icies on academic credit for ROTC courses vary among different schools and departments.

The academic rank of ROTC instructors has been another source of friction on campuses. Under the ROTC Vitalization Act of 1964, the senior officer in a unit must be granted the rank of full professor. In 1969, a Defense Department special committee on ROTC observed that the services, despite the wording of the law, have not insisted upon a special title for ROTC department heads. The Defense Department has since indicated that a title such as "visiting professor" is acceptable, provided the privileges and prerequisites of professorial rank (excluding tenure) accompany the position and the title is not "demeaning or indicative of some lesser status."

Behind the semantics of the title of instructors and similar issues lies the fundamental question of the identity of ROTC. The military is anxious that universities grant recognition to the educational worth of their offerings, while many faculty, students, and university administrators want to avoid any confusion between military and academic virtues. The formulas by which ROTC status is established on campuses, especially the credit granted courses, can have considerable impact on the number and quality of students entering the officer corps.

The proposals of the education associations reflect their double objective: they want to avoid penetration of the university by the military and to assure penetration of the military by civilian higher education. The Benson Report, upon which the associations based most of their recommendations, argued that the most important reason for continuation of ROTC is its contribution to "a civilian-oriented military leadership for a civilian-oriented country."

This ultimate goal has not really changed as university dissent over ROTC has percolated up from student demonstrators to the education "establishment." The reformers seek to strengthen ROTC for the same reason that radicals have sought to abolish it. The Benson Committee, military as well as civilian members, emphasize that "officer education by means of ROTC on civilian campuses strengthens our traditional civilian participation in and influence upon the military, whereas alternative plans yield more to domination by the military organization acting on its own." The Committee warned that, if ROTC were removed from the nation's campuses, "there would be grave danger of isolating the services from the intellectual centers of the public which they serve and defend."

Isolation of the military establishment from the Ivy League (and vice versa) seems to be the chief immediate result of the recent upheavals on campus. But declining enrollments across the country may be more profoundly influenced by reduced pressures from the draft. Should an all-volunteer army be established, civilian-oriented students will find little incentive to join ROTC. Then, at the very moment when the ranks are filled with career soldiers, the officer corps will be denied a major source of leadership from the civilian sector of society. The result could be a peacetime military force with over 2 million men and a mind of its own.

—D. PARK TETER

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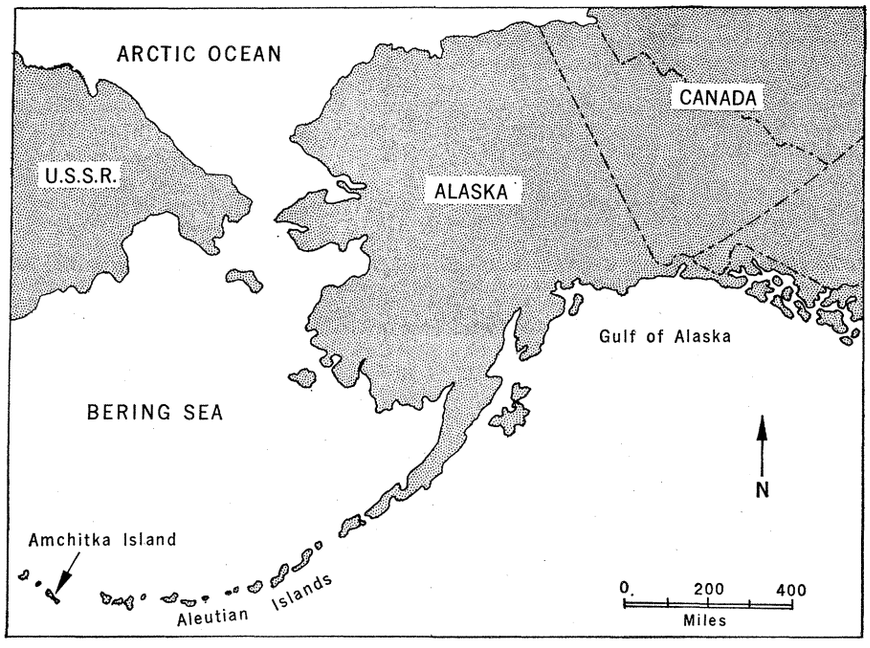
# Nuclear Tests: Big Amchitka Shot Target of Mounting Opposition

