimated by advocates of the space station. Indeed, it is much more cost-effective to improve the reliability and versatility of space equipment by preflight developmental and test work. The true "heavy hitters" in space science and utilitarian applications have been long-lived satellites and spacecraft based on intrinsically good design, good engineering, and rigorous testing.

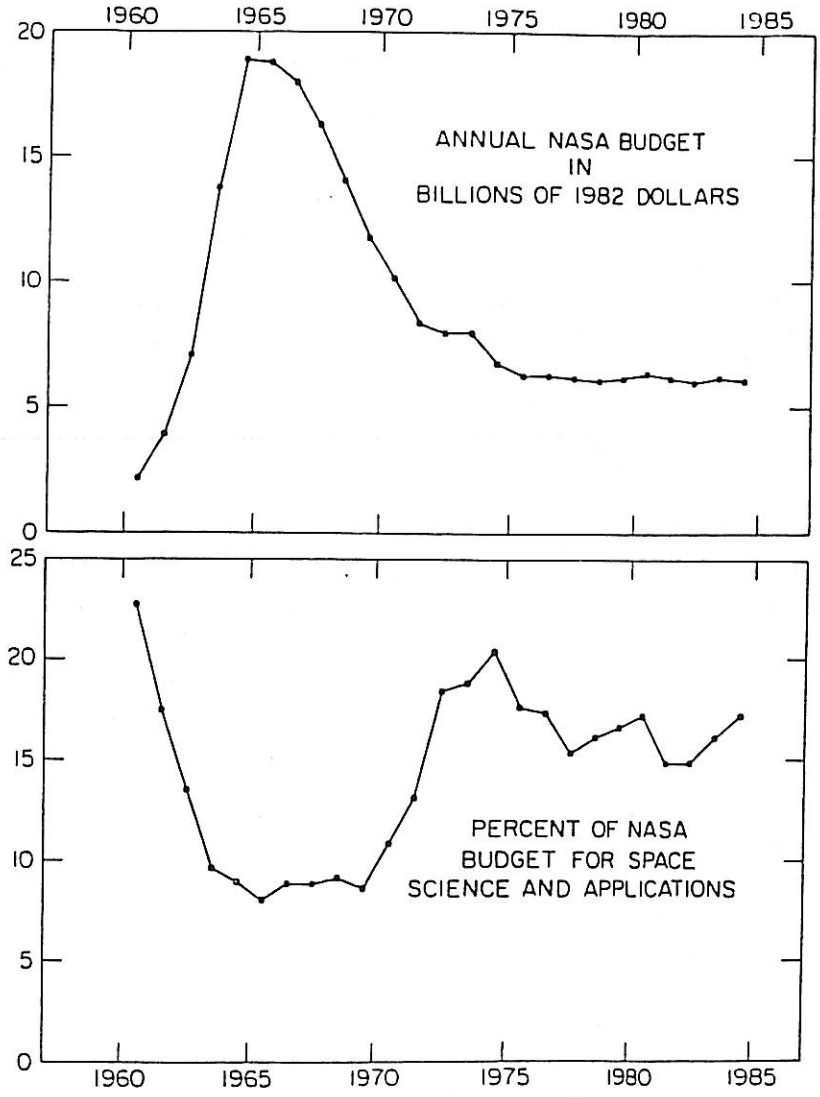
In an attempt to stimulate support in the scientific community for the proposed space station program, NASA has appointed groups of scientists to try to think of something for which a space station would be useful, if one were in existence.

The unmentioned assumption is that a space station can be created and maintained by some form of budgetary magic without any diminution of the resources available for space science and applications. I believe this assumption to be unjustified.

Following the peak of the U.S. space effort in the mid-1960s, the budget of NASA has fallen to about one-third of its peak value in terms of normalized dollars and has been essentially flat for the past twelve years (Figure 1). This latter fact must be interpreted as representing a sociological/political equilibrium between advocates of increased space activities and skeptics of their worthiness. Recognizing this fact in the context of the present federal budgetary morass, I submit that it is optimistic to even assume a zero-sum game for NASA's near-term budgetary future.

My conclusion is that a space station program, if actually pursued in the near term as now projected, will greatly diminish our future advances in

Figure 1



space applications of direct human importance and in scientific work of broad appeal to an intelligent citizenry. As a result, U.S. international leadership in space will continue to shrink.