ics factories?" At present, he explained, there is no evidence that critical facilities are any less vulnerable than they have been in the past. "There is no evidence," he says, "of a Soviet effort to harden industry to the point where it could survive a U.S. attack. And, you can underline the 'no evidence'."

Obviously, the matter of headcounting new industries, detecting underground factories, distinguishing between dirt mounds and civilian shelters, poses a long and arduous analytic task. Therefore, a recent National Security Decision Memorandum indicated, a definite answer on Soviet civil defense and its implications will not be available until 1977. Yet even the analytic problems seem to have become clouded by emotion and other interferences. Says one congressional aide who is close to the work of all the intelligence agencies on the issue, "The issue is so critical and important to our strategic thinking that it requires the highest standards of logical thinking and analysis. I haven't seen that standard met—anyplace."

The entire subject of Soviet civil defense seems destined to be caught up in a whole range of issues facing Congress and the incoming Carter Administration. Nitze, for example, in his *Foreign Affairs* article, cited the strategic imbalance as a justification for a new, multiple launch point missile system—a strategic concept the Air Force has embodied in the M-X, a ground-mobile intercontinental missile. Likewise, President-elect Carter faces a crucial decision on whether to produce the B-1 bomber, which is designed to survive a Soviet first strike and deliver a key portion of the U.S. retaliatory punch against Soviet military and industrial targets. (Jones' calculations assume that all 244 B-1's that the Air Force has requested, as well as the Navy's new Trident submarines, are built.) To those who want to upgrade or expand the U.S. strategic weapons arsenal, the threat posed by Soviet civil defense offers a brilliant rationale.

The issue is also being used by congressional conservatives in an attempt to discredit the détente and arms control policies of outgoing Secretary of State Henry Kissinger. Administration officials for years have said that an unwritten assumption behind the 1969 Soviet-U.S. treaty limiting deployment of antiballistic missiles (ABM's) and behind the SALT treaty was, that if nuclear war threatened, each country could hold the other's population hostage. If, since that time, the Soviets have been mounting a massive civil defense effort with the aim of fighting, surviving, and winning such a war, these American assumptions, and the disarmament decisions of U.S. leaders which were based on them, could look foolish indeed.

Most importantly, the entire subject is an opening wedge in calls for a rejuvenated U.S. civil defense program—an effort with which the country experimented in the early 1960's and abandoned because of stiff public resistance. The military debate has many of the same elements today as it did 15 years ago. Proponents of such an effort note that the U.S. effort is small (the government now spends approximately $100 million, which the Office of Management and Budget has been trying to cut further), while the Soviet program, estimated at $1 billion, is, they imply, ten times taller. "The asymmetry bothers people," says one official.

Scientists and analysts both have picked apart arguments for a U.S. civil defense effort. Before the Senate last April, Garwin of IBM argued against it on the grounds it is "a side issue" to more urgent problems Congress should consider. Likewise Panofsky called the possibility that the Soviets would be more prone to start a war on the basis of their current civil defense effort "absurd, and unsupported by both technical fact and currently available intelligence." The alarm, Panofsky noted, is mainly based on Soviet manuals; if someone read the U.S. manuals they might get the impression that the United States also had a massive, effective, civil defense effort.

Both scientists warned of the danger of a rekindled U.S. civil defense effort alarming Soviet leaders, who would perceive it as destabilizing, and accelerate their civil defense effort still further.

But to those who believe there already is a Soviet threat, the matter of fortifying America is an emotional issue, defying logical protest. Jones, for example, scored in an exchange with Senator William Proxmire (D–Wisc.), before the television lights and cameras on 17 November, when he testified to his estimate that a U.S. civil defense program would cost only $2 to $3 billion. Proxmire, in his sharpest, budget-slasher's manner, retorted ". . . I'd be surprised if it didn't cost $20, $30, or $40 billion, . . . money which would be sterile in terms of economic benefit." But, Jones countered, "Senator, I think it would be a good investment if you look at what the country is worth."

Sidney Drell, a Stanford physicist and long-time government weapons consultant, says that he thinks the whole subject will send shivers up the spines of many scientists, who will refuse to engage the issue. But, he notes, the issues of limited nuclear war, and survival from nuclear war, have been very little studied. Meanwhile Jones and other people claim to have examined them and reached some astonishing conclusions.

"Whenever there are changes in the technical terms and assumptions of our military strategy, scientists have a responsibility to examine them. This testimony has to be answered to see if it has weaknesses or uncertainties, or an Achilles heel. We can't walk away from it."

—DEBORAH SHAPLEY

Senate Class of '76: For Ph.D.'s, A Vintage Year at the Polls

A familiar admonition to scientists interested in public policy issues has been that they get involved in the decision-making process. Those who had heeded the call have generally aimed for administrative or advisory jobs, but in the 2 November election several candidates with scientific and academic credentials won high elective office.

The senatorial contests which drew the most national attention were those in the two largest states, New York and California, in part because of the personalities and curriculum vitaes of the winners, Patrick Daniel Moynihan and S. I. Hayakawa. As professor-senators they may come as close to Plato's idea of the philosopher-king as the present system allows.

They will be joined in the Senate by another Ph.D.—in geology—Harrison H. "Jack" Schmitt, an Apollo 17 astronaut who won in New Mexico to become the second astronaut, after John Glenn

(D-Ohio), to land safely in the Senate.

