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Perl, Drell, York differ on SALT future

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What next for programs dropped by AEC?

Prospects for the support of AEC-terminated physics research programs by the NSF are uncertain. NSF is in the midst of considering grant proposals from those being dropped, not only by AEC, but also the Defense Department, NASA and NSF's own Science Development grantees. If Congress approves the entire presidential budget request, NSF physics project-support programs are expected to be able to provide of the order of 40–50 cents on the dollar to dropped projects if all available incremental funds were used for this purpose.

The AEC Division of Research, which supports physics, chemistry, mathematics and computers, is completely terminating 136 contracts, amounting to $7.5 million. In addition, many contracts are being drastically curtailed. The AEC, which spent $271.4 million in operating funds for fiscal year 1971 for physical research, has but $259.5 million earmarked for that program in the President's budget for fiscal 1972 (*physics today*, April, page 65). More recently the President submitted a revised budget request for an increase of $4.1 million in costs for AEC's physical research program. Of the increase, $2 million would go for high-energy physics—$1 million to help the National Accelerator Laboratory prepare better for experiments, $650 000 for Brookhaven National Laboratory, which has just completed conversion of its Alternating Gradient Synchrotron, and $350 000 for the Stanford Linear Accelerator Center for its electron–positron storage ring. The controlled thermonuclear research program would receive another $1.8 million and medium-energy physics would get an additional $300 000 (all for the Los Alamos Meson Physics Facility and associated users groups).

"What criteria did AEC use for terminating its contracts?" we asked George Kolstad, assistant director of research for physics and mathematics. He cited a variety of reasons. AEC support of C. S. Wu in medium- and low-energy physics is being terminated, for example, because her intermediate-energy research is conducted at Columbia's Nevis Laboratory, which already is supported by NSF. AEC felt it made more sense administratively to support all of Wu's nuclear-physics research in the same agency, namely NSF. Other very good investigators were terminated, too, largely because AEC felt sure they would be picked up, Kolstad said. "Of course we have some work being dropped that is perhaps somewhat less germane to AEC's mission," he remarked. AEC is increasingly aware of supporting work related to its mission, he said. For example, AEC could not expect NSF to support its neutron cross-section work or its work in isotope separation; so AEC continues to support such efforts.

Many of the contracts are being terminated at the end of September, which is likely to be before NSF can hope to know how much money Congress will give it to spend in fiscal 1972. Kolstad explained that AEC has to meet its lower cost ceiling by terminating contracts earlier than would otherwise be desirable in some cases.

After a meeting between AEC Chairman Glenn Seaborg, NSF Director William McElroy and Presidental Science Adviser Edward David Jr to discuss the transfer, AEC sent out

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Perl, Drell, York differ on SALT future

Physicists speaking in public on the nuclear arms problem are agreed that, with the nuclear weapon inventory now at 10 tons TNT equivalent for each person on earth, there is little to point to in the way of concrete progress. They differ in their degree of pessimism, however, about the future and what the SALT (Strategic Arms Limitations Talks) might be able to contribute to slowing down or even reversing the arms race.

Speaking at the Spring Meeting of the APS in Washington, Martin Perl (professor, Stanford Linear Accelerator Center) argued that the 12-month-old SALT discussions must already be written off as futile. In his opinion the most that can be hoped for from these talks will be the ban on ABM's (plus possibly a freeze on land missiles) that the two participants recently agreed to agree on. But Perl believes such bans will not arrest the nuclear arms spiral. Expressing the opposite opinion, Sidney Drell (deputy director at SLAC) said in a recent address at Columbia that the SALT talks represent the best hope that he can see for shutting down the arms race. In his opinion SALT might lead to a ban on future tests of offensive weapons systems including MIRV but the highest priority should be placed on getting the ABM limit out of SALT, a goal that the two nations have committed themselves to. Drell, unlike Perl, believes the ABM limit is essential to halting escalation.

DRELL

Taking a position somewhere between these two, another speaker at the Washington Meeting, Herbert York (acting chancellor of University of California, San Diego), observed that "the SALT talks, by their very name are designed to

slow down, or at best, to stop some elements of the arms race. They are not designed to roll back the arms race, except perhaps in some minor ways." York argues that the SALT talks will prove useful only if they set the stage for later negotiations on actually reducing the level of nuclear armaments.

In commenting later on the new SALT development, York said he was cheered by the news but noted that it involved only an agreement on agenda and did not represent a concrete achievement.

In his talk York reviewed the 25-year

YORK

history of the arms race and concluded that agreements that merely limit arms efforts have not helped. He joined with Perl in asserting that the most significant of these agreements, the Limited Test Ban Treaty, has in retrospect made matters worse. First the rate of weapons testing has actually increased since the treaty went into effect in 1963. Because the testing is now all underground, radioactive fallout no longer threatens the environment. But eliminating fallout, the treaty has made things worse, York contends, by at the same time eliminating public interest in the arms race.

