

## NASA IN-HOUSE ASTRONOMERS - VERSE AND CONVERSE

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It is a particular pleasure to be here tonight, the degree of pleasure having been heightened by the unaccustomed luxury of participating, albeit rather passively, in the scientific discussions of the past days. The net result of the listening is an increased conviction that astronomy offers, along with biology, the best prospects of all the sciences for major increases both in our comprehension of nature and, simultaneously, in our awe at nature's complexities and energies. To the degree that the Space Telescope brings those prospects to fruition, it will have to rank as one of the premier astronomical tools of the 1980's and 90's. But I don't need to preach its merits to this audience. What I'd rather do is to give you some of my views on a topic commonly thought to be an "issue" and which has risen to a state of high visibility within NASA in large part on account of the Space Telescope and its operation. That "issue" revolves around the scientist who happens to work in NASA.

Most simply, the issue can be formulated as a number of statements which are thought by some non-NASA scientists to represent basic truths. To wit, the average NASA scientist:

1. Is not as "competitive," i.e. competent, as his academic counterpart, and obtains large amounts of supporting research and technology funding through an uncompetitive system;

2. Is guaranteed a job and security by dint of the "un-civil" service;

3. Gets preferential consideration in the allocation of research funding because the salary is not paid by the R&D budget;
4. Spends full time on research without the intrusion of students and committees;
5. Exerts undue influence on NASA Headquarters concerning scientific priorities and objectives; and
6. Has access to a large engineering capability which gives a favored position when competing for flight projects.

So far, you will notice that I've not been talking specifically about astronomers but have generalized to include all NASA scientists and for good reason; that is, non-NASA astronomers are not unique in their perceptions of the internal NASA scientist and centers. In fact, when I was at NASA, it became a common topic of conversation at meetings of the Physical Sciences Committee (PSC) (later the Space Science Advisory Committee), once in a while quite vociferous but more often sotto voce. My earliest inclinations, five years ago, were to ignore the rumblings and to chalk them up to sour grapes and a lack of visibility into the workings of NASA. The persistence, however, soon became bothersome. This was exacerbated by the tone of some of the discussion surrounding the Space Telescope and its operation. Clearly, we at NASA were dealing with a new (to us) community who had very little insight into NASA and who were used to a particular type of operation and interaction with the Government, a type I lump under the rubric "NSF-mode." The community you may recognize as one we in NASA loosely referred to as the "ground-based astronomers" (you may well ask, "is that in contrast to the astronomer based in space?").

Oversimplifying, it initially seemed to me that the desire of the ground-based astronomers to operate the Space Telescope via a Space Telescope Science Institute was primarily a paranoid reaction to the perceptions of NASA listed earlier, augmented by a desire to do business in the NSF-mode and further fueled by a belief that NASA sees itself as a builder of projects to the detriment of long-term operations. It might have been relatively easy to dismiss the arguments out-of-hand, point to successful NASA-astronomer relations and operations in the Copernicus and SAS projects, later augmented by HEAO and IUE, and tell the ST proponents that we'll do it the standard NASA way, take it or leave it.

Why didn't I? Partly because I, a few others at NASA Headquarters, fewer yet at NASA centers, harbored suspicions that some of the concerns were valid and, more significant, many of the people expressing concern were obviously not cranks but respected members of the scientific community. At the same time, all considered, it also seemed necessary and desirable to clear the air of what I was convinced were, and to a large degree remain, wrong impressions about the NASA scientists. Let me work my way back now to the statements of perceptions.

You are all aware of the outcome of the deliberations about an ST Science Institute. The decision to proceed with the ST Science Institute has been viewed by some NASA scientists, particularly at the Goddard Space Flight Center, as a vote of no-confidence in their integrity and abilities and as an explicit acceptance of the validity of the external perceptions listed earlier. Not so.