At the state level, the election of Dixy Lee Ray, a former chairman of the Atomic Energy Commission, as governor of Washington is noteworthy both because she has been a practicing scientist and university teacher for the balance of her career, and because she is the ranking winner among women candidates in a year when women did not fare remarkably well at the polls.

A beginner in electoral politics, Ray followed up a relatively narrow victory in the primary with an unexpectedly ample winning margin of about 10 percentage points in the general election. Ray did not have the enthusiastic support of the regular state Democratic party, nor did she put together a particularly efficient organization of her own, but she proved to be an effective campaigner. She acquitted herself well in television debates with her opponent late in the campaign, and this performance is thought to have clinched the victory.

A University Career

Ray, 62, earned a B.A. in zoology from Mills College and a Ph.D. from Stanford in biology in 1945. For the next 27 years she was a member of the University of Washington biology department. During that period she combined teaching, research, and the supervising of graduate students with a variety of activities outside the university. From 1960 to 1962, for example, she was in Washington as a National Science Foundation consultant; and for a decade after 1962, she was director of the Pacific Science Center in Seattle. In 1972 she was appointed to the Atomic Energy Commission and the next year became chairman. After the commission was disbanded 2 years ago she served as Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs, but left after a half-year in something of a huff, making it clear she thought that neither she nor her office was being properly employed.

When she decided to run for governor, her earlier activities as director of the science center, including regular television appearances, appear to have ameliorated the "name recognition" problem which afflicts most first-time statewide candidates. In her campaign she promised to reorganize state government and separate the big state department of social and health services into its functional parts.

Although a scientist whose field is marine biology, Ray has been critical of environmentalists who take what she regards as extreme positions and she continued to be so in the campaign. On the two leading environmental issues in the state, supertankers in Puget Sound and the development of nuclear power, Ray took the view that the only sensible policy was a cautious go-ahead, and came across generally as a rather conservative pragmatist.

Schmitt, like Ray, won without the passionate support of party regulars and with a campaign organization which was regarded as weak. He ran as a conservative Republican, hitting hard at the theme of government waste and inefficiency. Schmitt, 41, who earned his B.S. from Caltech in 1957 and his doctorate from Harvard in 1965, was selected among a group of scientist-astronauts to join NASA in 1965. He was one of two Apollo 17 crewmen who landed on the moon in 1972 and was the only scientist-astronaut to make the trip to the lunar surface.

Against his November opponent, Democratic incumbent Senator Joseph M. Montoya, Schmitt apparently benefited substantially from allegations of impropriety in the senator's business affairs and reports that an audit of Montoya's taxes had been blocked. On the stump, Schmitt combined an espousal of a Southwest strain of conservatism in the social and economic spheres with advocacy of the use of new technologies, for example, for desalting water.

Hayakawa is also a Republican, but by and large took a centrist position in the campaign, thus appealing to Independents and Democrats. Now 70, Hayakawa was born in Vancouver of Japanese-born parents. He got his schooling and early university training in Canada and took his Ph.D. in English at Wisconsin in 1935. A semanticist, he made a literary name for himself with a book for nonspecialists, *Language in Action*, which was a Book-of-the-Month-Club selection in 1941.

Hayakawa, however, made his mark on the public consciousness in the late 1960's by his firm line with militant students when he was acting president and then president of what is now California State University, San Francisco. He maintained his reputation as a salty social commentator after his retirement, but his placement on the political spectrum remains elusive and observers say that his stance on issues he will encounter in the Senate is unpredictable.

For California's aerospace and high technology industry Hayakawa's victory could prove a letdown, since the incumbent Senator John V. Tunney (D–Cal.), whom Hayakawa defeated, has been a leading proponent of the space shuttle and other big technology projects, and his interests and committee assignments would have given him leverage on matters particularly important to California.

Among the new senators, Moynihan, 49, has the most varied and extensive experience in government, all of it up to now in appointive jobs. He is unusual in having served in the Kennedy Administration at the subcabinet level, and then in the Nixon and Ford Administrations first as counsellor to President Nixon on domestic affairs and then as ambassador to India and later ambassador to the United Nations, a post carrying cabinet rank.

Despite service under Republican Administrations he is labeled a liberal Democrat and ran as one in his campaign against one-term conservative James L. Buckley. Since his victory at the polls, the junior senator-elect from financially beleaguered New York has been quoted as noting acerbicly that his state gets less federal money expended on it than is paid in taxes, which is not true of the relatively affluent "Sunbelt" states. He says he will work to redress the balance.

Academe and Government

Moynihan earned his undergraduate degree from City College and his Ph.D. from Tuft's Fletcher School of Law and Diplomacy, and then put his training in political science and economics to work in a career pattern established in the 1950's of moving back and forth between academe and government.

Moynihan's dual career has not forced him to eschew involvement in professional activities. For example, he served as chairman of AAAS Section K (Social and Economic Sciences) in 1971 and then was elected to the AAAS board of directors for a term beginning 1 January 1972. Just before taking office he made an impression at the 1971 AAAS meeting in Philadelphia—notable for its disruptions by activists—by refusing to deliver a scheduled speech by way of protesting the conduct of the disrupters. He attended only one board meeting before resigning to take up his post as Ambassador to India.

The Senate has had social scientists elected to it before. Senator George McGovern (D–S. Dak.) was a university teacher before launching a political career, for example, and Senator Gale McGee (D–Wyo.), defeated in the past election, was another. Moynihan, however, was the most prominent at the time of election. And he is certainly the first AAAS board member who has gone on to the Senate.—JOHN WALSH