A wide range of opposition, a bomb that may be useless, and a number of complex political considerations have raised the possibility that President Nixon may soon cancel the scheduled test of the largest underground nuclear device ever to be detonated by the Atomic Energy Commission. The blast, planned for this fall on the Aleutian Island of Amchitka, involves a 5-megaton bomb designed as a warhead for the Spartan antiballistic missile. To date, the AEC has spent some $160 million in preparation for the test. This includes the cost of a 1-megaton "calibration shot," code-named Milrow, which the AEC exploded underneath Amchitka on 16 October 1969.

The AEC encountered a good deal of opposition prior to the 1969 test (*Science*, 22 August 1969). And much of the debate surrounding the proposed 5-megaton test, with the code name of Cannikan, revolves around points that were raised against the 1969 test. Opponents of the test fear that the explosion could trigger a major earthquake, possibly leading to a destructive sea wave known as a tsunami. Tsunamis resulting from natural earthquakes in the Aleutians have caused extensive damage as far away as California and Hawaii. The opponents, including many Alaskans, are also worried about damage to the island's wildlife from the shock of the explosion, as well as possible leakage (venting) of nuclear material that could contaminate the ocean or the atmosphere.

Located near the western end of the Aleutian chain, the barren island serves as a refuge for sea otters, seals, and sea lions, as well as a nesting ground for two rare birds, the American bald eagle and the peregrine falcon. The bomb will be detonated at the bottom of a 6200-foot hole dug by the AEC.

In response to the Environmental Policy Act of 1969, the AEC has issued a draft of an environmental impact statement describing the probable consequences of the underground blast. And although many environmentalists believe the AEC's statement to be inadequate under the law (because they claim the statement reads more like a sales pitch than a catalog of possible environmental effects), the statement has formed the basis for a wider, more detailed discussion of the possible environmental consequences of the test. In response to a request from Alaska's Governor William A. Eagan, the Environmental Protection Agency held hearings from 16 to 19 May in Anchorage and Juneau, Alaska. There the AEC heard a parade of witnesses testify against the test. In fact, the only people speaking in favor of the test at the Alaska




hearings were employed by the AEC.

Over the past 2 years, environmentalists have gained both increasing public support and new political weapons. One factor that might influence the Administration to abandon the Cannikan test is the extension of environmental concerns beyond the esoteric and into the commercial. In speaking against the test, Senator Mike Gravel (D–Alaska) said, "In these days, when the nation is deeply concerned about mercury poisoning and the market for seafood has fallen off sharply, even the suspicion that radioactive water is leaking [from the test site into the ocean] could devastate the market for all fishery species of the North Pacific."

Another factor that may influence the President's decision is public knowledge of the test's purpose. A decision to conduct the test would be based on the assumption that the environmental risks were justified by considerations of national security. In its environmental impact statement, the AEC said that failure to conduct the Cannikan test "would severely hamper the development of nuclear weapons technology of prime significance to our national security requirements." Previously, such statements by the AEC have gone largely unchallenged, due to a veil of secrecy over the relevant data. But a good deal is known about the future uses of the warhead to be tested beneath Amchitka, and this has led to knowledgeable criticism of the test's utility. Much of this criticism has come from the Federation of American Scientists (FAS).

Herbert F. York, chairman of FAS and the first director of Defense Department Research and Engineering, called the Cannikan test a "pointless experiment in search of an unnecessary weapon." And in detailed testimony before the hearings in Alaska, FAS Director Jeremy J. Stone challenged the need for the 5-megaton test explosion.