The NASA Headquarters support for the ST Science Institute concept as it now exists can be attributed largely to the fact that it : (1) is what the bulk of the ST user community wants, is comfortable with, and has the potential competence to manage (I recognize, however, that one element of the user community's desire for an Institute is based upon the perceptions), (2) has real advantages as detailed in the Space Science Board study report, (3) doesn't cost appreciably more than if done totally "in-house," and (4) leaves to NASA those operational aspects which, in NASA's view, cannot or should not be "contracted out."

Although I maintain that the validity, or lack thereof, concerning the external perceptions about NASA and NASA scientists had little to do with NASA's ST Science Institute decision, the perceptions must be addressed. Let me first deal with NASA as a development-oriented agency. If one must generalize, my conclusion is that NASA in aggregate is indeed dominated by a "build-it" attitude, where the perceived challenge is mainly one of overcoming technical hurdles and of conceiving and implementing new, complex, sophisticated systems (sometimes overly so).

This has shown up in the past. For example, the decision to return to the moon after Apollo 11, largely for scientific reasons, was not uniformly popular in NASA. The predominant desire of the "Manned" space flight side was to get on with the Shuttle development. In some of the

early budget crunches, although Shuttle funding was also decreased, Apollo's 18-20 were completely deleted and Viking was delayed two years (I have no hesitation in believing that the Viking slip was a blessing).

With the end of Shuttle development in sight, there is an increasing sense of frustration in parts of NASA because there is no obvious major development goal to shoot for. Rationality is prevailing, but for awhile the desires were, on occasion, being expressed in the form of uncritical proposals for commitments to the likes of near-term space manufacturing and solar power satellites. Another related thought to ponder, as NASA is doing, is the possibility of contracting for the operation of the Space Shuttle when, and if, it becomes operationally routine -- the kind of thing that just does not require the same type of talents and interests NASA is known for and does well.

One can find examples, of course, of successful NASA long-term involvement in operations, e.g., launch vehicles Skylab, Kuiper Airborn Observatory, IUE, HEAO, Voyager, etc. but even in those systems much of the day-to-day routine effort is run by contractors.

A net result of NASA's orientation is a tendency, sometimes very subtle, to put development ahead of operations in the priorities. This is true on occasion even in Space Sciences, especially when a development project is in an overrun condition.

I conclude, not that it is wrong for NASA to be development-oriented, but that if there is a long-term high priority operational science program, an external well organized operator and advocate, such as the ST Science Institute, is a good thing.

The thrust of my talk now is to deal with the perceptions about the scientists in the hope that where they are valid the corrective action has been, or will be, taken and that where invalid the real situation can be demonstrated or at least advocated where judgment is required in place of hard fact.

1. Competitiveness and competency -- in the Office of Space Science we maintained that, all else being equal (yes, I'm aware that it usually isn't!), the science funding

should be used for the highest quality science, regardless of where the scientist is located. The most acceptable method at our disposal for ascertaining the quality of the science and of the scientist is by the proposal and peer-evaluation route. A study by the Physical Sciences Committee, published in May, 1976, was aimed at investigation among other things, of the balance between and the accountability of research projects at the NASA centers and at the universities. The Committee determined that they were satisfied, or "at least not dissatisfied" with the present balance of effort between NASA centers and universities but that the review procedure for in-house work needed to be beefed up with uniform procedures applied to both in-house and university research. That recommendation was implemented and should go a long way to assure that quality work is done across-the-board.

2. Guarantee of a job by dint of Civil Service -- there is some truth to this. However, the research money can be, and has been when warranted, cut off. The scientist still gets paid, albeit out of a different pot of money, and one can legitimately argue that taxpayer money is being wasted. Frequently, the scientist is transferred to another activity within NASA and on occasion leaves. It is not, I admit, a good system; my only retort as regards the university community, is to tell you that the tenure system suffers in the same way.

3. Preferential consideration in allocation of research funding on account of salary being paid from a non-R&D "pot" of money. The PSC and NASA agreed that in-house research appears to be about 40% less expensive than university research. The recommendation was, simply, that NASA officials in charge of research funding maintain an awareness that the appearance is deceptive and that the real costs are about equal between centers and universities.

