An Upheaval in U.S. Strategic Thought

Narrow thinking about Soviet missile accuracy created a drive for the MX missile

Early this year, the U.S. land-based force of nuclear missiles became vulnerable to a preemptive attack by the Soviet Union, as the Soviets deployed a large number of highly accurate warheads on their own missiles. They first demonstrated this capability in 1977. Since then, U.S. missile vulnerability has come to assume great importance in superpower relations. Western observers have portrayed the Soviet achievement as a sign of aggression, and made missile vulnerability into a symbol of declining American military strength. The government has proposed a vast military buildup of nuclear weapons, supposedly made necessary by this new threat. But the public is increasingly skeptical, and support for some form of arms control is growing.

The first article in this series examines how the United States learned of the Soviet accuracy, and why it caused such great alarm. The next article will examine the Reagan Administration's response to this threat.

The Soviet tests began in the autumn of 1977 and created considerable anxiety at the Pentagon and the White House. A series of intercontinental ballistic missiles was launched from Tyuratam, a remote spot in the Soviet desert, and aimed at a target area on Kamchatka Peninsula 4000 miles away. To the surprise of U.S. intelligence analysts, the missiles appeared to fly with extraordinary precision, achieving roughly twice the accuracy possible several years earlier. It was an important technical achievement, because it meant that the Soviets possessed—for the first time—the means to threaten destruction of the nuclear missiles based on land in the United States.

The Reagan Administration is the third to grapple directly with the technical and political ramifications of potential Soviet accuracy. The two previous administrations tried at first to forestall it through arms negotiations. When these proved unsuccessful, they turned to the engineers. Three ideas were given legislative sanction: one, that a new missile, the MX, would be constructed to replace the existing Minuteman missiles; two, the MX would be made accurate enough to threaten Soviet land-based missiles; and three, the MX would be hidden in order to protect it from attack. The Reagan Administration has endorsed these objectives and added a strategic package of cruise missiles, bombers, and submarine-based missiles that will cost more than $220 billion over the next 5 years.

Together, these new weapons are supposed to diminish the prospect of a Soviet strike against the United States. More significantly, according to Administration officials, they will serve as the backbone in American foreign policy, permitting the country to defend more vigorously the interests of itself and its allies.

Although these plans have been circulating for a long time in American domestic politics, what finally propelled them forward was the 1977 and 1978 tests. Part of the reason that the tests had this effect is that they caught the West by surprise. The shock made the achievement of accuracy seem more threatening than it was. Previously, the Central Intelligence Agency (CIA) had forecast that the achievement would require the construction of an entirely new generation of missiles. The forecast led directly to American arms control proposals aimed at slowing the pace of missile development, and to the somewhat leisurely pace at which the U.S. Air Force was looking for a way to protect its missiles. Instead, as the tests revealed, the Soviets merely attached a new final stage to their huge existing missiles, the SS-18 and the SS-19. Alarms were quickly sounded in Washington, and the pace of the search for missile protection quickened considerably.

Details of the tests came from satellites and U.S. intelligence devices near Soviet borders. The first signs of a test launch from the Tyuratam Missile Test Center, 75 miles west of the Aral Sea, were picked up overhead by a DSP 647 satellite, equipped with an infrared telescope and a visible light sensor especially attuned to rocket firings. The initial portions of each test were then monitored by two radars situated to the south in prerevolutionary Iran, at Klarabad and Kabkan. Warhead separation and reentry was tracked by an enormous Air Force radar on Shemya Island, an outpost in the Aleutian chain about 450 miles from Kamchatka. Missile maneuvers were plotted and then matched with data broadcast from guidance computers and intercepted overhead by an Air Force Rhyolite satellite. Warhead landing spots may have been photographed by an Air Force Key Hole satellite, equipped with cameras reportedly capable of resolution to 8 inches. Data from the satellites were relayed to the United States via CIA stations at Guam and in the Australian desert, the latter of which is reportedly capable of intercepting missile computer data itself.

Even with these sophisticated devices, the estimation of Soviet accuracy was difficult. For one thing, useful intelligence could not always be collected. The Soviets learned about the U.S. capability to intercept its VHF and microwave missile testing transmissions in 1977, and on two occasions in 1978, it broadcast the data in undecipherable code. One source says that the Soviets also tried to conceal warhead landing spots by creating false craters on Kamchatka.