According to Stone, the Cannikan test has been under consideration by the AEC since 1966 or 1967 as part of the development of a warhead for long-range (Spartan) missiles that could provide a curtain of x-rays outside the atmosphere over the United States. Such a curtain could theoretically defend the country from a light (that is, Chinese) nuclear attack. But, he said, when in 1969 the Administration changed the rationale for the ABM program from a defense against heavy (that is, Russian) nuclear attack to a defense of Minuteman missile sites, the large warhead was no longer necessary. This, said Stone, is because the type of ICBM's that the Russians would deploy would permit the use of short-range (Sprint) interceptors with smaller warheads.

In addition, Stone suggested that the need for Cannikan is "further undermined" by the Defense Department's announced intention of building an "Improved Spartan." According to the statements of Pentagon officials, the Improved Spartan will take over many of the original Spartan's functions, carrying a smaller warhead at much higher velocities in order to intercept submarine-launched missiles and low-trajectory ICBM's.

Finally, Stone claimed that, even if the huge warhead were needed, there would be little reason to conduct the test, since "there is little doubt that the Spartan warhead will detonate; and much can be known about the warhead's effectiveness through paper and pencil calculations." The effectiveness of the Spartan ABM system depends less critically on whether the warhead will fire than on such considerations as the tactics employed by the Soviets and the reliability of the missile itself.

Stone's critical assessment of the warhead and the underground test is apparently shared by some Administration scientists and defense specialists. The Undersecretaries Committee of the National Security Council, which consists of Presidential Assistant Henry Kissinger and representatives of the State Department, the Joint Chiefs of Staff, and the Central Intelligence Agency, is conducting a detailed study to counsel the President in his decision on whether or not to proceed with the test. Advising the committee for this study are representatives of the Arms Control and Disarmament Agency, the Office of Management and Budget, the Council on Environmental Quality, the AEC, and the Department of the Interior. According to reliable Administration sources, the study will make no recommendation because there is no consensus either for or against conducting the test.

"This whole thing is wrapped up in the sordid history of the ABM," said one Administration official. "The people who are defending the test are in a difficult position because the changing justification for the ABM forces them to keep changing the justification for the warhead."

Pentagon officials, who, if asked, will claim that they need almost any weapon, would reportedly be willing to give up the Spartan warhead if forced to make a choice between Spartan and certain other weapons, or if faced with overwhelming public opinion in opposition to the test.

Such factors will certainly be spelled out in the Undersecretaries Committee report to the President. But the purpose of the report is not to weigh the need for the weapon against the possible environmental consequences. Rather, it will concentrate on the possible

political consequences for Nixon if he goes ahead with the test or if he cancels it.

Of course a huge earthquake immediately after the test, particularly if it were followed by a damaging tsunami crashing against the shores of California, Alaska, or Hawaii, would hurt Nixon's chances for reelection in 1972. Most of the underground nuclear blasts in Nevada have triggered natural earthquakes that are one or more magnitudes less in intensity than the shock wave from the blast itself. And for the past few years, seismologists have suggested that an underground nuclear test might possibly spark a chain of events leading to a huge earthquake. The report of the Ad Hoc Panel on the Safety of Underground Testing, which was prepared for the President's Office of Science and Technology in 1968, stated that such a possibility was greater for tests exceeding 1 megaton and for tests conducted in the Aleutians because of that area's intensive natural seismic activity. The Panel thus concluded that "the need for these tests as planned should be compelling, if they are to be conducted in the face of the possible risks that have been identified."

The AEC's environmental impact statement declared it to be "highly unlikely" that Cannikan will trigger a huge earthquake, and "even more unlikely" that it will set off a damaging tsunami. In defense of these claims, the AEC argued that the 1969 Amchitka test did not set off any earthquakes with more energy than the blast itself. In fact, the 1969 test generated fewer aftershocks than were expected on the basis of the AEC's experience in Nevada.

Even with their one successful blast on Amchitka, however, the AEC is still dealing with an area where the lack of data makes predictions impossible. James Brune, a seismologist at the University of California, La Jolla, told *Science* that the 1969 test "shows that not every big explosion will trigger an earthquake." He added that "everyone agreed from the beginning that there was only a slight chance that it would happen."

