efficiency, which the President seems to seek. But success has yet to be attained, "and the vote won't be in for another 2 or 3 years," Ruckelshaus says, or perhaps fervently hopes.

Nevertheless, he and other EPA officials are convinced that their reorganization plan has already produced a fresh, if somewhat shell-shocked new agency—one in which administrative control is tighter from the top down and where communication is freer from the bottom up. Lines of authority have been simplified and shortened, with the result that some pollution programs have been disencumbered of at least two layers of bureaucracy, and once obscure subagencies and far-flung laboratories now feel as if they are "right in the ball game," as Howard Messner says.

At headquarters, he asserts, the new centralization of authority around Ruckelshaus makes for new accountability in decision-making. "For individual administrators, we've moved from a low-risk to a high-risk operation. . . . What we're seeking is accountability—define a mission, tell somebody to do it, and watch how he performs."

"A lot of guys are going to have new heartaches and headaches," Messner says, "but I suspect it's what the President wanted."—ROBERT GILLETTE

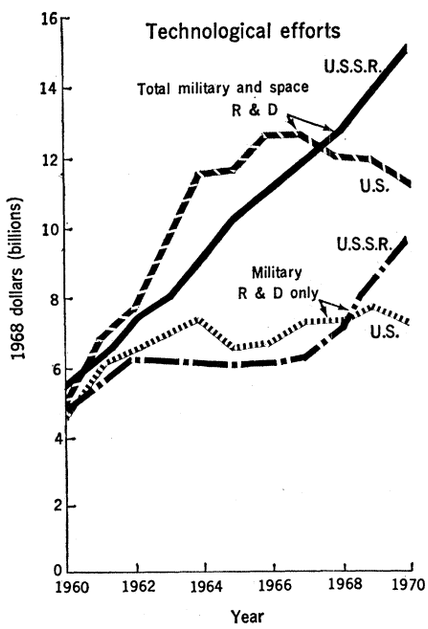
Arms Race: Scientists Question Threat from Soviet Military R&D

In a well-documented presentation before Congress, the Federation of American Scientists (FAS) has released a good deal of steam from the Defense Department's latest drive to inflate its budget on the basis of a threat from the Soviet Union. In the process, FAS has established itself as a source of independent expertise on military matters. The arms race just could slow down somewhat as a result.

"If the Soviets continue to increase their effort devoted to military-related research and development, and we continue our present trend," John S. Foster, Jr., the Defense Department's director of research and engineering, told a House subcommittee, "within the next few years the Soviet Union will assume technological superiority."

In a series of such statements over the past year, Foster and his colleagues have actively broadcast the notion of a gap in weapons technology between the Soviets and the United States. In their view, the gap may engender a "technological surprise" in the form of a weapon for which we lack adequate defense or deterrent power. Research and development has thus appeared as the latest generation in the family of gaps that the Defense Department presents to the Congress and the public from time to time as rationale for increased funds. In 1955 it was the bomber gap, in 1960 the missile gap, in 1967 the ABM, and in 1969 the large-missile gap.

Unlike its predecessors, the technology gap does not come attached to requests for specific weapons systems. Rather, as Foster put it, the new analysis of a potential Soviet threat is "presented as background to provide an understanding of the current situation and give some indication of what the U.S. has to do in the future if it is to cope with the problem." The Pentagon is seeking primarily to reverse a downward trend in congressional appropriations for military R&D and then, perhaps, to create an atmosphere in which Congress might be increasingly willing to spend more in the years to come. Congress cut the Administration's requests for military R&D by $1.1 and $0.4 billion for the past 2 fiscal years. The budget for fiscal 1972, still before Congress, contains a request for an $800 million increase over the 1971 level of $7.0 billion.



Defense Department figures comparing U.S. and U.S.S.R. expenditures for military and space technology. Both the Federation of American Scientists and the General Accounting Office have questioned the reliability of the techniques used to determine these amounts.