The estimation of accuracy was also handicapped because the United States could not always discern the actual Soviet missile targets. Accuracy is measured by firing a number of missiles at the same target, calculating the dispersal around the mean impact point, and then adjusting this figure according to the distance between the mean and the actual target, a distance generally known as bias. Several analysts say that, without knowing where the target is, the intelligence community is forced to make an educated guess at this last adjustment.

Needless to say, those who prepare the estimates are confident that they are correct. Albert Wheelon, a senior executive at the Hughes Aircraft Corporation and a former CIA missile analyst, says that long experience with U.S. tests and detailed information on potential sources

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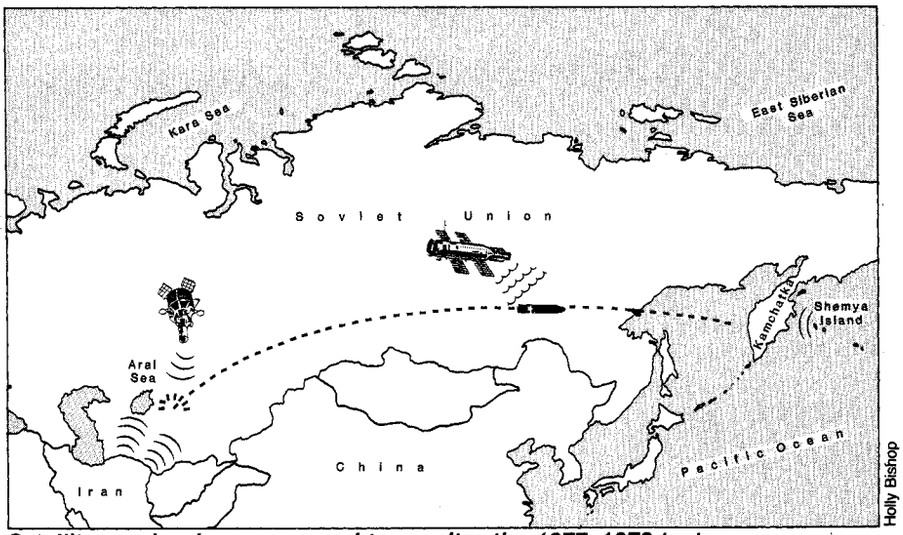
of bias such as gravity and weather, have eliminated any uncertainty. He says that the estimates are misunderstood because only a handful of people are privy to the information and techniques involved. "There are only about 12 people, perhaps a few more, who know how to adjust for random and systematic bias in Soviet missile tests," he says. "You'll simply have to take my word for it that they do it right."

In any event, the CIA decided by mid-1978 that the Soviets had achieved substantially better accuracy, and cited a number of physical improvements in the new rocket stages to support its statistical conclusions. Improved guidance systems were apparently used, incorporating a better accelerometer, gyroscope, and computer program. More streamlined warheads were included, which spun as they were released—much as a quarterback spins a football to obtain more stability. They were also dropped at a steeper trajectory, which minimizes the impact of unpredictable weather at a target site. Timing of the releases was precise, a critical capability that facilitates the use of more than one warhead at a single target. The effect of these improvements, in the CIA's opinion in 1978, was to advance the date by which U.S. missiles could be vulnerable to attack by 4 years, to early 1982. A memorandum with this unwelcome news was circulated promptly at the White House and throughout the defense establishment.

Not everyone privy to the estimate was immediately convinced by it. Two years earlier, a special group of advisers to the CIA, known as the "B" team on Soviet strategic capabilities, had mistakenly said that Soviet missiles were already accurate, a mistake that made some officials wary of the new data. Wheelon, who served on a panel in 1978 to review the problem for the White House science office, remembers that it was "an unpleasant, uncongenial reality, difficult for people to choke down." Still, unlike the earlier analysis, the latest estimate was based in part on observable hardware improvements. Most officials came to accept it as genuine, and became more concerned about Minuteman vulnerability.

Their concern stemmed from the fact that some of the Minuteman missiles can supposedly destroy targets in the Soviet Union that are hardened against the effects of a nuclear blast, such as missile silos and command posts. Submarine missiles are not now accurate enough to destroy such targets, and bombers and cruise missiles take hours to get there.



Satellites and radars were used to monitor the 1977–1978 tests.

The Minuteman III, of which there are 550, would take just 30 minutes.

