

objects never before observed. But scarcity of federal funds may force the panel to select only one proposal and to decide, to some extent, the direction of effort in radio astrophysical research for years to come.

Perspectives in Federal Physics Support—an Interview with Chalmers Sherwin

Basic research has perhaps no stronger supporter or more salutary critic in the counsels of government than Chalmers W. Sherwin, Deputy Assistant Secretary of Commerce for Science and Technology. In a recent interview we had with him at his office in the Commerce building, Sherwin told us that the real strategy for research should be one of coupling long-range scientific work to short-range practical results and that science could profit from a self-conscious analysis of its own methods. In the post-Vietnam period and beyond, he feels that science will gain increased support as the public attitude grows more sophisticated.

Sherwin, a former physics professor and researcher at Chicago, Columbia, MIT, and Illinois, and administrator for Aerospace Corp., had served as chief scientist of the Air Force and was Deputy Director of Defense Research and Engineering for Research and Technology before moving over to the Commerce Department last July as Herbert Hollomon's deputy. The 51-year-old scientist is also a member of the interagency Committee for Academic Science and Engineering (CASE) and consultant to several government offices.

While at DOD, Sherwin initiated two controversial and successful programs that have wide significance for future federal science support, Projects Themis and Hindsight. In Themis, the Defense Department is broadening its base of scientific support to the universities with programs that encourage university responsibility and strong leadership while fulfilling DOD needs. In Hindsight, DOD has endeavored to determine the extent of recent research and technology contributions to weapons systems employed by the department.

We began our discussion by asking him:

• *What do you feel are the most sig-*

Government agency sources say that even one \$20-million proposal, included as a separate line item in the next NSF budget, will encounter difficulty in Washington with possible geographic repercussions from Congress. Therefore, the strategy now is for the Dicke panel to make as strong a rec-

nificant results that Project Hindsight has for basic research?

"Hindsight showed a broad lack of coupling between basic and applied research during the previous 20 years, which the country will no longer permit. On the military-type equipment with which we dealt, recent undirected science made a very small impact. Our project also showed that although universities produced about 12% of all innovations, almost all were the result of 'contract research centers' or 'programs,' such as the Tri-Service Electronics Programs. This is where you get the programs to carry on basic research. The best strategy for research is to relate it to a mission and associate it with a strong leader. Hindsight said, in effect, 'If you want research funds, couple your request to an understandable need and justify the relevant long-range work by short-range practical results.'"

• *Is this not what you are trying to ac-*

ommendation as possible, carrying with it not only the support of competing groups but the sentiment of the entire science community. Only then can NSF use the prestige of this committee as a means of going to the Bureau of the Budget and Congress for necessary funds.

comply in initiating the Project Themis program?

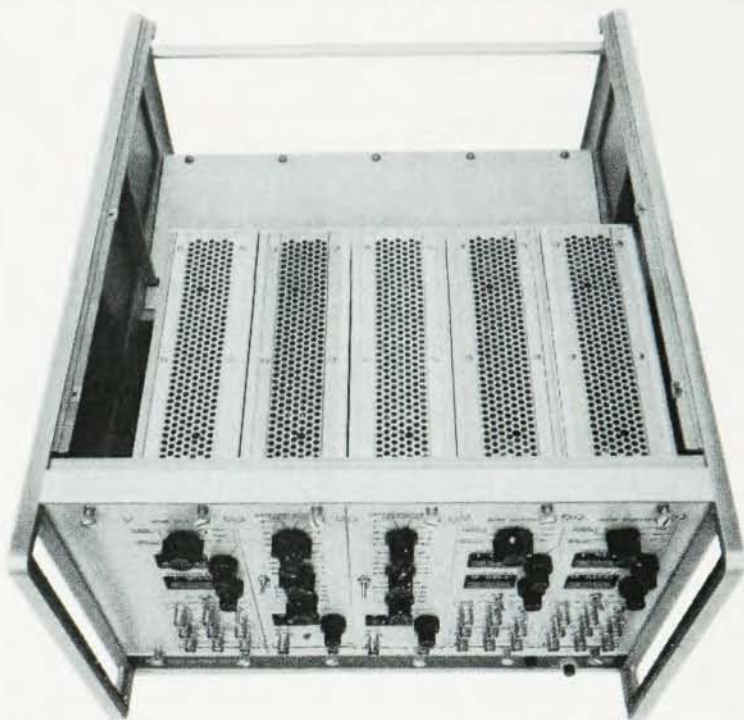
"Under the Themis concept, both basic and applied studies can exist side by side under university management. Themis gives the university responsibility and flexibility besides building local leadership. The advantage of this type of basic science support is that it provides a long-term stable justification to the people who look for results and pay the bills. I know of some beautiful general-relativity-gyroscope-precession experiments conducted at Stanford University under the program. Other experiments at MIT Lincoln Laboratories involve the effect of the solar gravitational field on the speed of light. In a basic-applied environment, scientists get to see some of the applied work and become educated in the potential excitement and intellectual satisfaction of good applied science."

