# Letters

## Defense Research

E. P. Wigner and R. K. Adair (Letters, 28 Jan., p. 356) conclude that the Federation of American Scientists (FAS) does not want to strengthen our defense research "if there is a chance that we will be safe," that we want "no defense measure adopted" unless it can be "shown with certainty" to be necessary, and that we require *"absolute"* proof before approving research funds.

These wholly inaccurate statements are, incredibly, based on an FAS report that did not recommend in any way, shape, or form that any defense expenditures be cut. Our report, "Is there an R & D gap" (*1*), simply attacked assessments of the Soviet research and development threat that have been highly controversial inside the government itself for years. Indeed, in discussing this report, a *Christian Science Monitor* editorial (*2*) called the FAS a "public front for the opposition inside the Administration. . . ." If our assertions had been the product of any peculiar appraisal of goals or of our value system, the U.S. Senate Subcommittee on Research and Development would never have given us the unprecedented public hearing that it did. We urge all concerned to read our report. If you agree with us, join us.

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### References

1. *Congr. Rec.*, 5 November 1971, p. S6517.
2. *Christian Science Monitor*, 12 May 1971, editorial page.

## Cost of the Space Shuttle

The space shuttle (see News and Comment, 28 Jan., p. 392) deserves to be carefully evaluated before the nation plunges ahead on a space project whose cost may well eclipse that of the Apollo program. "A total annual payload of about 1000 tons" reckoned on a 10-year schedule, equals 20 million pounds placed in orbit. Before we become absorbed in the possible cost-effectiveness of shuttling things to orbit, which NASA claims can be accomplished for $100 per pound, we need to determine what this immense payload will cost and what it is aimed at doing.

When he testified before the U.S. Senate Committee on Aeronautical and Space Sciences, NASA Associate Administrator Dale M. Myers (*1*) stated, "The costs of today's satellites run around $20,000 a pound, including research and development costs, and some are considerably higher." It can be argued that few-of-a-kind satellites are inordinately expensive, but Intelsat satellite serial units cost $9000 a pound (*2*). The argument that the shuttle's size will allow use of heavier, cheaper-per-pound instrumentation is not confirmed by data on heavy military satellites (*3*). If we make the extreme assumption that NASA's payload costs can be slashed to $2000 a pound, then 20 million pounds in orbit represent a national investment of $40 billion.

To this $40 billion we must add the shuttle costs. President Nixon stipulated (*4*) a $5.5 billion development cost for a modified shuttle that has an ocean-recoverable booster. A booster will cost $50 million and its reusability remains uncertain; unless it can be reused ten times, then over 500 missions will require more than 50 boosters at a total investment of $2.5 billion. I estimate that development, deployment, and operation of the shuttle system will cost from $11 to $16 billion. If we add up all the costs, the shuttle-related space program will cost from $51 to $66 billion.

NASA's contention that the cost of lifting a pound of payload from earth to orbit can be reduced to less than $100 is easily disputed. Simply take the minimum estimate of $11 billion (*5*) for the shuttle cost and divide it by 20 million pounds. That's $550 a pound and not much less than the $700 per pound that existing NASA launch vehicles cost (*6*). To focus on transportation costs, rather than payload costs, is like suggesting to Tiffany's that it concentrate on devising a low-cost method for diamond shipments. Only if orbital payloads can be reduced so they cost only several times more per pound than gold, is it meaningful to seek cheaper space transportation. Even then the nation ought to be asking what kind of space program is the space shuttle designed to support.

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### References and Notes

1. U.S. Senate, Committee on Aeronautical and Space Sciences, *Authorization for Fiscal Year 1972* (92nd Congr., 1st sess., 1971), part 1, p. 143.
2. Data derived from *COMSAT Annual Report to the President and the Congress* (Communications Satellite Corporation, Washington, D.C., 1971).
3. Testimony of R. C. Seamans, Jr. (*1*, p. 347) referring to Titan III-C launch vehicle and payload costs for unit production of reconnaissance satellites.
4. *Congr. Rec.*, 19 January 1972, p. S46.
5. This figure is smaller than the $13 billion total cited by NASA in 1971 for the shuttle using the manned booster. The latter would involve higher R & D costs, but presumably would be cheaper to operate. If the new shuttle's booster is limited in reuse, then it will be more expensive than NASA's original shuttle concept.
6. See (*1*, pp. 389 and 469). It should be noted that NASA's total 3-year budget ending 30 June 1972 is $10.4 billion, of which launch procurement costs add up to $0.38 billion or less than 4 percent of the total budget.

