names would embarrass his contacts and decrease his own effectiveness, it is almost certain that he is in fairly frequent touch with Cavanaugh, who has taken a special interest in the cancer program.

There seems to be a consensus among science policy buffs in Washington that, if anyone can negotiate with Cavanaugh and other White House people, Schmidt can. Schmidt is a straightforward and sensible man. As a managing partner of J. H. Whitney and Company, a venture capital firm in New York, he clearly has the business acumen the Administration respects. And, of course, unlike the scientists who have been protesting training cuts, Schmidt is a nonpartisan observer. If the White House is to change or modify its position, it seems certain that it will be Schmidt and people like him whose judgments will be persuasive.

While an effort at diplomacy is going on in one area of Washington, an attempt to win congressional action is being made in another. The scientists who have been unable to penetrate the White House have gotten through to Representative Paul G. Rogers, (D–Fla.), who has introduced a bill that would, in effect, reinstate the NIH training programs with only a few changes. Rogers' bill reportedly was written to a significant extent by officers of the American Association of Medical Colleges, an outfit whose members will be badly hurt by the loss of training money.

One of the Administration's primary objections to the training programs has stemmed from its belief that the money often goes to young men and women who, after getting 2 or 3 years of free education, go into private medical practice and get rich. These people, the Administration maintains, should take out loans, not rely on federal largesse. Although Rogers and his staff aides are not convinced that this is a serious problem, they were willing to try to handle it. The bill, therefore, provides that persons receiving training assistance be required to engage in research or teaching for 24 months for each academic year of training the government pays for. Anyone choosing not to meet that obligation, going into private practice instead, would have to repay the government.

The Rogers bill provides for a total of $643 million in training program funds for 3 years and includes an anti-impoundment clause to guarantee that the money will be spent. Whether Rogers' bill will pass the House is uncertain. Nor is it entirely clear how far Rogers will go in pushing for it, although there is no doubt that he is committed to health and research causes. It is possible, of course, that the anti-impoundment clause could stand in the way of the bill's passage, depending to some extent on what the Congress decides to do about this touchy issue in general. And it is possible that, even if the existing bill or some compromise version of it makes its way through the House and Senate, where Edward Kennedy (D–Mass.) is seen as the man to look to in health matters, Nixon would simply veto it. The outcome is therefore, to say the least, uncertain.

Meanwhile, back at the drawing board, biomedical leaders are talking about coming up with alternate proposals for systems of federal financing of training in biomedical sciences, but apparently none has actually been put together. However, as one investigator put it recently, "Something is bound to happen. We're just not going to abolish training, because the post-doc trainees are the ones who not only have bright ideas, as everyone points out, they're also the ones who do the work. They're essential. When it comes right down to it, we'll find a way to support them because we cannot do without them."

—BARBARA J. CULLITON

Space Shuttle: Despite Doubters, Project Will Probably Fly

The debate about the National Aeronautics and Space Administration's proposed space shuttle churned on in the Senate this month at hearings on authorizations and appropriations for the agency in fiscal 1974. The basic issue seems to be the wisdom of embarking on a costly new long-range project in a decade when NASA can expect only level funding at slightly more than $3 billion a year. The Administration has requested an appropriation of $475 million for development of shuttle plans in 1974, the beginning of a sharp rise in allocations which are expected to climb to $1 billion per annum in a couple of years.

Proponents of the shuttle say it is essential for retaining the United States' lead in space activities and that ultimately it will result in big savings. Opponents say the shuttle is not economical, that its introduction is premature, and that it will severely cut into other less glamorous but essential NASA scientific activities.

The Senate Committee on Aeronautical and Space Sciences tried to cast some new light on shuttle matters by staging something akin to a debate among a panel of six distinguished personages, equally divided on the advisability of plunging ahead with the shuttle. Pro-shuttle were Klaus P. Heiss, the economist who headed the 2-year study by Mathematica, Inc., of Princeton, N.J., that is being used to justify the project; Allen F. Donovan of the Aerospace Corporation; and Harrison (Jack) Schmitt, the geologist who went on the Apollo 17 mission. Antishuttle (at least for now) were Thomas Gold of the Cornell Center for Radiophysics and Space Research; George W. Rathjens, political science professor at the Massachusetts Institute of Technology; and James Van Allen of the University of Iowa.

It was a good debate for people who tire of having domestic problems and poor people injected into every discussion of national priorities. The only mention of such matters was made by Rathjens, who suggested that some of the NASA budget could better be used for lowering taxes or improving educa-

tion. Instead, the debate centered on allocations of funds within NASA. The cost figure stipulated by Mathematica —$8.05 billion for research, development, two prototypes, and three operational vehicles, plus launch facilities and extras—is viewed skeptically by those familiar with cost overruns.

A major problem is that the NASA budget is expected to remain more or less level through 1978. The rapidly rising shuttle budget (covering a 6-year development phase) will inevitably cause a slowdown or curtailment of many of the agency's other scientific activities. Since few people of knowledge or power in this field oppose the idea of the shuttle per se, the issue has boiled down to whether it is more desirable for NASA to keep its routine scientific applications flourishing or for it to plunge into a dramatic new project whose benefits to science and mankind simply cannot be quantified now.

