

WHAT EVER HAPPENED TO FEDERAL FUNDS?

When federal funding contracts while research expands, a realignment of science goals with those of the sociopolitical community is increasingly urgent.

CRAIG HOSMER

IT HAS BEEN SAID that the way to get rich quick is to marry a rich woman. But that is not the only way as the scientific community discovered early in the 1950's. Its way was to romance a rich uncle.

But since all good things must come to an end, I think one may agree that the cozy relationship between the physical sciences and the federal treasury is on the rocks. And the situation is likely to worsen before it improves. In view of this state of affairs I want to analyze the trends in federal science spending and what they mean to the scientific community. I also want to look at some specific problem areas and suggest some alternate solutions.

Trend in science funding

The Eisenhower and Kennedy years were particularly good ones for science support. Government research and development expenditures increased an average of 15.1% annually during the Eisenhower administration and 16.6% during the Kennedy years. Under President Johnson, the percentage has continued to increase but only at a 3% annual average, which is less than the cost-of-living escalation.

Particularly significant is current fiscal year 1968, which actually saw a decline in federal research and development money of 1.2%. For next year the total is up 4.6% to \$17.3 billion, which is about 11% of the overall federal budget. One should note that research and development's fraction of the total budget has been

declining slowly but steadily since President Johnson's first budget in fiscal year 1965.

But percentages and even money totals alone fail to reveal three other significant trends in federal research and development spending. First, whereas formerly the bulk of the money was spent by the Pentagon and NASA, now slightly more than half of the research and development funds are controlled by other agencies of the government. Second, where previously the share for social sciences was negligible, the fiscal-year-1969 budget boosts it to \$238 million. Third, where basic research claimed a lion's share in the past, the fiscal-year-1969 budget puts an increasing emphasis on applied research aimed at results visible to the voting public. For example, marine science and technology is up 13% to \$516 million; transportation research moved up 16% to \$140 million; air-pollution research climbed 12% to \$138 million; and post-office research and development went up 58% to \$36.4 million. On the other hand, spending by the National Institutes of Health increased only 1%, with an Administration directive to put more emphasis on improved patient-care techniques and less on long-range research.

Another important point is that research and development spending accounts for almost half of the "controllable" portion of our \$186-billion federal budget this year. Research and development thus is in a highly competitive funding area; this is a fact of life facing the scientific fraternity.

There is no doubt at all that Congress, in addition to the President, will do some "controlling" this year. Congressman Wilbur Mills, chairman of the House Ways and Means Committee, has already been quoted as saying that research and development spending looks like a fertile area for some budget cutting.

Before I go further, I would like to state that I am a lawyer and a politician, not a scientist; but I believe in science as a farmer believes in seed. My attitude toward it is one of good will and confidence rather than any deep understanding. After a decade on the Joint Committee on Atomic Energy, I have seen enough research and talked to enough scientists to real-



The author is a Republican congressman from California who is a ranking member of the Joint Committee on Atomic Energy. He obtained his law degree from the U. of Southern California in 1940 and during 1948 was an attorney for AEC and special assistant US district attorney at Los Alamos. This article is based on a speech given last March at the Neutron Cross Sections and Technology Conference.



SUPER SCIENCE AGENCY: "coördination of effort and better use of funds."

ize the magnitude and significance of this national resource. I totally agree with Donald Hornig's assessment that "research and development is important because this is our future—it's the function of what our country can do in 5 to 10 years."

It would be a tragedy of the highest order if we allow ourselves to become intellectually sterilized by turning our backs on science while we wrestle with the here-and-now problems of Vietnam, crime and urban blight. To do this would be the worst kind of shortsightedness.

Reasons for shifts

From this standpoint, let me ask and try to answer the question: What has caused this leveling off and change in emphasis of federal research and development spending? My three answers are as follow.

First, the heavy financial cost of the Vietnam war is draining our resources and manpower. Its consequences are felt in every corner of this country, and they increase day by day. The public's moods are ever changing on how it wants its tax money spent. I believe that its love affair with science was cooling anyway, but there is no doubt that the added impact of the war has accelerated the process.

Second, events in recent years have focused attention on the neglected problems of our own domestic environment. In response to public demands, both the President and Congress want more direct and visible results from research and development dollars. Such things as pollution control, faster and safer transportation, better housing and crime control are now on top of the priority list.

Third, there appears to be a new emphasis on achieving national goals through research and development and considerably less concern—at least in the public's mind—about the acquisition of knowledge for its own sake. Such concepts as "World Leadership in Science," or "Leading the Transuranium Race," or "Closing the Accelerated Gap" are rather nebulous to the average citizen when compared with our immediate sociopolitical goals.