Similar considerations apply to the possibility of leakage. Pointing to the AEC's record at the Nevada test site, where 67 out of 230 underground tests have leaked at least small amounts of radioactivity, critics of the test contend that a distinct possibility exists for a leak from Cannikan. While the AEC admits to the possibility, the environmental impact statement terms it an "unlikely event." Officials of AEC point out that none of the leaks in Nevada occurred with tests over 100 kilotons.

In addition to threats to Nixon's political future from earthquakes that might be triggered by the blast, the Undersecretaries Committee must consider the possibility that a coincidental natural earthquake might follow the blast on Amchitka and be attributed by the public to the AEC test. Three weeks before the 1969 test, a 6.6 Richter scale earthquake rocked Amchitka, and AEC Chairman Glenn Seaborg breathed a public sigh of relief that the quake hadn't taken place after the test.

### Possible Senate Battle

But perhaps more significant to Nixon than the possibility of natural calamities following the test is the possibility of a fight in the Senate before the test. The AEC authorizations bill, which will be reported out of committee to the Senate floor sometime in the next few weeks, contains $20 million in additional funds for the Amchitka test. And several senators are willing to support an amendment to delete those funds. As part of their study of possible political consequences of the test, the Undersecretaries Committee has sent a State Department representative around the Senate to sample opinion on the proposed amendment to delete funds for the test.

So far, the movement against the Amchitka test has been rather low key, with only Senators Gravel and Hubert H. Humphrey (D–Minn.) speaking against the test. "We don't want to put so much pressure on Nixon that he can't cancel the test," said an aide to Senator Gravel. "Let him be a hero for a change."

Although it is unlikely that the opponents of the test have enough votes to block the appropriation, a Senate squabble could prove embarrassing to the Administration. The Administration would be particularly sensitive to such a controversy because other provisions of the AEC authorization, including the fast breeder reactor, will also be under attack.

Besides the domestic politics, the decision of whether to continue the test necessitates international considerations. The governments of Canada and Japan have each filed notes of protest against the test, just as they did prior to the Milrow test in 1969.

Franklin A. Long, vice president of Cornell University, testified prior to the 1969 test that "There is a grave risk that . . . the unilateral U.S. action of performing large nuclear tests on the very brink of the Pacific Ocean will encourage anti-Americanism in Japan and Canada and . . . our national security will be *decreased*, not increased." Long told *Science* that "nothing has happened to change my viewpoint." At the time of the 1969 test, 18,000 Canadians closed off a border crossing with the United States, and more demonstrations are planned if Cannikan takes place.

Moreover, some observers believe the test could adversely affect the Strategic Arms Limitation Talks. FAS Director Stone said in his testimony at the hearings in Alaska that "none of the alternatives for limited ABM's being discussed at SALT require the basic Spartan missile."

Nixon has until the middle of September to make the final decision on whether to go ahead with the test. But the report of the Undersecretaries Committee is due for completion by the end of June, and the President's decision should be announced shortly thereafter.

To keep up the pressure against the test, a number of environmental and peace groups, including the Wilderness Society, the Committee for Nuclear Responsibility, the Sierra Club, Friends of the Earth, and the Federation of American Scientists, have formed the Coalition Against the Nuclear Test in Alaska. Still giddy from their victory in eliminating the Supersonic Transport, the environmentalists are confident that they can stop the blast underneath Amchitka Island.

In defending the need for the 5-megaton test, the AEC maintains that there is little danger and that the weapon is vital to America's national security. But, in matters of nuclear energy, the public appears less and less willing to accept the AEC's word as proven fact (see page 1215). The cancellation of the Amchitka test could serve as the first indication, albeit slight, of a change in America's weapons policies.—ROBERT J. BAZELL

*Erratum*: In "Developmental behaviors: delayed appearance in monkeys asphyxiated at birth" by J. A. Sechzer *et al.* (19 Mar., p. 1173), the last two lines of column 1 and the first five lines of column 2, page 1175, should read "Deficits in learning and memory (*10, 11*) when compared with the establishment of these developmental behaviors (although significantly delayed) suggest that brain damage by neonatal asphyxia can result in a degree of dissociation. . . ."