This capability is highly prized by the Pentagon. General Lewis Allen, until recently the Air Force Chief of Staff, explains that "in general one looks at the ICBM's as being the way in which we have our strategic force go to hard-target kill." And General Richard Ellis, the recently retired director of strategic target planning, has explained in congressional testimony that having such a capability "is the only method of damage limitation that we have in the United States. Our ability to destroy the other side obviously will limit damage to the United States."*

There are two principal concerns about the Soviet threat to Minuteman—one, political in nature, but asserted chiefly by the armed services, and another, military in nature, but asserted mainly by some politicians. This latter concern most often takes the form of a military scenario that goes as follows: In the event of a Soviet preemptive strike against the Minuteman III, there might be no means of retaliation short of an attack by submarines on Soviet cities. But such an attack would invite a Soviet attack in kind. Consequently, a president would withhold retaliation and swallow casualties of up to 10 percent of the population in the preemptive strike, rather than set in motion a general annihilation. Understanding this in advance, the Soviets might be lured to attack.

President Richard Nixon was one of the first proponents of this scenario. In 1970, he publicly asked, "Should a president, in the event of a nuclear attack, be left with the single option of ordering mass destruction of enemy civilians, in the face of certainty that it would be followed by the mass slaughter of Americans?" A year later, he answered himself on the same topic: "I must not be, and my successors must not be."

Despite Nixon's statements and a subsequent debate over nuclear weapons targeting, the scenario did not achieve wide circulation until it was taken up by the Committee on the Present Danger, a Washington-based lobby that was instrumental in persuading the Senate not to ratify the second Strategic Arms Limitation Agreement. Many of the committee's officials have assumed top positions in the Reagan Administration. During recent congressional testimony, Secretary of Defense Caspar Weinberger indicated that he believes the scenario is realistic: "We do think that we will invite the possibility of attack or intimidation if we don't keep our strength up, and if we don't modernize, and if we don't regain the balance that we feel we have to gain."

Officials in the Carter Administration, in contrast, derided the scenario as implausible. "It has never seemed realistic to me," testified Harold Brown, Weinberger's predecessor. Submarines would retaliate adequately against unhardened military targets, he said. "The only thing missing from this scenario is the capability to hit their strategic ICBM's within half an hour instead of 10 hours. I submit that it is not a central issue in the midst of a thermonuclear war."

Even the Joint Chiefs of Staff admitted in their 1980 posture statement that "it does not seem likely that attainment of strategic parity or even an overall advan-

*The Pentagon has, over the last 6 years, spent $428 million to preserve the capability of the Minuteman III to destroy hardened Soviet targets (accuracy has been improved and the warhead yield has been doubled). The new MX missile was deliberately designed to be even more capable against such targets.

They Have More EMT Than We

"What in the name of God is strategic superiority? What is the significance of it, politically, militarily, operationally, at these levels of numbers? What do you do with it?" asked former Secretary of State Henry Kissinger in 1974. His point was that with so many weapons on each side nowadays, disparity in numbers hardly makes any difference. Yet concerns about an imbalance in the number of U.S. and Soviet nuclear weapons lie at the heart of the debate over building and deploying the MX missile.

Kissinger's viewpoint is accepted by many statesmen, but by few military officers. Ever since both the United States and the Soviet Union acquired the ineradicable ability to obliterate each other, the Pentagon has been struggling to assess who is ahead and who is behind in nuclear weapons.

The difficulty is created because the lethality of each weapon is such that only a few are necessary, and each side currently possesses more than 15,000. The question of how many nuclear weapons one really needs was systematically addressed in the 1960's under the direction of Defense Secretary Robert McNamara. "After careful study and debate, it was McNamara's judgment, accepted by Presidents Kennedy and Johnson, and not disputed by Congress, that the ability to destroy in retaliation 20 to 25 percent of the Soviet population and 50 percent of its industrial capacity was sufficient," report two Defense Department weapons analysts from that era, Alain Enthoven and K. Wayne Smith. "Once each side has enough nuclear forces totally to eliminate the other's urban society in a second strike, the utility of extra nuclear forces is dubious at best. In this context, notions of nuclear 'superiority' are devoid of significant meaning."

> "We are in somewhat of an equivalence in a sense, but with some very serious deficiencies," says Secretary of State Haig.

McNamara calculated that approximately 400 "equivalent megatons" (EMT) would fulfill this requirement. EMT is a measure of an arsenal's ability to obliterate primarily people and buildings in urban areas. Although the United States is circumspect about the amount of EMT in its present arsenal, several analysts estimate that it is around 1000.