And new decision-making tools are being employed to shift research and development dollars quickly to the new areas of emphasis. The cost-effectiveness formulas of the economists, and

the Pentagon's Planning-Programming-Budgeting System (PPBS) are coming into widespread use as tools for federal budgeting. It is clear enough that cost-effectiveness formulas give applied research an edge over pure research. PPBS imposes a phase-by-phase check on progress through an entire project—from feasibility studies to production—at each stage measuring the chances for success in the next stage, thus weeding out the less promising programs at earlier stages than ever before.

The real world and spending

The real world and its environment in which science must compete for public funds is both troubled and highly competitive. Decision makers who allocate public dollars possess sharp, new decision-making tools. They are acutely aware of public pressures to ease irritating physical and social environmental conditions.

The most imposing feature of this real world is the Vietnam war, a seemingly endless one we are not allowed to win. Last summer's Middle-East war demonstrated that Uncle Sam always has to be where the action is. We appear also to be on the verge of another arms race. The Red Chinese are making frightening progress in their nuclear-weapons program, thus posing a new threat to the entire world. Our Atlantic alliance is in disarray. The French had already stopped being one of our allies when the British decided that they could not afford the price of remaining a world power. Our cities are being burned down because we have not paid sufficient attention to the problems of the slums. Federal social and welfare programs proliferate in number and cost while the American people strenuously balk at rising budgets, inflation and taxes.

As the pieces of this puzzle fall together, we begin to have a new and—for us—frightening thought: As a nation we can not do everything at one time. There simply are not enough resources and manpower to do everything that is necessary, much less desirable.

This is the real world. These are but a few of the irritations and concerns plaguing the tax-paying public. This is why the pressure is on the President and Congress. And this is the environment in which the scien-

tist has to operate as he tries to find another dollar for his research project. Research is still on the public's list of priorities, but it is not, for sure, to be found on the first page anymore.

Science and public opinion

What can the scientific community do about all this? I believe it must go back to the equation $PE = PM$ (Public Esteem equals Public Money) and consciously rekindle some of the public's former affection for science. I have the following practical public-relations suggestions.

- The science community should take greater pains to make clear that its efforts contribute directly and indirectly to progress benefiting every man, woman and child in the country. The public will not buy science for science's sake—so sell it to them for their own sake. Public interest is in the human sciences, man as a living being and man in his environment. That is where the money will be. Therefore adjust research priorities to the public's priorities to the extent possible. The public does not ask for a money-back guarantee if an idea fails, but it wants reasonable assurance of some visible benefits if it succeeds.

- The public should be reminded ceaselessly by scientists of their vital contributions to national security. There is no function more appropriate for the federal government than to provide for national defense. And there is no other purpose for which taxpayers more willingly approve expenditures. I do not mean that every research pig-in-a-poke stamped "national-security possibility" should be funded. I do mean that where there is such a possibility, scientists have a responsibility to their profession to make it clearly known.

- I respectfully recommend that scientists stop knocking exclusively on Uncle Sam's door for their research support and start going to rich private foundations for some of their money. They have largely stayed away from grants to the physical scientists. They have done so because the government was supporting them generously. Now that this is no longer a fact, it should be made known to the foundations and their assistance sought.

The future

There are many basic questions that big science will face sooner or later.

To find answers with which the scientific community can live, it will be necessary for scientists to understand these problems and influence their solution. Lacking this, one may be stuck with something intolerable.

Consider, for instance, the rising cost of big science: High-energy physics is an example. The 200-GeV accelerator will cost about \$0.5 billion to build and probably up to \$100 million a year to operate. Such annual operating costs would fund a thousand university research projects at \$100,000 per year and exceeds by about \$30 million the total Canadian budget for its very respectable atomic-energy program.

Big basic-science expenditures, whether in one great chunk like the 200 GeV or a package of smaller endeavors adding up to a similar price, will be increasingly difficult to come by. Improved selling techniques by the scientific fraternity and even major revisions in the scope of projects, their underlying philosophy, organization or even location may be required. For instance, a major project slated for location in one state satisfies only one congressman and two senators. Possibly it could be recast as a multi-state project that picks up additional support and votes.

Further, if projects are susceptible



"The science community should take greater pains to make clear that its efforts contribute directly and indirectly to progress benefiting every man, woman and child in the country. The public will not buy science for science's sake—so sell it to them for their own sake.

to proceeding in the context of an international joint venture with other nations sharing costs and thereby reducing our own, appropriations will be easier to obtain. Scientific endeavors are not exempt from the general public feeling that Uncle Sam should start inducing others to help pick up some of the tab. Big-science ventures have international ramifications anyway. In fact, one of the factors that led to the selection of Weston for the 200 GeV was its proximity to O'Hare International Airport and through flights around the world.

