

fit to both sides. It is not a technology transfer scheme. Bromley does not think it unrealistic to expect progress within 24 months, "not when you've got the two heads of state breathing down your neck."

Like others, Bromley mentions that the project is due to receive about \$10 million in U.S. support and a similar amount from the Indians. This would make it quite significant, larger in budgetary terms than the exchange with China. However, officials at NSF mention a lower figure—\$2 million—and say even that is tentative. The NSF budget has not cleared Congress, so at this point the agency does not want to specify just how much will be available or exactly where it will come from. But NSF Director Edward Knapp has pledged to find \$2 million in the 1984 budget one way or another. This will be used to pay for travel, exchanges of data, and the support of Indian scientists in the United States. India will support Americans abroad. The research covered by the program is for the most part already under way. The new element, as an NSF staffer put it, is its "internationalization."

One of the more promising areas is the study of monsoon dynamics. The administrative pattern in this case seems typical of the whole. According to NSF, research on the monsoon has been going on since the mid-1970's when the agency learned, much to its surprise, that many American scientists are interested in the subject. The agency now spends about \$2 to \$2.5 million annually on monsoon work and has participated in two large experiments—one based in Kuala Lum-



*Reagan and Gandhi discuss science agreement, July 1982*

pur and the other in Delhi. It also supports collaborations between U.S. and Chinese scientists.

The short-term goal for the monsoon project will be to introduce Indian scientists to the latest U.S. weather modeling techniques and to help them transfer the computer tricks learned in the United States to Indian systems. The U.S. scientists hope to gain access to an enormous data base on monsoons collected by Indians, and they hope to share the data collected by an Indian satellite to be launched soon into geosynchronous orbit. The information will be valuable to those who live and voyage in the tropics, including the U.S. Navy.

In the area of public health, ongoing projects in leprosy and other problem diseases will be made a part of the program. Nutrition-related blindness and control of fertility will be given special attention. Bromley mentions that U.S.

researchers would like to know much more about the epidemiology of slow virus diseases, and India could provide unique data on some of them. In agriculture, collaboration will focus on fuelwood research, nitrogen fixation, and the efficient use of fertilizer in irrigated lands, where large losses are common. The fourth area of concentration—materials research—is less clearly defined, but will involve the use of photovoltaic cells to provide power in remote villages under harsh climatic conditions.

In virtually all these areas, the U.S. agencies have already found volunteer collaborators and drawn up agendas. In some cases, the proposals have already been sent off to India; in others, the proposals are due to go out in a matter of days. The next phase will not begin until the Indians have given a formal response, which is not expected before June.—ELIOT MARSHALL

## Scientists Fault Charges of Soviet Cheating

*Experts say that the United States lacks good evidence of Soviet dishonesty on strategic arms treaties*

Senator James McClure, a conservative Republican from Idaho, seems to be privy to a lot of sensational information about Soviet compliance with arms control treaties. Just the other day, he received a "comprehensive statistical study of Soviet weapons testing," which proves that the Soviets have repeatedly violated the Threshold Test Ban Treaty. He claims to have seen official documents that describe Soviet testing of two new intercontinental ballistic missiles in direct violation of the SALT II treaty.

He also has government reports on the secret stockpiling of Soviet ICBM's and the deployment of banned Soviet missiles. It all adds up, he says, to "a consistent pattern of Soviet violations of the whole range of arms control treaties."

If true, the allegations would probably force the United States "to reassess its entire spectrum of negotiations and relations with the Soviet Union," as McClure says. There is only one problem. The issue is gray and not black and white. Interviews with scientists, gov-

ernment officials, and outside experts with access to classified information reveal that considerable doubt exists about all of his charges. They say that McClure has at best exaggerated and at worst flatly distorted the facts.

This obstacle notwithstanding, McClure and some conservative congressional colleagues are pressuring the Administration in a series of speeches and press conferences to charge the Soviets officially with treaty violations. They say that their aim is to acquaint the Ameri-

can public with the depth of Soviet treachery and the enormity of the Soviet threat. In so doing, they hope to develop support for the President's strategic weapons-building program, particularly his proposal for 100 MX missiles, and to defeat the movement behind the nuclear freeze. They also intend to free the Pentagon from existing arms control constraints. "In those areas where there have been violations, it would be foolish for us to continue to abide by that agreement," McClure says.

Administration officials have hinted that they support the charges of Soviet cheating, although they have yet to pro-

Senators Orrin Hatch (R-Utah) and Steven Symms (R-Idaho), are frustrated by the delay. "Mr. President, please don't allow yourself to be pushed into a corner by overly cautious advisers," McClure said recently. "If you allow yourself to be hamstrung by doubts, you will always find them." McClure, a right-wing attorney who opposed the Panama Canal treaty and voted for development of the neutron bomb, says that he has no doubts whatsoever. Evidence that the Soviets are illegally testing two new missiles is "open and shut." Evidence of the deployment of banned Soviet missiles is "strong." Evidence of secret missile

withstanding the lack of attribution, McClure's assertion was repeated unquestioningly in the *New York Times* and other publications, as were many of his other charges.