The Pentagon Joint Chiefs of Staff have created a way to justify the extra weapons, however. The balance of power is determined by numbers, not sufficiency, they claim. Four numbers in particular interest them: total weapons, EMT, weapons capable of destroying military targets, and weapons capable of destroying such targets quickly. As General Richard Ellis, former director of the strategic targeting staff, testified in 1979, these are "hard mathematical things that can be associated with actual force capability." In recent years, the Joint Chiefs' annual posture statements have been filled with warnings that the Soviets have achieved superiority or are about to achieve it in these measures, and that the U.S. nuclear war arsenal must be expanded and improved in order to avert this.

The defect in this assessment is that it focuses on capability that might be useful in a first strike, not a retaliatory strike, which is the professed choice of the U.S. government. In an effort to respond to this criticism, the Joint Chiefs and others at the Pentagon have created computer models that simulate the effects of a nuclear conflict on U.S. and Soviet arsenals, and again take a reading of the measures listed above.

One version of this model has been published since 1978 in the annual report of the Secretary of Defense, as part of the sales effort for a new land-based missile. As Secretary Harold Brown noted in 1981, the charts show that the Soviets would have substantially more EMT, and possibly even more total warheads, if a new land-based missile is not constructed. "With Soviet forces under SALT II limitations, it is MX that gives the United States a post-exchange warhead advantage in the latter half of the decade; without SALT II limits, MX is needed to reverse the adverse post-exchange warhead trend," Brown said.

The relevance of these computer models to any real measure of U.S. security is highly suspect. In the first place, they are inherently sensitive to assumptions about how a nuclear exchange might occur, a matter that no one can really address with authority. They fail, for example, to consider the effects of an attack on military command and communications capabilities, which would surely be the first targets attacked. Some posit a Soviet surprise attack out of the blue, which most experts consider highly unlikely. More important, they fail to consider what life would be like after a nuclear war.

As McGeorge Bundy, former national security adviser to President Kennedy, wrote last year, "There is an enormous gulf between what political leaders really think about nuclear weapons and what is assumed in complex calculations of relative 'advantage' in simulated strategic war. Think tank analysts can set levels of 'acceptable' damage well up in the hundreds of millions of lives. . . . They are in an unreal world."

However unreal it is, many U.S. officials reside there. As General Ellis said, "We are charged with two overriding national objectives. The first one, of course, is to deter attack against the United States and against our allies. The second, if deterrence fails and a nuclear exchange takes place, our objective is to emerge in a better relative position than the Soviet Union."

Officials in the Reagan Administration heartily embrace this viewpoint. Reagan himself has said that the Soviets are at present in "a position of great advantage" vis-á-vis the United States, and that a freeze on nuclear weapons would enshrine it. "We had superiority. We have lost it. We are in somewhat of an equivalence in a sense, but with some very serious deficiencies," says Secretary of State Alexander Haig. Secretary of Defense Caspar Weinberger told the *New York Times* that "we had a degree of superiority" in the 1950's, and that the United States needs to regain it. The flaw in this quest is that genuine superiority may not exist.—R. JEFFREY SMITH

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tage by the Soviet Union foretells a realistic possibility of a Soviet 'bolt out of the blue' strategic attack."

What worries the Joint Chiefs, then, is not the military consequence of missile vulnerability but its political ramifications. "A far more likely consequence is that it will affect the Soviet perception of the military balance in a such a way that it will embolden them to act with less restraint in international affairs . . . and to exploit instability in the Third World when it occurs," their report said. Because of the missile vulnerability, the United States will be powerless to restrain aggressive Soviet behavior, and other nations will be more likely to side with the Soviets in a crisis.

This view is the most widely shared justification for the construction and protection of the MX missile as the means to redress vulnerability of the Minuteman III's. Donald Rumsfeld, the Secretary of Defense under President Ford and the first to approve the MX, said that "while vulnerability would in no way give the Soviets a disarming first strike, it could create a dangerous asymmetry" that had to be corrected. This viewpoint was shared by his successor, Harold Brown.

More recently, the Reagan Administration has taken up the cudgel and asserted that nuclear perceptions bear on foreign policy. Secretary of State Alexander Haig told the Senate Committee on Foreign Relations that "the confidence we have in our nuclear deterrent cannot but influence how we will behave in a crisis. Our strategic capabilities also affect the perceptions of our adversaries. Doubts about our . . . deterrent can only increase the chances that our political will would be tested during crises."