Stretch and versatility

Another approach science can make to enhance the attractiveness of its proposals is to design both stretch and versatility into them. The Joint Com-

mittee on Atomic Energy strongly recommended that the 200 GeV be designed to go up in power later with a minimum of additional capital cost. Robert Wilson has been able to accomplish this goal with a success far beyond the committee's expectations. I believe that this concept of expansion might be helpful in many projects.

The Omnitron being designed by Lawrence Radiation Laboratory scientists illustrates a somewhat different application of the expansion concept. Here a relatively modest \$26.5-million machine would serve the needs of a wide variety of scientific disciplines, including not only chemistry and physics, but also biology, medicine and the like.

Scientists are investigating a new concept of accelerating ions by add-

ing them to an electron cloud (PHYSICS TODAY, February, page 51). This may cut even further the cost of heavy-ion accelerators, thus illustrating that clever cost-cutting innovations in design also can be used to enhance a project's prospects.

I believe the scientific community also has to face the problem of cost cutting as it relates to eliminating a host of mission-oriented laboratories spread throughout the government that, in the aggregate, consume several billions of public funds annually. The Department of Agriculture's multifarious in-house research programs and agricultural experiment stations, including even a peanut-research station, are notorious examples. But almost every department and agency has self-perpetuating activities of this sort.

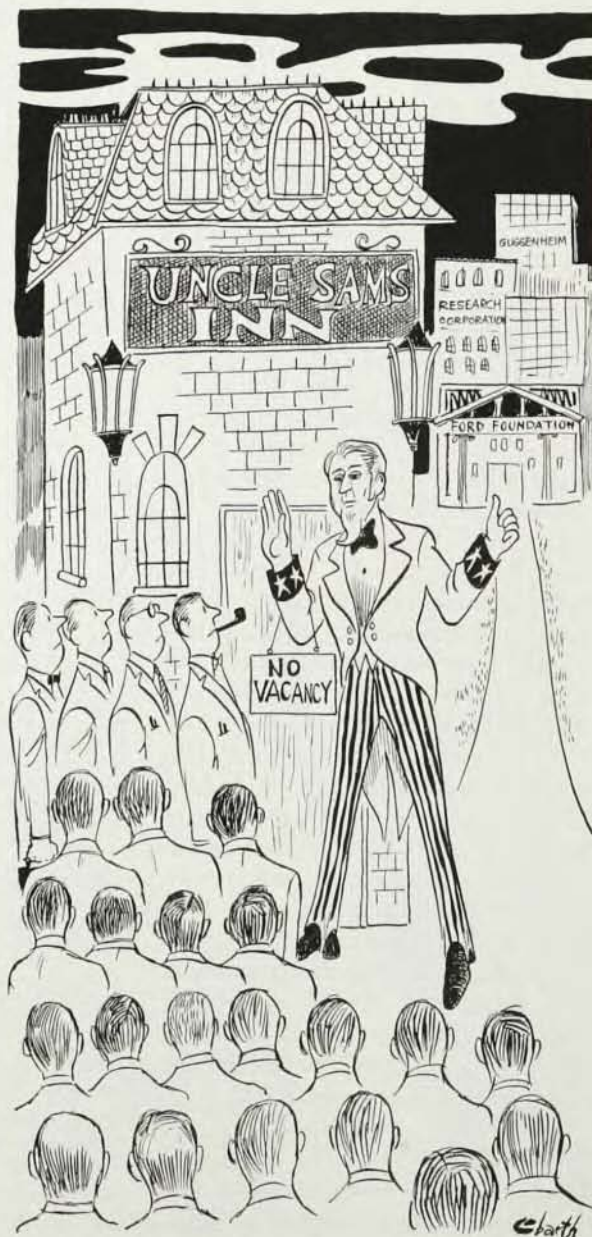
The analogy most commonly heard about these expensive facilities is that their existence is like the life cycle: They are born; they grow, and finally they reach maturity. But to follow that analogy to its logical conclusion, they also should die. But they do not appear to. Someday these labs will successfully complete their intended mission. And we certainly can not afford a Medicare program for old labs.

We have retirement programs for people. Should we also have a retirement program for laboratories? Should we perhaps think in terms of phasing out a laboratory over, for instance, five years? Over that period of time could we not direct the people and equipment toward new missions and new priorities? I think that we should concentrate on some of these anachronisms and give it a try.