4. Spends full time on research without the intrusion of students and committees. There undoubtedly are NASA researchers who enjoy the luxury of full-time research. Equally true, of course, of a growing number of university-associated researchers who have recently been designated the "un-faculty," a class resulting from the filling-up of the tenured positions. That aside, my experience convinces me that a sizeable fraction (I can't tell you what fraction) of NASA scientists do their fare share of penance running or participating on committees, working groups,

project reviews, and budget reviews, or serving as project scientists, post-doc advisors, thesis or research advisors to grad students from near-by universities, or teaching. At any given time, in Space Science, there are apt to be 5 to 10 serving a one year sentence at Headquarters, along with another 15-20 full time. These scientists serve an invaluable function at both the Centers and Headquarters in advocating Space Science across the board and in making it an acceptable and vigorous part of the space program. There is one very great detriment to being a NASA scientist--the ability to travel to scientific meetings and to other laboratories is now severely limited by budget, relative to that of the university scientist, and often lowest priority when compared to project-related travel.

5. Exert undue influence on NASA Headquarters regarding science priorities and objectives. I think that at one time this may have been true to the extent that in the 1960's a large number of the Explorer missions had a high proportion of NASA experimenters. How much of that was a real bias caused by proximity to the decision making and how much to the fact that NASA had a lot of the recognized experts I can't say. What I can say is that the opening of the Explorer program to the announcement-of-opportunity process in 1974 certainly cut down on the likelihood of undue influence.

It is a fact -- one of the few maybe -- that participation on working groups and advisory committees can, and in my view ought to, influence priorities and objectives. A look at the membership of the NASA-related working groups and committees, including those of the Space Science Board, shows a dearth of NASA members, in fact below what I consider to be a correct proportion if it is assumed that the prime criterion for membership is scientific expertise. This is a genuine form of reverse discrimination, provable for one internal advisory committee which prohibited NASA membership (a policy I reversed when I found out about it).

6. Access to engineering capabilities which enhances competitive position. Quite true. A major part of the NASA center activity revolves around technology development and spacecraft engineering. Proximity to those activities, along with the ability to direct manpower resources to tackling areas of frontier science, has to result in a competitive edge -- if it doesn't, something is wrong. The question is, is this good or bad?

I maintain that it is good to the degree that the best science gets done and for the reason that there ought to be some perceived advantage to working at NASA. It is not good to the degree that an in-house, lesser quality scientist ends up on top of a technology which could be better exploited by an external scientist. The problem, then, is how to assure at least some competition for the technology and engineering resources.

This is a question of increasing concern to the university community as the cost of supporting engineering staffs become greater, for a host of reasons, and as the sophistication of the technology increasingly exceeds the capability of small university groups to understand and/or manage it.

A partial solution is to open up the technology, engineering, and research capabilities of the NASA centers to increased outside participation. This is indeed the intent of an item in Dr. Frosch's policy statement on academic involvement in the NASA R&D program. As you all know, policies are too often wonderful reading but frequently end up as nothing more than placebos. It is incumbent on both NASA and the academic community to assure that the intent of the policy is implemented. At this point, I'd like to suggest that, in view of the importance to astronomers of access to high quality facilities, and in view of the proscription on the ST Science Institute regarding internal engineering capabilities, that the management of the Institute, whoever that may be, work diligently with NASA to avail itself of the NASA capabilities, both facilities and people.

In summary, for a multitude of reasons, not all of which I've had time to adequately address, I believe that a strong NASA in-house science capability is essential to the health of the larger space science endeavor. Maintaining high quality and proper balance vis-a-vis the academic world depends upon your continued support of NASA through direct participation -- send some good graduates to work there and sweat through your share of committees and by vocal but constructive criticism when you think something is out of whack. There are many people in NASA who want to hear you.