Richard DeLauer, the Pentagon's top scientist and one of the architects of the Reagan strategic plan, spoke even more bluntly in an interview. "The Soviets don't have to have a preemptive first strike. They just present the situation and say, Look. They marched into Afghanistan and what the hell was the best thing we could do? We withdrew from their goddamn Olympics. The last time they tried to march in and put their missiles into Cuba, we got their butt out of there. The Soviets don't have to pull the trigger. They have superiority. They've got a deterrent and we don't, and that's the window of vulnerability."

Some historians suggest that this is a myopic view of foreign policy. Stanley Hoffman, a history professor at Harvard, addressed the issue in broad terms during testimony on the SALT II treaty. "It is impossible to prove that the outcome of political conflict in the last 30 years has been determined by the exact ratio of strategic military forces. It is the relative importance of the stake to each side in every crisis which has been decisive." Similarly, at the request of the Defense Department, the Brookings Institution in Washington recently studied the relationship between weapons and conflicts. The study's authors concluded that "data would not support a hypothesis that the strategic weapons balance influences the outcome of incidents in which the United States and the U.S.S.R. are involved."

R. Jeffrey Smith

Albert Wheelon

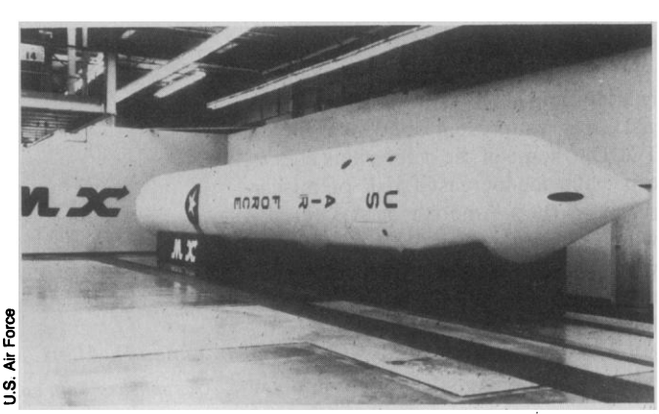
Soviet accuracy was "an uncongenial reality"

In view of these challenges, how did the development of Soviet accuracy come to be regarded with such fear? One reason is a preoccupation with the technical aspects of weapons evolution among those charged with assessing the strategic balance. After the B team analysis for the CIA of Soviet missile accuracy, the Senate Select Committee on Intelligence reviewed two decades of the agency's official estimates of Soviet capability. It concluded that the "greatest attention often is given to the least likely Soviet actions, such as nuclear attack, rather than to Soviet intentions and assertive world activity short of these extremes." Had more attention been paid to these matters, the CIA's assessment of Soviet accuracy in 1978 might have been cast in a different light.

Another occasion where the perspective of policy-makers might have been broadened was the convening of a panel of experts by President Carter's science adviser Frank Press that same year. The panel members were asked to examine alternative solutions to Minuteman vulnerability, but not to address the question of whether it was worrisome in the first place. "That was not in the charter," says panel member Jack Ruina. "We were hired as a technical committee, and were not to address the moral, ethical, or political basis of resolving the problem." Ruina believes that the vulnerability of land-based missiles can have no real impact on American security or foreign policy. "It's not worth much attention," he says. During the panel's deliberations, however, he held his tongue. Several other panelists apparently did the same. "It would have been like getting five doctors together and asking them, What's the prognosis and the treatment? They didn't want a lecture about public health."

What do the Soviets gain from narrow thinking about their achievement of missile accuracy? "They won the political benefit that comes from having all those smart people in the United States, including the President, saying the United States is militarily inferior," says Richard Garwin, a longtime Pentagon consultant. George Rathjens of MIT, another consultant, has testified that "to the degree there is a problem, it is largely of our own making. We exaggerate the growth of Soviet nuclear capabilities in order to gain support for our own prospective nuclear programs. Having done so, it is hardly surprising that others expect us to remedy what we have identified as critical deficiencies. Failure to do so would indeed make us appear irresolute by our own standards."

Even William Perry, the former undersecretary of defense, who expressed



U.S. Air Force

The $7-billion MX missile is scheduled for its first test flight early next year.

great concern about vulnerability, says that "to a certain extent, we have shot ourselves in the foot. We have inflicted these problems on ourselves by the way we have advertised them." The consequences of Soviet capabilities—not the capabilities themselves—have been exaggerated, he says.

The decision to build the MX missile and to spend billions of dollars to hide it from a surprise Soviet attack is perhaps the most visible and costly consequence of the narrow interpretation of the consequences of Soviet missile accuracy.

