

Comments on a Continuing Space Program

Adelbert O. Tischler

Through several recent administrations NASA has tried to define a “new” space program. At the core of NASA’s problem is the significant gap between needed funds and those that will be available in the reasonable future. That restrains the definitions. Although initial steps toward development of new transportation vehicles have been taken no specific new mission or set of new missions has been politically or publicly endorsed.

NASA has previously abandoned systems that could fulfill some of the requirements that are being examined now. I refer, of course, to the Saturn launch systems and Apollo space systems that facilitated the Apollo program. These became unintentional *ad hoc* developments; their demise was dictated by the costs of maintaining their capability.

Since then the NASA manned space activities have refocused on LEO operations. NASA solicited and obtained international support for the orbiting international space station (ISS), which is now threatened with similar abandonment. NASA cannot now discard the arrangements made for the ISS without a significant loss of its status as the lead organization in developing and operating this laboratory.

Earlier NASA studies pointed at preserving the operational capabilities of existing vehicle systems and of the space station. Some of the other launch systems in use by United States customers, by default, are vehicles built and launched abroad. Any added cost is submerged in the profits of operating commercial satellite systems.

NASA has sought to generate appropriations to replace launch systems, including the semi-reusable Shuttle, with new vehicles showing modest operational improvements. The most recent actions have spent nine billion dollars in preliminary development of new launch systems ultimately capable of returning to the moon to establish it as a base for farther trips, including, presumably, expeditions to Mars.

But, future Federal budget restraints dictate the necessity for multiple uses for the principal transportation vehicles built. Considering what has happened previously, it seems to me shrewd to project the scope of what is

to be done with new system developments throughout their useful life.

Unless we contemplate and present the complete picture of the space program prospects and restraints NASA could undertake systems unsuited or already outmoded for new tasks. What happens then is that arguments arise among involved groups who must use those systems, both within and outside of NASA, the system development goes into fits-and-starts mode as cost overruns occur, providing an excuse to constrict development funds. Meanwhile the mission objectives and/or strategy plans shift. Finally compromise systems are entered or reentered into the planning process. The result will be to establish a new version of the overlapping array of motley transportation systems that we now have. Maintaining and using such a variety of transportation systems is costly, and those costs stifle ambitious mission projections.

Furthermore, decisions on exploration and exploitation of space must mesh with plans of foreign nations also participating in space activities. In many cases these missions will be joint endeavors that will require a high level of international cooperation -- political, scientific, engineering and development. These problems constitute unresolved steps in the path of implementing decisions. NASA must recognize that at this point dictatorial vehicle decisions may be too costly to rescind or to revise.

To gain continuing support for future missions what NASA needs is a clear picture of where our future space endeavors will take us, and what may be gained from going there, along with a ranking of their priorities and cost consequences. At the least we should pose the right issues and questions in providing the answers to what we are planning to do, rather than to present plans that imply that NASA already has or will soon develop the right answers as funds are provided.

In addition selling any new mission proposition requires a sales campaign that must now be addressed to more than a few supporters in the Congress and in the Administration. Let me say a few more words about that.

A concern that needs to be addressed is the extent of unmanned and of manned ventures into space and their trade-offs. Space exploration missions should be planned with a view to producing the greatest beneficial advantages for all of us -- contributors as well as participants. Remotely

controlled explorations can be conducted at far less cost than manned expeditions, and space issues now hinge on what the nation, with the cooperation and funding help of cooperating nations, can afford to support. For many reasons my thinking of what we'll ultimately trying to do in space does not divide manned exploration of space from unmanned probes. Probes to glean all the information that we can get remotely before undertaking an expensive venture will reduce astronauts risks, and may even answer many questions adequately. Each method of exploration has its advantages and disadvantages, and no missions are really unmanned; those designations refer only to whether there are people aboard the exploratory vehicle.

The most important concern, however, is: to whom must we sell the new space program? One of the advantages of the manned Apollo program was that the mission had already been described in story book form nearly a century earlier. Many people were aware of Jules Verne's imaginative tale, and anyone could go outdoors most nights to look at where we were going. Therefore everyone, presumably, could grasp the ostensible objective of landing men there and bringing them back. The real purpose, which was to boost the American economy while staking a claim for American leadership in space enterprises, was seldom openly stated. President Kennedy was able to get a commitment from the Congress to support that objective to completion.

In the face of problems brought on by ongoing lengthy wars and economic recession the enthusiasm of public support has waned considerably since then. To put NASA's present problem of presenting saleable missions in terms that can again be readily grasped by the public that must support it we need a comprehensive and convincing list of new adventures and investigative tasks to be conducted in space that will appeal to the imaginative interests of our collective supporting constituents, not primarily those whose self-interests are being served.

Justifying any of the many mission options will be more difficult than previously because the missions objectives must first be defined in a way that excites not only many American participants, supporters and politicians but also the international public and the political, technical and business groups representing them.

The reasons for undertaking such missions must, from here forward,

extend well beyond fulfilling a story-book adventure. The resultant total plan must show promise that fulfilling its objectives can reward this country, and all who participate, with values and benefits that extend beyond the necessary expenditures.