## AAAS Meeting

At the 1971 annual meeting of the AAAS in Philadelphia, two important events occurred which were not mentioned by John Walsh in his summary report (News and Comment, 7 Jan., p. 42). First, a women's caucus was organized, and second, a motion introduced by Hazel Fox of the University of Nebraska on behalf of the AAAS women's caucus was passed by the AAAS council, the chief policy-making body of the AAAS. The motion was as follows:

WHEREAS the talents and contributions of women in science are not fully recognized, and

WHEREAS there is no central listing of women in science,

I move that the Council request the Board of the American Association for the Advancement of Science to consider establishing an Office for Women's Equality to

work toward full representation and opportunity for women in scientific training and employment, affairs of the Association, and in the direction of national science policy.

The tasks of this office would be (i) to develop and undertake programs to improve the status of women scientists; (ii) to prepare a directory of women scientists; and (iii) to write and edit a page on women's equality in *Science* once a month. The AAAS women's caucus requested that the staff for this office include at least two professional-level women who are feminists and an adequate supporting staff.

A steering committee to represent members of the women's caucus was appointed and charged with making necessary arrangements for presenting a detailed proposal and budget to the board of directors of the AAAS at their next meeting.

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The continued disruption of speakers at the AAAS national meetings was a disgrace. It is a sad commentary on the whole American Association for the Advancement of Science that the heckling was allowed to continue. The entire arrangement committee should be censured for not making adequate provisions to assure decorum.

Those jackasses who consider that free speech is for them only should be taught, even at the expense of some broken heads, that other people have rights too. I, for one, will not continue to support the AAAS unless drastic changes are made for future meetings and the membership is assured that scheduled speakers will be permitted to speak.

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For two consecutive years, events have occurred at the annual meetings of the AAAS that have been widely construed as being intimidating to invited speakers. These occurrences might be all in a day's work for a politician. However, speakers at a scientific convention should not have to undergo the kind of vituperation and calumny that might have been expected by someone standing for Parliament from a rotten borough in the 18th century.

A major purpose of the AAAS is to promote a free inquiry into all natural phenomena. This objective certainly implies an audience for all kinds of views, however unpopular. But if the convention atmosphere is one of coercion, threats, and blasphemy, people will indeed refrain from speaking their minds freely. A tumultuous and violent environment exerts its own form of repugnant censorship.

Surely the carefully selected and illustrious leadership of the AAAS is ingenious and resolute enough to find a method whereby speakers of all persuasions can orate uninterrupted by castigations, especially of those whose self-righteousness and moral conceit impel them to acts that have as their purpose the prevention of rational discourse and free speech.

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## Social Responsibility

The editorial of 17 December (p. 1187) that was reprinted from the *New York Times* warns the nation's anthropologists against the mixing of politics and social science. It is certainly possible to agree with Lord Macaulay that "It is of very much more importance that men should have food than that they should have pianos. Yet it by no means follows that every piano maker ought to add the business of a baker to his own; for, if he did so, we should have both much worse music and much worse bread." But this delightful quotation hardly supplies an appropriate put-down to the recent concern of anthropologists that studies of Thai tribesmen may have been conducted by some of their colleagues for military purposes.

I read Macaulay's statement as recognition of the fact that pianos and bread are only very loosely coupled, and as advocating that they should remain so (a sort of Ockham's coupling rule—*Copulae non sunt multiplicanda praeter necessitatem*). I read the better part of the anthropologists' concern in about the same way, as advocating the proposition that anthropology and military affairs should be decoupled, lest at least one of them lose its humanistic reputation. Ockham's coupling rule, as implied in Macaulay's quotation, would therefore seem to *support*, rather than confute, the concerned members of the anthropological community.

But this scholarly nit-picking obviously misses a more serious point, whether the members of any profession have a right to exhort their company to its practice for the benefit, rather than the destruction, of men. They have such a right, of course; the real question must properly concern the degree to which this exhortation may extend. Who did or did not do what in the matter of the Thai anthropological studies are matters of fact, and we may therefore hope that they will be established by investigation.

The appropriate mode of conduct for the professional anthropologist, on the other hand, can only be decided by discussion within the anthropological community, and we must hope it will continue to be discussed there as we must hope it will be discussed in all the professions, or the lesson so painfully learned by the atomic scientists will be lost. The scientist is human and has social responsibilities; he must recognize them and deal with them. He cannot escape them by piously defining them out of his code of professional conduct.

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To employ the separation of church and state as an analog to the science and society issue is patently misleading if not dangerous. While the First Amendment makes clear the nature of the church-state relationship, there is fortunately no such similar guidance for the knowledge-society interaction. One reason for this may have been Sir Francis Bacon's famous dictum, "Knowledge is power" (*1*).

To endorse an individual's efforts and accomplishments as the only criteria for judging his professional competence is to unequivocally accept positivistic doctrine. Such an endorsement denies the true definition of professional, which places upon an individual the responsibility for assessing as best he can the consequences of his actions.

As long as the products of scholarship may be exploited by powerful individuals and institutions for selfish purposes, researchers will have an obligation to encourage and publicize the open discussion of possible attendant societal consequences. Hopefully this may lead to a better informed society and a reduced probability that subsequent actions will yield undesirable impacts. Although the practice of partisan