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Scientific Exchanges and U.S. National Security

On 9 October 1981, in a letter addressed to The Honorable Frank Carlucci, Deputy Secretary of the Department of Defense, Mr. William D. Carey, Executive Officer and Publisher of *Science*, criticized statements by the Department of Defense concerning scientific exchanges, conferences, and the unclassified, open scientific literature. Mr. Carey's letter and the reply he received from Mr. Carlucci are printed here verbatim.

I must tell you that the otherwise excellent brochure on *Soviet Military Power* went off the rails badly, in my opinion, in contending (pp. 80-81) that U.S.-sponsored scientific exchanges and scientific communication practices enhance Soviet military power.

I am dismayed to find the Defense

Department indicting inter-Academy exchanges, student exchanges, scientific conferences and symposia, and the entire "professional and open literature" as inherently adverse to U.S. military security interests. These normal and well-accepted fora for advancing scientific progress constitute the primary in-

frastructure of U.S. and worldwide communication in science, and without them the U.S. technology base would go stale very quickly.

The Defense Department should know, by this time, how scientific practice is conducted and how necessary unimpaired communication in science is to advancing the state of the art and improving our own essential capabilities. I find it deplorable to have our Defense Department taking a public and well-advertised stance that exchanges and the open scientific literature constitute still another window of vulnerability and a free asset handed to our principal adversary.

It is also somewhat astonishing to have the Defense Department charging that bilateral U.S.-Soviet scientific and technical exchanges are giveaway channels benefiting Soviet military power. These bilateral exchanges, as you must know, are legitimized by formal inter-governmental agreements initiated by

President Nixon and continued by his successors. Whether the Defense Department likes them or not, they constitute the present foreign policy of the United States. As to the merits, it is very important to U.S. interests to be well-posted on the quality of Soviet scientific research. The contact we have through the bilaterals has left no doubt as to Soviet excellence in fields that matter to us, including metallurgy, condensed matter physics, theoretical physics, astrophysics, geophysics, and cancer research. Nobody is arguing that the exchanges should involve security-related fields of science. Elsewhere, in fields where both sides are equally good, it is to our country's advantage to pursue the exchanges. The DOD paper shows an extremely disappointing grasp of what the exchanges are all about.

If I seem exercised by the position taken by the Defense Department in *Soviet Military Power* it is because I *am* exercised. In particular, that position strikes in a deadly way at the dependence of scientific progress on open communication and shared information. Our own military power will be diminished, not enhanced, if the wellheads of scientific communication are sealed and new knowledge confined in silos of secrecy and prior restraint.

Mr. Carlucci's reply

This is in reply to your recent letter in which you state that the Department of Defense (DOD) views the inter-Academy exchanges, student exchanges, scientific conferences and symposia, and the entire professional and open literature as inherently adverse to U.S. military security interests.

Be assured the DOD is well aware of how scientific practice is conducted and fully recognizes the importance of unimpaird scientific communications to the mutual benefit of all parties concerned. In our considered view, however, the exchanges to date, in the main, have not been reciprocal. Rather, it is quite apparent the Soviets exploit scientific exchanges as well as a variety of other means in a highly orchestrated, centrally directed effort aimed at gathering the technical information required to enhance their military posture.

Because of the importance I attach to this complex issue, I want to respond in some detail and thus ask your indulgence. Illustrative examples follow which, at least in part, indicate the basis for our concern.

The energy bilateral agreement began with 14 subtopics. The U.S. promised

and delivered the large magnet and magnetohydrodynamics (MHD) channel details as well as a great deal of information on other topics. The Soviets promised but did not deliver data on geothermal energy and energy resources, consumption, production, and forecasting. Consequently, the U.S. Department of Energy has been curtailing its participation. The only topic still active is the one on MHD.

Under the S&T bilateral agreement, the Soviets had been sending large numbers of scientists to the U.S. in the field of chemical catalysis, but the U.S. was gaining virtually nothing in return. Consequently, in 1980 the U.S. terminated the one-sided exchange. It now appears, however, the Soviets will try to use the inter-Academy exchange or other means to acquire the information they deem vital.

Another example of their persistence was demonstrated in the electrometallurgy subtopic of the science and technology bilateral agreement. The Soviets wanted to establish an exchange in the fields of superplasticity and fracture mechanics. A concerned U.S. government scientist succeeded in stopping the exchange in these militarily related topics. However, it was dismaying later to find that the Soviets had acquired the information under the auspices of a new subtopic on corrosion.

One of the provisions common to many of the government-to-government bilateral agreements encourages the establishment of separate agreements between individual companies in the west and entities of the Soviet government, primarily the State Committee for Science and Technology and the Ministry of Power Engineering. These are sometimes referred to as the "Article IV" Agreements and in the case of the U.S. involve a large number of companies that are among the world's leaders in areas in which we know the Soviets to be deficient. The degree of concern with this situation was such that previous policy was altered to the extent that the Export Administration Act of 1979 now requires that companies file notice with the Department of Commerce when such agreements are signed.

We also have evidence that the Soviets are misusing scholarly exchanges. In the area of graduate student and young faculty exchanges, administered by the International Research and Exchange Board (IREX), the U.S. sends young master's and doctoral level students, mostly in humanities, primarily to two universities, Moscow State and Leningrad State. For the most part, the USSR

sends senior, experienced, technical people. Almost all possess *Kandidat* degrees; some come from closed military research institutes, and attend any of a hundred or so U.S. universities. In accordance with the openness of our society, Soviet students are granted academic freedom and, with almost automatic government approval, can travel practically at will. Conversely, American students in the Soviet Union are much more isolated and restricted in their travel and professional contacts.