• *In the future will basic research sup-*



SHERWIN: "We must do only those experiments that are crucial to theoretical issues. Some scientists seem to want to do research only if it is useless."

Can this NIM power supply give you unequalled performance?



That's a safe bet.

Module protection and a ± 6 V capability ideal for integrated circuits work are two unique features in the new Hewlett-Packard 5580 NIM Power Supply. The 5580 conforms to AEC voltage standards (TID—20893), has ± 24 V, ± 12 V and ± 6 V outputs—furnishes 120 watts output power. Plus built-in overvoltage protection, blower-cooling for better reliability. This total performance is the result of the 5580's being built to HP's own exacting standards—it could make the difference between stable operation or drift and premature failure.

Modules powered by the 5580 are protected by a warning light to indicate when marginal operation might endanger

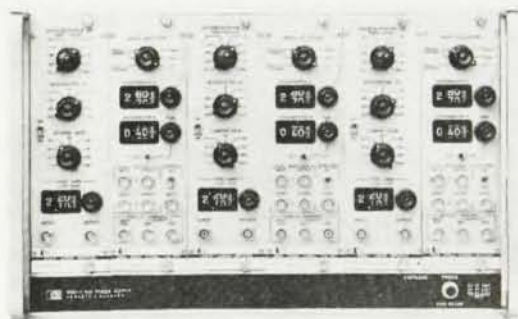
the validity of your data. Specially-designed current-limiting protection circuits act automatically to prevent costly damage from shorts and overloads in your modules. The mutual impedance between modules is very low, which prevents loading at one connector block from adversely affecting the dc voltages at other connector blocks.

For applications not requiring the full range of output voltages the 5580 can be ordered with only two or four supplies, can later be expanded to a 6-voltage supply simply by adding plug-in circuit boards.

The 5580B has space for 12 module widths. The 5580A has space for 11 module widths and is packaged to be compatible with the standard Hewlett-Packard modular enclosure system. Both models are identical electrically, both are rack mount or bench top convertible. Price: 5580B (12 module width), \$825; 5580A, \$775.

For more information on this and the other nuclear instrumentation offered by HP, call your Hewlett-Packard field engineer or write Jim Sheldon, Hewlett-Packard, Palo Alto, California 94304; Europe: 54 Route des Acacias, Geneva.

5580B with three HP 5582A Linear Amplifiers and three HP 5583A Single Channel Analyzers installed.



HEWLETT  **PACKARD**
NUCLEAR INSTRUMENTS

port lie largely with this mix of applied and undirected science?

"Yes, through relating a social need to the schools as in Themis. On the other hand, for those scientists who decide they want to do research unrelated to a social need—whose only concern is to advance fundamental knowledge—I believe that a self-conscious analysis of their scientific activity is in order. In the future we must do only those experiments that are crucial to theoretical issues. Some scientists seem to want to do research only if it is useless."

• Do you feel that basic science could profitably perform its own hindsight analysis over a longer time period?