Most experts consulted by *Science*, both inside and out of government, expressed doubt that such a study exists. Eugene Herrin, for example, is a seismologist at Southern Methodist University who chairs the advisory panel on yield estimates for the Defense Advanced Research Projects Agency (DARPA), which funds the bulk of the government's work on this problem. Herrin, who has access to classified information, says that he has never seen a study that fits the description given by McClure. In addition, he says, "from a scientific, technical point of view, the evidence is insufficient to assert that the Soviets have been cheating—certainly in no more than a very, very few cases—and even then not with a high degree of confidence."

Herrin says that some of the apparent violations could actually fall under the so-called "whoops" provision of the treaty, which he helped to negotiate in 1976 as part of the U.S. treaty delegation. The provision recognizes the difficulty of estimating exact test yields in advance, and allows each side "one or two slight unintended breaches per year" of the 150 kiloton limit. Pentagon officials peg the number of suspicious blasts at 15, or about two per year since the treaty was signed.

There is speculation that McClure got his data from a paper prepared by Donald Westervelt, a physicist at Los Alamos National Laboratory. The paper has not been peer reviewed or formally endorsed by any government panel, and some other scientists at Los Alamos say that they disagree with its conclusions.

The paper is an independent analysis of a recent classified study by two physicists at Lawrence Livermore National Laboratory, where most of the government's work on seismic verification is conducted. The study is entitled "An Analysis Based on Seismic Data of the Pattern of Soviet High-Yield Nuclear Tests from March 31, 1976, through December 31, 1981." Warren Heckrotte, one of the authors, recently summarized the conclusions as follows: "the distribution of seismically measured yields of Soviet weapons tests is not inconsistent with Soviet observance of the 150-kiloton limit. However, the distribution is also not inconsistent with a distribution of actual yields in which there are some events above 150 kilotons." In short, the evidence is not conclusive. Peter



*"Mr. President, we are all aware of the analogy of the 1930s to the 1970s," McClure wrote recently. "History teaches us that appeasement brings war, not peace."*

duce the evidence and make a formal statement. President Reagan has stated, for example, that "we have reason to believe that there have been numerous violations" of the Threshold Test Ban Treaty, which prohibits the testing of nuclear weapons with a yield of more than 150 kilotons. When reporters recently asked him whether the Soviets had violated the SALT II treaty, he answered jokingly, "When have they stopped?" Only when Reagan was asked for details in a formal news conference did he back away and acknowledge that the evidence might not be clearcut. "It is difficult to establish, and have hard and fast evidence, that a treaty has been violated," he said on 22 April. But Reagan considers the allegations serious enough to warrant a formal investigation by William Clark, his national security adviser, and a panel of top government officials. "Whether or not I'll be speaking out or not" depends on this study, Reagan said. No deadline has been set for a report.

McClure and his confederates, such as

stockpiling is based on "careful conservative estimate." And evidence of test ban treaty violations is "clear and conclusive," he says. "I strongly believe that the American people need to be told the straight truth about Soviet behavior."

One of McClure's "truths" is that the Soviets have repeatedly violated the Threshold Test Ban Treaty. McClure says this is proved by a comprehensive study that "reflects a majority conclusion among those who have analyzed the Soviet test data." The study shows, he says, that the probability of substantial violation is 95 percent or greater. "These conclusions are almost completely unaffected by the uncertainty attributed to our seismic yield determinations," McClure says. "There is now strong agreement on this judgment within the government."

McClure declined to be interviewed about any of his sources, and his staff is coy about the authorship of the nuclear testing study. "All I can say is that it was performed by experts within the field," says David Sullivan, a staff aide. Not-

Moulthrop, his co-author, told *Science* that "if the Soviets were taken into court for cheating, there would be no case against them. They may have cheated, but there is not a case against them that can be substantiated." He adds that this conclusion is uncontradicted by any Soviet tests since the study was completed.

There is a division of opinion over the Livermore report within the seismological community, stemming from substantial uncertainty about the correct method of calculating Soviet yields. Herrin and many others associated with DARPA favor estimates derived from the magnitude of seismic waves that travel through the earth's mantle, corrected only slightly for regional variations in geology. Moulthrop, Heckrotte, and some others at Livermore accept this approach, but favor a more substantial correction for regional variation. Another group, which includes Lynn Sykes of Princeton University and Jack Evernden of the U.S. Geological Survey, favors estimates derived from seismic waves that travel through the earth's crust. But scientists in every group agree that there is no conclusive evidence of Soviet cheating.