Schmitt is one who believes in the latter course. At the hearings, Schmitt emphasized the need for imagination. "The shuttle gives license to our imagination," he said. He went on to imagine the shuttle as a stepping-stone to an orbiting space education facility for students of all nationalities and disciplines.

Sacrifices Made

On a more down-to-earth level, Gold, a scientist active in the early Apollo flights, pointed out that many unmanned projects, such as additional communication and earth resources satellites, the Grand Tour of the outer planets, and the High Energy Astronomical Observatory, have already been sacrificed because of determination to go ahead with the shuttle. Gold said that, if further projects were dropped, the United States might fall behind irretrievably: "We cannot afford to give up the lead for a while and hope to regain it later."

Van Allen, discoverer of the radiation belt by that name, took a somewhat different negative angle. He thought the shuttle would be fine if cost were not an important consideration. But, he maintained, it is not a matter of national urgency and is "at best a long-term investment" that would disable other projects clearly within the nation's capabilities. Summing it all up, he said that, if NASA dropped everything to build the shuttle, it would be as though "General Motors stopped building Chevies, Buicks, and Olds to build a steam-powered automobile."

The problem, the confident analyses of Mathematica and NASA notwithstanding, is that the long-term utility and costs of the shuttle are impossible to foresee. There is much disagreement on the likely extent of cost overruns, the savings the shuttle will make for satellite launches and operation, and the number of missions per year the shuttle will fly. Heiss *et al.* maintain that the shuttle will be cost-effective if it makes at least 30 flights a year, the current rate of satellite launchings. Donovan expressed confidence that the existence of the shuttle would stimulate traffic. Others such as Rathjens say there is no reason to anticipate this, since it flies in the face of current trends.

Uncertainties also surround the utility of the space tug, a returnable item (development price: $750 million) that is needed to boost payloads into a geosynchronous orbit 22,000 miles above the shuttle's low earth orbit. Gold doesn't think the tug is economically realistic because of the tremendous added weight the necessary fuel would impose. Others maintain the shuttle is hardly worth having unless the tug, scheduled for development 5 years later, is developed along with it. The tug would be used in about half of the shuttle's missions.

The shuttle's use to the military is a major selling point—Air Force activity would account for about half the missions. Yet the Air Force has made it clear that space activity is not high priority, and the shuttle program would get nowhere if it were left to the Department of Defense. The Air Force has said it would save money on expendable boosters by relying almost entirely on the shuttle for transporting its satellites. But Gold, for one, thinks it inconceivable that the military would place total reliance on shuttles, which are more vulnerable than boosters to accidents and sabotage.

Proponents say international cooperation will be one of the great spinoffs, although the extent of foreign interest in the shuttle has not been ascertained (the European Space Research Organization has tentatively agreed to build a sortie lab for manned scientific missions, after backing off from developing the expensive tug). Competition with the USSR is another factor, but it is not known whether the Soviets are contemplating a shuttle of their own.

Just why NASA wants the shuttle so much is not altogether clear. The primary arguments have been economic—that the shuttle would ultimately save billions of dollars in launch costs and would supply a means to repair, refurbish, and reuse satellites. However, NASA administrator James W. Fletcher has said the cost-benefit ratio is not the crucial factor—rather, it is the capability the shuttle would give people to work quickly and routinely in space. Indeed, NASA is very eager to keep its "manned option" so it can stay open to new possibilities, as well as (presumably) hang onto its reputation as a glamor agency.

Then there are practical but irrelevant motivations, such as the fact that shuttle work is expected to create 50,000 new jobs during peak developmental activity in 1977.

Visceral Reactions

In some respects, the debate is like that surrounding the SST—both sides have gut feelings about the shuttle. Oskar Morgenstern of the Mathematica study, for example, said he felt "intuitively" that the shuttle made sense. And Schmitt is driven by man's need to explore: "History does not allow us a choice," he said, "we must move with all deliberate speed."

SST logic is also in there. Senator Barry Goldwater (R–Ariz.), after proclaiming that the way to solve the space applications versus shuttle dilemma was to have "both," said his main reason for supporting shuttle development was, "I see no other source of jobs for young people."

Shuttle proponents have avoided at least two contentions: that its immediate development is vital to the onward march of science and mankind, and that it is a military necessity. The emotionalism accompanying the SST debate is not so visible when it comes to the shuttle—perhaps because it is an argument mainly among scientists, rather than advanced technology versus The People. In addition, the project appeals even to those such as Rathjens (coauthor of an antishuttle study by the Federation of American Scientists), who would merely like to see it postponed until more immediate national needs are met.

In a way, it is a dispute between the realists and those who dare to dream. Perhaps President Nixon was thinking of the shuttle when he spoke of "the lift of a driving dream." In any case, Nixon wants it, so it looks as though the nation will get it.

—CONSTANCE HOLDEN

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