The Pentagon's strategy appears, however, to be falling far short of its goals—due primarily to the efforts of FAS to demonstrate that the technology gap is little more than a figment of the Pentagon's imagination. In a scholarly report issued 6 May * entitled *Is There an R&D Gap?*, and in subsequent testimony before Congress, FAS has doggedly pursued Foster and his associates, focusing both on contradictions and discrepancies in their public statements and on flaws in the methodology they used to analyze the supposed threat. The report noted that Foster has successively argued that the United States will lose its technological superiority in "a decade," "the next several years," "in two years," "in the latter half of this decade," and "in the middle of this decade." "This entire episode," concluded the FAS report, "has been a classical numbers game featuring selective disclosure, questionable assumptions, exaggeratedly precise statements, misleading language, and alarmist, non sequitur conclusions."

To date, the FAS has achieved surprising success in its challenge to the Pentagon. Several influential members of Congress have listened to their ar-

* A copy of the report, along with extensive testimony and the Defense Department's response can be found in part 4 of the 1972 Senate *Hearings on Authorization for Military Procurement.* Available free of charge from the Senate Armed Services Committee, Washington, D.C. 20510.

NEWS & NOTES

● **MEETING SOUTH OF THE BORDER**: The AAAS will join with Mexico's newly formed Consejo Nacional de Ciencia y Tecnologia to hold the first general inter-American meeting on science and technology, in July 1973. The 3-week gathering, to take place in Mexico City, will be largely devoted to meetings of societies representing special fields of science. One week is earmarked for discussions of interdisciplinary problems of science and ways in which science and technology can be directed toward resolving problems of society. Some 5000 scientists from all countries in the Western Hemisphere are expected to attend.

● **NAS ANNOUNCES SLAVIC PROGRAM**: The National Academy of Sciences is accepting applications from scientists for expense-paid trips to Russia and Eastern Europe. Under agreements with the academies of science of the U.S.S.R., Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and Yugoslavia, American scientists may make 1-month visits to acquaint themselves with foreign research efforts, or 3- to 12-month visits to perform research. The NAS pays the bill, including reimbursement of salary lost during long visits. Applicants must be U.S. citizens and have a doctoral degree or its equivalent in physical, biological, or behavioral sciences, mathematics, or engineering sciences. Applications should be made to the NAS, Office of the Foreign Secretary (U.S.S.R./EE), Washington, D.C. 20418, before 22 November.

● **TURNOVER AT OST**: John Dickson Baldeschwieler, a 37-year-old chemistry professor at Stanford University, was confirmed by the Senate on 29 July as successor to Hubert Heffner, who for the last 2 years has been deputy director of the Office of Science and Technology. Heffner resigned as of 15 July to return to Stanford, where he is a professor of engineering and applied physics. Baldeschwieler has been on the President's Science Advisory Committee since May 1969 and has served as its vice-chairman since last spring. Holder of a Ph.D. in physical chemistry from the University of California at Berkeley, Baldeschwieler taught at Harvard for 5 years before joining the Stanford faculty in 1965.

guments attentively, and an independent study by the General Accounting Office (GAO) backed up the FAS position. Furthermore, the soon-to-be-released annual report of the Senate Armed Services Committee is likely to side with the FAS, thereby issuing a blow to Foster's credibility. The FAS challenge comes in an area where Pentagon witnesses have often appeared in the past as the sole experts. But the FAS is not lacking its own experts, and Congress can hardly dismiss FAS witnesses as misinformed pacifists. Chairing the 26-year-old organization, which was recently resuscitated as "the voice of science on Capitol Hill" (*Science* 26 March) is Herbert F. York, the occupant of Foster's Pentagon position from 1958 to 1961. In addition, the group that authored the report on the R&D gap consists of four well-seasoned arms experts, one of them a former Defense Department employee †.

At the heart of the Defense Department's concern about Soviet weapons technology is the belief that the Russians are now outspending us at the rate of some $3 billion per year for military RDT&E (research, development, test, and evaluation). This fact was revealed, according to Foster, by recently devised intelligence techniques for analyzing the Soviet budget. This analysis disclosed that since 1968 the Soviets have shifted from an emphasis on investment in technology for space to an emphasis on military R&D. Because the American RDT&E investment has essentially leveled off in this period, in the Pentagon's view, we are in danger of falling behind.