"I think one could learn a great deal about how to proceed more efficiently in basic science by a retrospective analysis of the really critical contributions. Basic science should look at what basic science has done. If they want to have a happy future, scientists should invest their time in a study of their own accomplishments. John Platt, formerly of the University of Chicago, makes the point in various articles and books that, in high-energy physics and molecular biology, a very sharply focused pattern of research has developed, aimed not at the truth but on blocking out error efficiently. He feels this approach accounts for their very high rates of progress."

"I believe the theory of the efficient advance of scientific knowledge is an open subject for research. Until a systematic analysis of what scientific discoveries were really critical historically, we really don't know what the relation is between focused and unfocused effort. Such a study is probably one of the most valuable activities of society in the long run, and yet it is not being subjected to critical understanding by anybody, least of all by scientists."

• Do you think that the pure physicist whose devotion is only to his subject will become an increasingly rare individual in the future?

"A smaller fraction of physicists today and in the future, no matter what their inclinations, are going to do the really frontier basic science, simply because of the high unit costs. Many who want to do basic research because

of the long tradition of the community are just not going to be funded unless they invent a new frontier field that is relatively inexpensive."

"On the other hand, there are tremendous opportunities in the newer fields of oceanography and transportation where a good physics training makes an ideal basis. Physics has practically taken over the chemistry analysis business. There is a wonderful future for physics in the whole field of medical instrumentation."

• But the newer disciplines that attack our social problems do not generally require extensive application of physics research.

"That is true. The needs of society today are not matched by physics to the same degree they were 20 years ago. One reason, of course, is that the frontiers of physics have moved well away from urgent practical affairs. Basic science is in crisis, a crisis caused by success."

• What do you foresee after Vietnam for basic research support?

UNESCO Sponsors Project For Teaching Crystallography

United Nations Educational, Scientific and Cultural Organization will sponsor a pilot project on the teaching of crystallography in relation to the physics and chemistry of solids. The endeavor will concentrate on developing new learning materials that can be integrated into existing curricula or that may inspire new approaches.

The International Union of Crystallography will collaborate with UNESCO on the project, and the International Commission on Physics Education of the International Union of Pure and Applied Physics will help publicize it. It is expected that groups will form in several countries at laboratories known for their research and teaching and that such groups will be the focal points of activity for carrying out the project. All proposals can be sent to (and further information can be obtained from) A. Guinier, chairman of the teaching commission of IUCr, Laboratoire de Physique du Solide, Faculté des Sciences, Bâtiment 210, Orsay (Essonne), France; with a carbon copy to N. Joel, UNESCO, Place Fontenay, Paris 7, France.

"The United States is an extremely wealthy country, and we can even now increase enormously our basic-research effort. But we are afraid to let loose and spend our resources on public goals: increased scientific research as well as pollution control and improved cities. We still have a Depression mentality; we still remember the days of poverty for most of us. We lack only the will to accomplish our many goals."

• How long will it be before the public is sufficiently sophisticated to exercise this will?

"I say it will be another decade before we realize we are rich and know how to spend our riches. And I also think the fine arts and other activities that don't have immediate economic or social benefits will also profit. In other words, we will be able to afford a whole lot of elegant, complicated and exciting intellectual activities that we never had thought we could afford before. And I think science will share in this realization."

—BH

AIP Initiates New Manpower Surveys with NSF Support

A study of attrition from the ranks of physics students and another on supply and demand for research physics personnel will be undertaken by the Education and Manpower division of the American Institute of Physics under a recent grant of \$63 825 for two years from the National Science Foundation. Susanne Ellis, who will supervise the two new programs, explained to PHYSICS TODAY that the new studies will pursue questions raised by previous studies. The older programs, initiated under NSF grants which led to the report *Physics Manpower 1966* (PHYSICS TODAY, January, page 103), are being carried on with AIP funds.

The study of attrition among students begins with undergraduate physics majors at the junior and senior level and follows those students who comprise the attrition between successive physics degrees. A similar survey was previously conducted by the Education and Manpower division (PHYSICS TODAY, March, page 75), but then it was the physics department chairmen who supplied only general reasons for student dropout. In the new survey