—R. JEFFREY SMITH

Court Upholds Privacy of Unpublished Data

University of Wisconsin successfully fights off attempt by Dow Chemical to review raw data of controversial study

The U.S. Court of Appeals for the Seventh Circuit has taken a strong stance in support of academic freedom by ruling in February that the Dow Chemical Company cannot have access to the files of a former University of Wisconsin (UW) researcher. Only a few such cases have reached the appellate court level, and the decision, according to both sides in the litigation, sets something of a precedent.

"Our view," says UW attorney Michael A. Liethen, "is that a scientist has to be free to take his inquiries where they lead him, and that a scientist should not be forced to disclose his research data until he has results he is willing to stand behind."

The ruling involved a UW researcher who entered a complex battle between Dow and the Environmental Protection Agency (EPA) over the proposed cancellation of two herbicides, 2,4,5-T and silvex—both manufactured at least in part by Dow. The herbicides have been used extensively for years to control weeds and brush in forests, rangelands, and along highways. In the 1970's they were found to contain traces of a highly toxic contaminant known as TCDD (2,3,7,8-tetrachlorodibenzo-*p*-dioxin). In 1979 EPA halted most uses of the herbicides, citing a significant increase in the number of miscarriages among women in an area of Oregon where large quantities of 2,4,5-T had been sprayed by helicopters in order to increase the productivity of commercial forests.

At the subsequent EPA cancellation hearing, James R. Allen, a UW pathologist, was to present evidence linking TCDD to some of the deleterious effects, especially an increased risk of miscarriages in rhesus monkeys. A key EPA witness, Allen was an ambitious worker who had gained an international reputation on the effects of the toxic substance. Part of his renown came because of the poison's ubiquity. TCDD is also a contaminant of the Agent Orange defoliant used in Vietnam and the chemical cloud that descended in 1976 on Seveso, Italy. When the cancellation hearings began in 1979, Allen had published several studies in which a 500 ppt (parts per trillion) diet of TCDD had been fed to monkeys. He had also published an abstract concerning a 50 ppt study and was working on 25 and 5 ppt studies. His work showed that even extremely low doses of TCDD caused abortions, stillbirths, and decreased fertility.

Dow in 1979 asked for access to all of Allen's raw data—for work both published and unpublished. The admitted aim of the company was to discredit Allen's research.

This task was soon helped along by Allen himself, who in late 1979 pleaded guilty to lifting $900 from a federal grant to pay for some ski trips (*Science*, 15 February 1980, p. 743). "There are compelling reasons to require full scrutiny of Dr. Allen's work," said attorneys for Dow at the EPA hearing. "Toxic PCB's have been found in tissue from test animals in Dr. Allen's 500 ppt monkey study, raising serious questions about the reliability of any of Dr. Allen's work. In addition, Dr. Allen's general credibility is impugned by his recent admission of guilt involving the theft of government funds." For the purpose of attacking the credibility of a witness, the *Federal Rules of Evidence* allow a lawyer to cite for up to 10 years a conviction involving dishonesty or false statement.

William J. Broad

James R. Allen

Unpublished data cannot be subpoenaed.

Amid the controversy in 1980 over the grant money, Allen resigned from UW but still planned to present evidence at the hearing. At Dow's request, the EPA administrative law judge for the cancellation hearing early in 1980 issued a subpoena for all of Allen's raw data, notes, files, and other laboratory records relating to the TCDD studies. At first Allen resisted, but soon he voluntarily produced documents for the 500 and 50 ppt studies—in other words, for the ones that had already resulted in publication either of papers or abstracts. He did not come forward with the lower-level studies, however, and the squabble soon ended up in federal court.

In June 1980, the district court in Wisconsin found Allen had been correct in resisting further incursions by Dow. The judge ruled not that academic freedom was at stake but that the subpoenas would be onerous for Allen and his assistants. "It would be a substantial burden on respondents," wrote the judge, "to force them to produce the information requested from the 5 ppt and 25 ppt studies which are nowhere near completion and which have not been subjected to peer review."

In arriving at the opinion, the judge noted that Allen no longer planned to testify at the cancellation hearings and that the EPA no longer "apparently" intended to introduce the Allen studies for which Dow wanted raw data.

Downplaying this development, Dow pressed for access to the raw data by appealing the court's ruling. "We pursued the issue," says Dow attorney Edward W. Warren, of the Washington firm of Kirkland & Ellis, "because we didn't know if the promises that Allen was not going to appear as a witness were going to materialize, and we didn't know

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