Foster acknowledges that in most areas the United States still holds the same 2- to 3-year lead that it has had over the past 10 years or so. (Indeed, virtually every major innovation of the arms race has been the product of U.S. technology.) Nevertheless, if we allow the Soviets to continue to outspend us for military RDT&E, we could, according to Foster, expect some technological surprises from the Soviets within the next year or so, lose our technological superiority by the middle of the decade, and risk the necessity of enormous expenditures over several years to protect our national security.

The FAS attacked the Pentagon's assertions on several levels. For a number of reasons, they questioned the reliability of the estimates of Soviet spending on military RDT&E. These included uncertainties in the exchange rate of rubles to dollars and difficulties in dissecting the individual components of the highly secret Soviet budget.

Moreover, the FAS report claimed that, even if it could be known for certain that the Soviets are outspending us for military RTD&E, this is no reason to assume that they are headed for technological superiority or even a technological advantage. According to the FAS report, the Pentagon makes no effort to distinguish between possible advances in the Soviet "technological base" (breakthroughs in basic concepts of weaponry) and vastly more expensive development based on existing technologies. Thus the increased Soviet expenditure could be directed entirely toward bolstering their stocks of existing weapons.

On these points, the independent study by the General Accounting Office, undertaken at the behest of the ad hoc subcommittee on R&D of the Senate Armed Services Committee, essentially substantiated the FAS viewpoint. "On the basis of the limited information available to us," said the GAO, "we believe that extreme secretiveness by the Soviet Union results in data which are insufficient for a realistic measurement of its military R&D efforts." The report concluded, "Although we believe that the Defense Department methodology with its limited data base may be useful in indicating trends and the apparent magnitude of the Soviet Union military R&D threat, we have reservations as to its usefulness in quantifying relative efforts or spending gaps between the two countries." The GAO report noted that even the Defense Department's assessment of U.S. expenditures for military RDT&E had been inaccurate.

All of this has had the effect desired by FAS of deflating Foster's claims of an imminent threat of Soviet technological superiority. But FAS spokesmen have carried the argument even further, questioning the very need for our frantic efforts to maintain tech-

† The committee that wrote the report was chaired by Marvin Goldberger, chairman of the Physics Department at Princeton University and a former high-level official of the Institute for Defense Analysis, as well as a member of the President's Science Advisory Committee and the Defense Science Board. The other members are George Rathjens, professor of political science at M.I.T. and former deputy director of the Defense Department's Advanced Research Projects Agency; F. M. Scherer, professor of economics at the University of Michigan and coauthor of a standard work on military R&D, *The Weapons Acquisition Process*; and Richard R. Nelson, professor of economics at Yale and internationally recognized authority on the economics of research and innovation.

nological superiority. Their position is based first on the premise that our efforts may only be leading us into a "race with ourselves." "Since the Soviet Union rapidly learns of our discoveries," says the FAS report on the R&D gap, "we are protecting against being surprised by new weapons only by guaranteeing that we will be confronted by these same weapons." Second, the FAS argues that, if we were to let up somewhat, the Soviets would catch up with us, but there is no reason to assume that they would surpass us. In fact, according to FAS witnesses, a number of factors, such as the Soviets' lack of computers and the organization of their scientific establishment, make it unlikely that they could surpass us. "The Soviet system," says the FAS report, "is thought to be especially well designed for catching up, if poorly designed for getting ahead."

George W. Rathjens, a professor of political science at M.I.T. and one of the authors of the FAS report, sketched the argument still further in testimony last week before the Joint Economic Committee of Congress. According to Rathjens, who was formerly deputy director of the Defense Department's Advanced Research Projects Agency, in the area of strategic weapons it wouldn't even matter if the Soviets did surpass us. "The strategic systems serve their purpose," he said, "if there is enough likelihood that they will serve as deterrents. I do not see how a modest or even quite substantial technical advantage possessed by one side could be very useful. Certainly, evolutionary changes in technology will not upset the present, relatively stable balance. A dramatic breakthrough, for example a virtually airtight ABM system, might; but I see no such possibilities on the horizon." For tactical warfare, however, Rathjens indicated that technological advantage could be quite critical.