Donald Helmberger of Caltech, who serves on the DARPA panel, says that "we simply don't know if the Soviets are cheating." Donald Springer, the deputy manager of Livermore's seismic monitoring program, says that "most people in my laboratory believe that the evidence is equivocal. The Administration and the military just want to believe the worst." Charles Archambeau, a seismologist at the University of Colorado who has been a consultant to DARPA for 20 years, says that "no rational scientist would draw the conclusions that the present Administration is drawing. It's fairly evident that there's a lot of politics involved in this." Similar viewpoints are expressed overseas. Ola Dahlman, a research director at the Swedish National Defense Research Institute in Stockholm, says that "we have so far no convincing evidence that [the Soviets] have exceeded the limit." The British Ministry of Defense has taken a similar position.

The only scientist that McClure cites by name is Harold Agnew, a former director of the Los Alamos National Laboratory. In a recent letter to *Science* (8 April), Agnew wrote that Soviet tests "appeared to us to range as high as 400 kilotons based on detection criteria which were in effect at the time of the initial agreement." Those criteria have now been thoroughly discredited by scientists who remain active in the field, and Agnew admits that official govern-

ment estimates of Soviet test yields have never been as high as 400 kilotons.

Administration officials have cited the allegations of Soviet cheating as the principal justification for an attempt to renegotiate the Threshold Test Ban Treaty and to suspend indefinitely all negotiations on a comprehensive nuclear test ban (*Science*, 18 February, p. 819). Their argument has been paraphrased by McClure, who asks, "How can one plan to reduce the allowed nuclear test threshold when the current threshold is being exceeded?" The Soviet embassy in Washington, in a detailed rejection of the renegotiation plan on 12 April, replied that "the U.S. side has no basis for raising the issue of 'improving' the verification provisions." It said that once the treaty has been ratified, verification

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**"No rational scientist  
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questions can be resolved through routine consultations, as the treaty provides. It also said that the Soviet Union is willing now "to resume the trilateral negotiations in order to finish drafting of the treaty on complete and general prohibition of nuclear tests."

To McClure, this rebuff—in and of itself—provides "conclusive evidence of Soviet cheating." And he lurches onward, finding additional examples in the more arcane aspects of the SALT II treaty, never ratified by the U.S. Senate. Under the treaty, neither side may flight-test or deploy more than one new missile. A new missile is one that did not exist as of 1 May 1979 and that varies significantly from all old missiles. On 26 October 1982, the Soviet Union tested a new solid-fueled missile that matches the MX in size, and declared that it would be the one permitted new missile. Subsequently, on 8 February, it tested another missile that the Soviets said was merely a modification of an existing missile, the SS-13, and therefore not new.

The question confronting U.S. intelligence analysts is whether the second missile varied so much from the SS-13 that it is in fact a second new missile. William Jackson, a former director of the State Department's principal arms control advisory committee, has learned that all U.S. intelligence-gathering systems were not operating on the date of the test, so that data are unusually sparse. Nevertheless, it appeared at first that the

weight-carrying capability of the missile was significantly more than that of the SS-13. Jackson, who is now a guest scholar at the Brookings Institution in Washington, D.C., says that his sources in the intelligence community characterize this conclusion as "preliminary—more inference than fact." It also appeared at first that the missile's sole warhead was so light that the Soviets could add more later. This, too, would be a SALT II violation. But Jackson says that this too is a questionable assertion, and that firmer conclusions must await additional test launches. Several intelligence sources, who asked not to be identified, agreed. "In general, one test is not conclusive," one said. "The way you arrive at confident conclusions, as opposed to suspicions and exaggerations, is that you watch a series of tests."

In March, a panel of senior Administration officials found only ambiguous evidence that the second test was in violation of the treaty. This is why a second group was impaneled by the President. None of this is good enough for McClure, who believes that there is "an open and shut case." McClure admits that his purpose in raising this point is to free the United States from its own obligation under SALT II not to test two new missiles. President Reagan proposed recently that two such missiles be deployed in the late 1980's and early 1990's—the MX and another, smaller missile.

McClure also charges that the Soviets have secretly gathered "a significant, covert . . . strategic ICBM force," which could be rapidly launched from existing silos in a second wave. But none of these missiles are stored near the silos, as prohibited by SALT II, and—according to a Defense Department handbook on Soviet weapons—the liquid-fueled rockets cannot be loaded into the silos in less than a few days. The Soviets could also level a similar charge at the United States. The Reagan Administration wants to produce dozens of extra MX missiles, each capable of being loaded into an existing silo.

Sources on Capitol Hill speculate that much of McClure's information—tenuous and vague as it is—comes from the White House. Robert Sims, the director of public affairs for the National Security Council will say only that "we try to respond if interested members of Congress ask us for information." Should the suspicions be correct, McClure is merely a pawn in a deliberate strategy to raise the issue of Soviet cheating without having to prove it one way or the other.—R. JEFFREY SMITH