Alternatives to AEC

Another basic question that we will have to consider sooner or later is commonly called the Atomic Energy Commission "national-laboratory problem." Within AEC, the question is how many and what kinds of labs should it be operating? To me, the answer to the first and controlling part of the question is "fewer" unless some basic changes are made in the AEC structure. Unless the AEC charter is revised to give it a responsibility to conduct research for other government agencies, it would appear that some of these facilities and programs would be better off under an

"I respectfully recommend that scientists stop knocking exclusively on Uncle Sam's door for their research support and start going to rich private foundations for some of their money."



organization more fundamentally oriented toward basic research such as the National Science Foundation.

You can not keep a major national laboratory facility operating just because you have some sort of sentimental attachment to it. If that were true, we might still be operating the Stagg Field reactor. And AEC can not justify many of its lines of basic research as particularly relevant to its nuclear responsibilities alone. Rather, in many respects, it is functioning *de facto* as the government's basic-research agency in several disciplines. Its budget bears the cost, and it controls the programs exclusively. Perhaps other government agencies that require the data produced ought to have some say about researching for it and ought to bear some share of the cost of the efforts.

AEC is skilled both in the conduct of in-house research and the techniques of contracting for it with universities and private laboratories. As a lawyer for AEC at Los Alamos, I helped to write the first postwar contract with the University of California for running the lab and know personally of the great difficulty in making workable contracts in the research and development area. Our new government departments and agencies such as Housing and Urban Development, the Department of Transportation and others have little, if any, skill in this area.

If AEC were recognized by law as the government's principal agency for research and development of all kinds, except possibly defense and space, with its services available to all other branches of the government (perhaps even to the states and cities as well), the problem of proliferating and self-perpetuating government in-house laboratories would become manageable. AEC could see to it that a fair share of research and development is contracted. Its national laboratories would receive invigorating new research challenges in both the physical and social sciences. These national laboratories would no longer need (as some of them appear to in order to justify their continued existence) to go out scouting for business in provinces usually reserved for the university and private laboratories.

As a matter of fact, unless AEC develops some function such as kind of a general-services administration

for major scientific programs, it could pass into history like the Brooklyn Navy Yard and its responsibilities would be diffused elsewhere.

I am not going to commit nuclear hari kari by suggesting that AEC should be boarded up tomorrow. But it is clear that there will not forever and ever be an AEC, at least by that name and by its present functions. One might reply that this is baloney: There will always be an AEC because there will always be a Joint Committee, and the Joint Committee is not about to let itself be legislated out of existence. Well, I have an answer for that. I predict that the Joint Committee will outlive the AEC. And there is a good justification for this prediction. Until someone figures out a way to un-invent atomic energy, there will be a need for a congressional committee specifically charged with overseeing nuclear programs. It would be a serious mistake to place responsibility for this tremendous force with a congressional committee that is more concerned with something else.

As far as AEC is concerned, there really are two major directions in which it can move over the long haul. One would be to evolve into a National Energy Commission. Under such a plan, most AEC research programs could be pawned off on another agency, leaving what is now the regulatory staff as the heart of the commission. This could be combined with the Federal Power Commission and related functions elsewhere in the government. I do not have the faintest idea how such a move might come about or where it might stop and start. But again, it is a concept slowly turning into a problem that should command the science fraternity's attention.

The other direction in which AEC could move is towards the science-agency concept that I mentioned above. Perhaps my semantics are bad: Let us call it a move towards some sort of Super Science agency, charged with conducting and overseeing government-sponsored research. I know the scientific community generally discards this idea as leading to a monolithic bureaucracy that would stifle rather than encourage research and development. But, as a general rule, AEC is fast and flexible with its \$2.5 billion per year, and I think it could retain the same char-



"Should we also have a retirement program for laboratories? . . . You can not keep a major national laboratory facility operating just because you have some sort of sentimental attachment to it."

acteristics even with \$17 billion or so to spend.

There is precedent for this kind of gathering together in one place and under one agency of related programs. President Johnson took a group of obscure federal agencies and shaped them into a Department of Transportation. He did the same thing with Housing and Urban Affairs. The objective in each instance was coordination of effort and better use of funds. Now we can look around and see such establishments as AEC, NBS, NSF, NASA, NIH and others all conducting various types of research, often duplicating the efforts of someone else. There must be at least two dozen committees in the executive branch charged with formulating science policy, and we still do not have a national science policy. In Congress alone there are 32 committees whose jurisdictions and interests encompass government policy, legislation and funding for various scientific and technological activities.

With all of this fragmented and duplicative effort, I am certain that someday the scientific community will be face to face with the prospect of a consolidation of federal science effort, by one method or another. The budget bureau already is reorganized to place the science-oriented agencies under one budget-review organization. Perhaps this is a straw in the wind. □