Just how much effect will the FAS testimony have on our efforts in military technology? With respect to our general arms posture, not much. The U.S. strategy, as stated by Foster, is "to push as aggressively as we possibly can across a broad range of research and technology, in an attempt to discover first the kinds of things that an enemy might later have in store for us." Even some of the more vocal congressional advocates of disarmament would get jittery if this country were not the first to perfect every innovation in the arms race. In responding to the FAS position, Foster said in a letter to Congress that it represented "a simplistic view of the arms race." "Of course," he said, "both the Soviet Union and the United States pay attention to each other's weapons systems development and deployments, but these considerations are only a portion of the fundamental motivations in the development of any one or a group of military weapons systems."

"The Soviet Union," Foster concluded, "is a proud country. . . . Soviet military and space science and technology is innovative and creative and not 'relatively backward and inefficient.'"

Yet no matter how highly he regards Soviet abilities, Foster is likely, in the wake of the FAS-generated controversy, to experience increasing difficulty in his campaign to convince Congress that the Soviets are on the verge of surpassing us. This could have many subtle, but far-reaching effects on the defense budget.

Congress is ill-equipped to challenge most of the complex items in the defense budget. Instead, it acts in response to a general feeling of what is needed and what isn't. As one congressional aide put it, "The net result of something like the threat of the technology gap is that the Congress hears cries that 'The Russians are Coming.' If somebody convinces them that the Russians aren't coming, then the prevailing attitude is that we can take a harder look at the budget."

Whatever the final effect, in dollars and cents, of their actions, the FAS is offering Congress something they have lacked for many years: expert, independent testimony on the question of how much weaponry is really enough.—ROBERT J. BAZELL

APPOINTMENTS

Thomas A. Graves, Jr., associate dean of the faculty, Graduate School of Business Administration, Harvard College, to president, College of William and Mary. . . . **Gordon B. Carson**, vice president, Ohio State University, to executive vice president, Albion College. . . . **Robert L. Gluckstern**, head, physics and astronomy department, University of Massachusetts, Amherst, named vice chancellor for academic affairs and provost. . . . **John E. Bardach**, professor of natural resources, wildlife, and fisheries department, University of Michigan, to director, Hawaii Institute of Marine Biology, University of Hawaii. . . . **Leo Goldberg**, director, Harvard College Observatory, to observatory director, Kitt Peak National Observatory. . . . **Terence A. Rogers**, acting dean, University of Hawaii School of Medicine, appointed dean. . . . **James B. Farison**, acting dean, College of Engineering, University of Toledo, appointed dean. . . . **John G. Skalnik**, professor of electrical engineering, University of California, Santa Barbara, to dean, College of Engineering at the university. . . . **Francis N. LeBaron**, professor of biochemistry, University of New Mexico School of Medicine, named chairman, biochemistry department. . . . **Robert S. Daniels**, professor of psychiatry and social medicine, University of Chicago Pritzker School of Medicine, to director, psychiatry department, University of Cincinnati. . . . **Marvin Stein**, chairman, Mental Health Extramural Research Advisory Committee, NIMH, appointed chairman, psychiatry department, Mount Sinai School of Medicine, City University of New York. . . . **Calvin H. Plimpton**, president, Amherst College, to president, Downstate Medical Center, State University of New York, Brooklyn. . . . **John K. Major**, dean, Graduate School of Arts and Sciences, University of Cincinnati, to dean, Graduate School of Arts and Science, New York University. . . . **Henry L. Price**, professor of anesthesiology, University of Pennsylvania Medical School, named chairman, anesthesiology department, Hahnemann Medical College and Hospital of Philadelphia. . . . **Charles B. Beck**, professor of botany, University of Michigan, to chairman, botany department at the university. . . . **William L. Thomas**, professor of geography, California State College, Hayward, named chairman, geography department at the college. . . . **Julius B. Richmond**, professor of child psychiatry and human development, Harvard University Medical School, named head, preventive and social medicine department at the school. . . . **Antolin Raventos**, president-elect, American Radium Society, appointed chairman, radiology department, University of California School of Medicine, Davis. . . . **Ralph C. Brown**, chairman, geography department, Wisconsin State University, Superior, to chairman, geography department, University of North Dakota.