Soviet weakness is not in basic research, which, as you point out, is on the whole excellent. Rather their weakness is in putting technology into production. It is therefore not surprising to us that the scientists the Soviets nominate are often directly involved in applied military research. For example, in 1976-77 S. A. Gubin's course of study involved the technology of fuel-air explosives. Mr. Gubin studied this topic at one of our leading universities under a professor who was a consultant to the U.S. Navy on fuel-air military explosive devices. As a parenthetical comment, one must admire their ability to determine so precisely where to send their "students." Gubin, incidentally, during his stay ordered numerous documents pertaining to fuel-air explosives from the U.S. National Technical Information Service. When he finished his study, he returned to his work in the USSR developing fuel-air explosive weapons.

In the case of K. H. Rozhdestvensky, it was not until several months after his departure that we learned his research paper was concerned with the "wing-in-ground effect" aerodynamic vehicle. This vehicle has significant potential military applications and indeed, the Soviets have been attempting to develop a wing-in-ground effect machine for quite a number of years.

T. K. Bachman, a psychologist, came to study the interface between man and machine. In the opinion of U.S. researchers, this field was directly applicable to the design of heads-up displays which optimize the amount of data presented visually to a military weapon system operator. Bachman attended several very significant conferences on this topic and was able to observe state of the art demonstrations of such work funded by the Department of Defense.

This graduate student/young faculty exchange is such that each year it is recommended that at least one-half the Soviet nominees not be allowed to pursue their desired topic of study at all or that significant modifications be made in their study program. This is because the

information the Soviets seek is either embargoed by law or militarily sensitive. Hence our concern.

In the senior scholar exchange program also administered by IREX, each side sends a number of scholars for a total of 50 man-months per year. As with the graduate student/young faculty program, the Soviets nominate physical scientists, while the U.S. nominates scholars specializing in the arts, literature and history. Until a few years ago, most Soviets in this program conducted very basic research. No objections were voiced to such courses of study. Currently, practically all the Soviet nominees propose to study in fields having military application. Some examples of proposed research topics in 1981 are:

- Properties of adhesive joints of polymers.
- Macromolecular materials and composite materials (two nominees).
- Preparation of micro-tunnel diodes in gallium arsenide by annealing and/or molecular beam epitaxy.
- Theory of computer science and programming methodology.
- Thin-film metals in semiconductor technology.
- Semiconductor and infrared technology, ion implantation, radiation defect analysis and infrared detector techniques and materials.
- Machinability of difficult to machine materials.

Largely as a result of dissident physicist Andrei Sakharov's ill treatment, the U.S. Academy of Sciences imposed a moratorium on joint symposia and other high level contact with the Soviet Academy of Sciences. Nonetheless, individual exchanges are still permitted and the Soviets continue to nominate scientists to study and conduct research in topics that are either embargoed or militarily sensitive. Of 25 scientists nominated by

the Soviets during 1980, 11 topics proposed offered a significant potential for loss of critical U.S. technology. There was a somewhat lesser, but nevertheless real, degree of concern over the remaining 14 topics.

With regard to scientific conferences and symposia, the Department of Defense has become increasingly concerned over the type and volume of defense-related information openly provided. As you will undoubtedly recall, the concern has been such that Soviet Bloc scientists were prevented from attending the First International Conference on Bubble Memory Materials and Process Technology, and the Conference on Laser and Electro-optical Systems/Inertial Confinement Fusion early in 1980. This denial was precipitated by the revelation that Hungarian physicist, Gyorgy Zimmer, provided the Soviets the scientific knowledge on magnetic bubble memories gained as a result of his frequent visits to U.S. laboratories. A thorough review then followed which resulted in an official U.S. policy restricting Soviet attendance at U.S. conferences and symposia. This policy was widely publicized in a number of scientific journals.

With regard to professional and open literature, U.S. and western applied and basic research papers are usually quite explicit in explaining their purpose and are published promptly and without censorship. The author's affiliation and the sponsor of the research are almost always provided. This is contrasted with Soviet and other Communist country publications where the purpose and goal are usually not mentioned or deliberately obfuscated. Authors' affiliations frequently are not provided and the sponsor of the research is rarely identified. In addition all articles are subject to censorship.

I would also point out that it is and has been for many years U.S. policy to make available all unclassified government sponsored research to anyone in the world at very nominal cost through the National Technical Information Services (NTIS) of the Department of Commerce. Similar Soviet research holdings are maintained by the All-Union Institute of Scientific and Technical Information (VINITI) which is jointly administered by the State Committee for Science and Technology and the Soviet Academy of Sciences. The NTIS assisted the Soviets in setting up VINITI under the auspices of the bilateral agreement on Science and Technology, yet the holdings of VINITI are not released to anyone outside the Soviet Union.

Other examples abound, but I trust that these will suffice to provide you with the context within which our views were framed. The Department of Defense favors scientific, technical and educational exchanges and the free exchange of ideas in basic and fundamental science. However, since the military posture of this nation relies so heavily on its technical leadership, the Defense Department views with alarm the blatant and persistent attempts, some of which have just been described, to siphon away our militarily related critical technologies. I note this is precisely your point when you state "nobody is arguing that the exchanges should involve security-related fields of science." By the very nature of our open and free society, we recognize that we will never be able to halt fully the flow of militarily critical technology to the Soviet Union. Nevertheless, we believe that it is possible to inhibit this flow without infringing upon legitimate scientific discourse. I hope that this letter has allayed your concerns and look forward to additional views you may wish to offer.