That can be done, I believe, by addressing cost benefits: that is, return on investments. I personally believe that the space program has generated fall-out industries and their related jobs that are worth many times the entire expenditures of the space program thus far. People seem to forget that when the space program began we didn't have many of the communications, navigation, imaging and calculations technologies our kids accept as commonplace today. The stimulus provided by the space program was real and it was transformed and transferred into real business opportunities and results in many commercial fields. And it did provide for the United States an aura of prestige among its international peers that, unfortunately, has since been squandered in conducting wars of retribution against the wrong opponents. Underlying this surge of new businesses, of course, was the fact that the space program also helped to stimulate furthering the education and training of the baby boomer generation that advanced the scope and productivity of our total economy.

NASA has done such a modest job of reminding the nation of stimulated fall-outs to day-by-day business applications that most people -- particularly, young people -- simply take them for granted, seemingly accepting that progress as an unearned inheritance, without conscious appreciation of how it came about. But history shows that the economic progress of nations, and even of civilization, depends very much on technological innovations conveyed into new applications.

It is certainly not my intent to try to spell out a new individual plan for the space program future. But just to show the breadth of possibilities let me list several directions in which we might go from here, along with some indication of the issues and decision points that they generate.

What will be the principal objectives of our future space program?
To illustrate the question will it be:

1) Scientific Exploration?

Search for origins and (new) physical laws governing the distribution and behavior of energy and matter in the

universe?

2) Exploitation of commercial uses of space?

- Communication
- Navigation and Traffic Control
- Mapping
- Surveillance
- Weather Forecast
- Crop and Resource Monitoring

3) Development of new technologies with fall-out consequences?

- Robotics
- Continuing progress stimulation on communications and electronics.
- New Materials and Fabrication Processes Development

4) Continuing Support of ISS --

- LEO science experiment and observatory laboratory?
 - Expand?
 - Continue?
 - Cut back?
- Consider a space station as a deployment base for farther trips to planets?

5) Economic Preparedness?

- Maintain cadre of engineers and scientists and manufacturers skilled in engineering arts, as well as facilities and laboratories to put to use rapidly in case of national need, including its defense

Related issues:

Should the space elements of the systems be:

- Manned or Unmanned for
 - Orbital operations?
 - Planetary expeditions?
 - Scientific investigations?

How best to achieve the chosen principal objectives?

- Maintain capability of a family of systems to enter and operate

in space -- LEO, intra-planetary, far space
Develop new systems specific to the early missions

Extent of International Participation

Planning Agreements

Funding Responsibilities and Commitments

Management and Project Control

Reporting

This incomplete list makes it obvious that no single activity can either encompass or exclude other missions; many of them relate and overlap, and all have much in common, but, in view of costs of engineering, development plus facility and manufacturing capacity, proposing to support all of them simultaneously is clearly an unattainable goal. It is far more important that the program plan be a continuing one, with mission objectives taken in an order that permits progression from the capabilities generated at each mission step, along with the learning in both sciences and technology, to be applied logically to the succeeding endeavors in a manner that takes advantage of both knowledge and skills acquired and developed as we go. To maintain the cadre of dedicated and highly skilled personnel and the manufacturing, test and operational capabilities that are required to achieve successful execution that will require commitment to continuing support. We can not expect these people to venture into the extra-terrestrial realm without assurance that their careers will not be abruptly truncated by politically-governed actions. The totality of the efforts will require decades, but I am confident that what we aspire to explore, along with the revelations we will find, will be there.

The way to eat an elephant is one bite at a time. What the overall mission plan must aim to do is to divide, spread and prioritize the listing so that each mission element becomes feasible at points in time where the objectives of the missions, the capability (personnel and facilities), the support (political acceptance, funding), and the willing coordination, cooperation and communication to carry it to completion can all be brought to realization in logical sequence within reasonable expenditure limits acceptable to participants and contributors. With a commitment to such continuing support it may be possible, with the cooperation and collaboration of international partners, to do all the things I've listed above and, in time, many that are beyond what we can now visualize.

At some point the further plan will depend on and be shaped by the discoveries and findings being made. That is how progress progresses.

The outline of such a comprehensive plan, extending well beyond estimates of our nation's budget for the next year, or even a ten-year projection of that budget, is not visible in present planning discussions, but I believe many of us would like to see its image before we undertake the next defining steps toward future journeys into space that, to succeed, require intense dedication by people to their purposes. Such projections will be meaningful and exceedingly important to those who will commit their careers to fulfilling its purposes.

A list of time and capability-related mission objectives will provide some assurance that the program will generate mission-related results with potential technological application to economic purposes so that the public can accept the conclusion that the ends justify the means, rather than a conclusion that the means are the end. That makes it imperative to hinge plans and anticipated results and their consequences on much more than a single spectacular mission.

Such a plan will also make visible the opportunity for continuity as well as commonality of some of the mission hardware, operations, and participants, a strategic arrangement that, I dare to say, may cut the ultimate total cost of space exploration endeavors by a factor of about three. Such step-by-step planning of a continuing effort will go a long way toward selling a long-range program at a time when the flimsiest pole in the tent is the funding that the nation can dedicate to the effort during these stringent times.

To summarize all that in fewer words: let's not flail around in gloom and frustration for funds to preserve space endeavors *per se*. Let us light a candle, draw a map, and plot a path to the discovery of greater knowledge of the universe we live in and to applications of our concomitantly-developing knowledge and technologies that enrich our welfare. Then we can estimate its consequences and benefits, and, with the help of others, arrange projects and their funding in a sequence that is both logical and doable to seek a continuing commitment of support. That agenda, if accepted, will enable us to proceed with confidence in our decisions on space programs.