He is concerned that if we get a freeze on ABM and some missiles at SALT and nothing more is done, the number of deployed warheads will continue to multiply. Following any agreements reached at SALT there must, in his opinion, be a determined effort to negotiate a substantial rollback of nuclear arms. For example, complete elimination by both nations of one of the three existing deterrent systems (land-based missiles, submarines and manned bombers) and reduction of one of the others. York believes that both nations would be able to verify that there was no cheating without requiring on-site inspection.

In Perl's view the most serious threats to stabilization of the arms race are the deployment of MIRV warheads and continued research and development on weapons technology. The deterrence value of land-based missiles is founded on the assumption that an enemy has to use at least one missile to destroy one of his opponent's missiles. But MIRV has changed this balance. Armed with three to ten warheads (each of which can be preset to hit a different ground target), a single MIRV missile might be able to destroy several of the opponent's land-based missiles. Thus with MIRV one nation would have the capability of wiping out the other's land-based missiles in a first strike.

An even greater source of escalation to Perl's mind is the continual R and D effort that produces destabilizing innovations such as MIRV about every four years. For instance, if our own current R and D efforts were to give just a hint that a method could be developed to carry out a successful first strike against the opponent's nuclear-submarine deterrent, then we would worry that our own submarine fleet would no longer be invulnerable in a few years and we would begin now scurrying around to find counter-counter measures—just as both we and the Soviets are already doing to try to defend against MIRV. Perl argues that nuclear stability will be impossible until there is a ban on further research, development and testing. However, he feels that the chances of SALT agreeing on such a ban are even more remote than they are for a ban on MIRV.

He proposes that a unilateral halt in R and D on the part of the US (with the hope that the Soviets would follow suit) would present less of a risk than the continuing arms escalation. However, he admits that such a move would be politically unacceptable to our government although some Congressmen are becoming interested in trying to restrict funds for weapons research. Perl suggests that the only course remaining at this time is to appeal directly to scientists and engineers to refuse to do weapons research.

In his talk at Columbia, Drell cited three major obstacles to progress in the SALT negotiations: Foremost is the need for precise and unambiguous definition of each nation's policy goals. He gave examples of widely differing views among political and military leaders in the US about our treaty aims and about the meanings of terms such as "deterrence" and "nuclear sufficiency."

Second is the problem of verifying that there are no violations of arms-control treaties. Like Herbert York, Drell is optimistic that each nation would not need on-site inspection to assure itself that clandestine efforts are not taking place that could imperil its deterrent. He suggests that it should be especially easy to verify compliance with a ban against testing and deployment of new weapons system and that, in general, big steps in arms limitations are less sensitive to cheating than small steps.

The third problem Drell sees is that of agreeing on strategic-force trade-offs

PERL

once an arms rollback got under way due to the difference in US and Soviet forces and geography. This problem, he believes, does not present the same kind of obstacle to SALT as the policy-definition and verification problems, which are central and of crucial importance.

According to Drell, an important function of SALT is to serve as a "more or less permanent forum," which eventually will create the political climate that would make arms-control agreements possible.

Most crucial among the political issues to be resolved in Drell's view is the need for unambiguous definition of policy. At this point some Administration officials define "deterrent" to mean massive retaliation against industry and population, while other officials say that our deterrent must be capable of selective response against military targets and missile silos and also capable of limiting the damage to ourselves from small attacks or accidental launches or even "ensure military victory" following a larger attack. We will be un-

able to get anywhere at SALT, Drell argues, until we make up our minds (and the Soviets likewise) whether we are pursuing the former strategy ("minimum deterrent") or the latter ("selective response"). His own analysis of these two options leads him to conclude that a strategy that would include fighting and winning nuclear wars would make arms-reduction agreements all but impossible. Any system designed to minimize losses from a small or medium-sized attack would have to have, at least, an elaborate ABM network. But such a network, together with accurate MIRV warheads threatening an opponent's unlaunched missiles, would always give us the potential for a preemptive first strike. The other side could legitimately worry whether we intend to launch an attack hoping to knock out many of their missiles and then intercept the retaliatory missiles that can still function with our ABM.

In terms of what to try for at SALT, Drell would opt not only for a ban on ABM but also a ban on the testing and deployment of new weapons. He believes that the Soviets have not tested MIRV yet, so that a ban in the near future on testing could still stop MIRV. (This assumes that the Soviets would be willing to trust their intelligence reports gathered in our open society to verify that we have honored an agreement on our part to withdraw the MIRV we have already deployed.) Directly counter to what Martin Perl proposes, Drell would want a strong research and development program on new weapons to continue under a ban on full-scale system testing. He feels this kind of effort would protect us against technological surprises that could erode our deterrent.

Drell's reaction to the more recent SALT announcement was that it provides a clear negotiating framework as well as a political commitment at the highest level to achieve agreement.

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AEC programs

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termination letters that urged their recipients to submit proposals to NSF. Edward Creutz, NSF assistant director for research, then sent a memorandum to his program directors, advising them on criteria for picking up projects. He said: Projects of highest scientific merit should be supported even if some NSF grantees must be terminated. Below this outstanding class, in cases of proposals of substantially equal merit being dropped by AEC, these should be given preference over new starts within the same field because of this latest $7.5-million budget cut. Proposals from AEC-supported scientists should be treated according to the usual criteria if they have not been identified as "dropouts." For some scientists with proposals of significant merit, NSF may have to give interim support until it knows what its full budget is.

Contracts dropped. AEC showed us a list of those contracts being terminated in low and intermediate-energy physics, including not only nuclear physics but also atomic and low-temperature physics (see table). The dollar amount given is the approximate annual rate. Kolstad remarked that these support levels were already squeezed back from prior budget crunches; so they do not represent adequate support levels for the groups affected.

No new facilities have been authorized for several years by the AEC Division of Research. This means that as installations now being built or currently in operation grow old, Kolstad said, a hiatus can be expected to develop in frontier areas of research.

A similar note was struck by theorist Keith Brueckner, whose contract (at the University of California in San Diego) for $130 000 ends on 30 September; he decried the lack of new machines for nuclear physics. He feels that the funding for nuclear-structure physics has been in a bad way in the United States for half a dozen years. "The development of new work in experimental physics in Southern California has been prevented as a consequence." The contrast between the sterile environment in the US and the rapid development in Europe is quite striking, Brueckner said. The San Diego contract supported three postdoctorals, six or seven graduate students and three faculty. He suspects that if NSF picks them up it will be at about half the level they got from AEC.

In intermediate-energy physics AEC felt a commitment to support the new MIT electron linac and LAMPF, Kolstad said, and this dictated the termination of the contracts at the University of California at Davis and at Texas A & M University. The Davis operation is essentially built around the 76-inch isochronous cyclotron, which started running in 1967. Kolstad said that the entire department would essentially be wiped out unless some corrective action is taken. Both the experimental and theoretical programs are being terminated. John Jungerman told us that the Davis group is attempting to diversify. For example they are developing trace-element analysis using the cyclotron and are hoping for support from the NSF RANN (Research Applied to National Needs) program and from the Environmental Protection Agency. They are also doing work in nuclear medicine and radio chemistry, which they hope will be supported. Jungerman feels that nuclear physics will continue to be supported, but the level of support is not clear.

Texas A & M has a variable-energy 88-inch cyclotron with provision for heavy ions; it was in the process of building a polarized-ion source as well. In addition to the main AEC physics contract for $530 000, AEC had also given several chemistry contracts that will continue (provided the accelerator continues to run), according to A. D. Suttle. The group also received three-year grants from the Robert A. Welch Foundation for nuclear chemistry and some contracts for biomedical work from various Texas medical centers, bringing the total support to about $1.5

AEC Terminations in Low- and Medium-Energy Physics

Contract	Amount
Univ. of Arizona, Douglas Donahue	$ 95 000
Univ. of California, Davis, John A. Jungerman	520 000
Univ. of California, Davis, Kenneth Greider and William True	125 000
Univ. of California, Los Angeles, Leon Knopoff	35 000
Univ. of California, San Diego, Keith Brueckner	130 000
Univ. of California, Santa Barbara, Paul H. Barrett	35 000
Case Western Reserve, R. M. Thaler and Harvey Willard	151 000
Catholic Univ. of America, Robert Deutsch	40 000
Columbia Univ., C. S. Wu	180 000
Cornell Univ., David D. Clark	35 000
Johns Hopkins Univ., Brian Judd and Henry Crosswhite Jr	60 000
Univ. of Kansas, Ralph Krone	170 000
Kansas State Univ., Walter Meyer and John Mingle	40 000
Univ. of Maryland, William Hornyak	150 000
Michigan State Univ., Peter Signell, Hugh McManus, Jerzy Borysowicz and K. Kolltveit	150 000
Univ. of Michigan, H. R. Crane	350 000
Univ. of Notre Dame, Charles Mullin and John Mihelich	175 000
Oregon State Univ., V. A. Madsen and Wilson Au	19 000
Univ. of Oregon, Bernd Crasemann and Amit Goswami	201 000
Purdue Univ., Rolf Steffen	350 000
Texas A & M Univ., A. D. Suttle Jr and Ronald MacFarlane	530 000
Univ. of Wisconsin, J. R. Dillinger	65 000
Yeshiva Univ., A. G. W. Cameron	35 000