Qualified Approval for Binary Chemical Weapons

Congress has come close to approving production; critics focus on technical problems, lack of military justification

It has become a familiar annual exercise. The Reagan Administration insists that new chemical weapons are needed to offset Soviet advances in chemical warfare capabilities; Congress, in a close vote, stops just short of doing away with a moratorium on the production of new nerve gas weapons by the United States that has now lasted for 17 years.

This year, Congress came the closest yet to giving the Administration what it has wanted. Fearful of appearing to undermine the President's negotiating position at Reykjavik, Democrats in the House agreed to drop a series of tough arms-control amendments that they had earlier tacked on to the defense authorization bill. Under the final compromise, passed on 15 October as one piece of a mammoth catchall spending bill, the Pentagon will be allowed to build production facilities for new binary chemical artillery shells and air-delivered bombs, and to begin manufacturing the chemicals and hardware for the weapons. Only the final assembly of these components into working weapons is barred—artillery shells for 1 year, bombs for 2 years.

The Administration has argued that new binary chemical weapons are needed to "modernize" U.S. chemical warfare capabilities. Much of the existing stockpile of nerve agents has deteriorated to the point of being unusable, Administration officials have asserted. The new binary weapons will be easier to handle and transport because they consist of two relatively safe components that form a lethal agent only when mixed together inside the weapon itself. The program has, however, been challenged by critics who argue that technical problems may prevent some of the weapons from working as advertised and that the military and strategic case for the program is far from proven.

Opponents of renewed chemical weapons production in the House hope that the prohibition on assembling the weapons will buy time to allow negotiation of a new treaty eliminating chemical weapons, or that the election of a Democratically controlled Senate will enhance the prospects for stopping the program next year. In negotiations in Geneva this summer, the Soviets were reported to have eased some of their opposition to on-site inspections; talks are scheduled to resume in February.

The opponents also hope that a provision in the compromise calling for continued monitoring by the General Accounting Office (GAO) of the technically troubled Bigeye chemical bomb will prove a productive source of ammunition against the program as a whole. In a report released last June, the GAO once again concluded that the Bigeye is not ready for production because of several fundamental technical problems (*Science*, 20 June, p. 1493).

The price paid for European acceptance of binaries was agreement that they will not be stored there.

The GAO found that high pressures may rapidly build up inside the bomb when its two chemical components are mixed, possibly causing the bomb to blow up prematurely. Following just such an explosion in an October 1982 test, Department of Defense (DOD) scientists installed pressure-relief valves on the bombs that were used in subsequent tests; the actual weapons, of course, will not be so equipped. Other problems include the Bigeye's continuing failure to meet specifications for purity of the nerve agent, and the possibility that the nerve agent itself, known as VX, may spontaneously "flash"—vaporize and catch fire—when dispersed from the bomb.

Defense Department spokesmen have called these "nonissues," maintaining that more recent operational tests, which they say GAO failed to take into account, demonstrate that the bomb is ready for initial production. But Representative Dante Fascell (D–FL), chairman of the House Foreign Affairs Committee, released on 15 October an unusually strong-worded letter from Eleanor Chelimsky, the GAO official heading the study, who accused DOD of having "selectively analyzed, declassified, and reported to the press data that put Bigeye in a favorable light. . . . Unlike DOD, we cannot selectively declassify information." GAO officials have said, however, that the successful operational tests cited by the Pentagon were not even designed to address the fundamental technical flaws raised by GAO. Because open-air testing of live chemical agents has been banned since 1969, the operational tests use bombs loaded with chemical simulants. These tests are designed only to assess such issues as the aerodynamic compatibility of the bomb with various fighter aircraft, the reliability of the release mechanisms on bomb racks, and the accuracy with which the bomb can be dropped on a target.

Chelimsky's letter also noted that DOD's own report of the operational test results raises a number of basic design problems. For example, the turbine that mixes the chemicals together has a service life of only 60 days, as opposed to the 1 year required by the Air Force's own specifications. And a still-classified GAO study dated 10 October states that "unresolved issues continue to plague the program."

Lost in the technical and political squabbles, however, are some fundamental questions about the military and strategic role of chemical weapons that military analysts say have been largely ignored in the current debate. Analysts point to three major questions that have yet to be answered adequately: how large a stockpile does the United States need to effectively deter Soviet use of chemical weapons in the event of war; what delivery capabilities are needed to get the weapons to the right targets; and how do chemical weapons compare to advanced conventional weapons in achieving specific military objectives.

One of the most basic uncertainties is the extent of the Soviet stockpile of chemical weapons and Soviet strategy for employing them. While there is general agreement that the Soviets attach great importance to chemical warfare preparations, hard evidence is difficult to come by. The U.S. Presidential Chemical Warfare Review Commission, chaired by Ambassador Walter Stoessel, stated that the "most conservative informed estimates" place the Soviet stockpile at "several times larger than the usable portion of the U.S. inventory." But most of the numbers appear to be largely guesswork, based, for example, on estimates of how many tons of chemicals could be fired per day given the current strength of Soviet ground and air forces. A classified 1981 study by the Defense Science Board makes clear that little is

actually known about the Soviet stockpile.

On the other hand, the Soviets are known to train extensively in chemical operations. Soviet military vehicles are built with chemical protection systems, and virtually all Soviet conventional weapons can carry chemical warheads. Officials at DOD have recently singled out for special mention the Scud-B surface-to-surface missile, which has a range of about 200 kilometers. Although chemical weapons are termed "weapons of mass destruction" in the Soviet military literature—the same term applied to nuclear arms—chemical capabilities are integrated into the Soviet forces at all levels.

The threat that U.S. officials point to is twofold. First, a Soviet chemical attack—or even the serious threat of such an attack—would force NATO troops to don cumbersome protective gear: not only gas masks, but full-length rubberlike suits that become unbearably hot and reduce a soldier's performance by something like one-half. Of perhaps greater concern is the threat that chemical attack holds for shutting down key installations that NATO depends upon for supplies and reinforcements, especially commercial ports and airfields manned by civilian employees. "If the Dutch longshoremen think somebody's going to dump nerve gas on them, I suspect that a lot of them are not going to show up for work," says Alan Shaw, a defense analyst with the congressional Office of Technology Assessment.

An ability to retaliate in kind would force Soviet troops to likewise don protective gear, thereby neutralizing any advantage to be gained by launching a chemical attack against NATO forces. Thomas Welch, deputy assistant to the secretary of defense for chemical matters, said last year in congressional testimony that the current U.S. stockpile "does not constitute a deterrent." Only 10% is in a usable form, he said, and that "is not enough to fight a 30-day war in Europe." The Stoessel commission, however, found that the Pentagon had been "unduly pessimistic," and suggested that in the event of war the United States would be able to put to use at least a portion of the stocks now considered unusable. And, the commission said, "Rumors of the stored munitions being dangerous or leaking appear to be exaggerated and inaccurate. All the weapons in Europe are serviceable."

Estimates from open sources place the number of serviceable U.S. chemical artillery shells at approximately 2 million; perhaps 100,000 of those are in Europe. The 90% that Welch said is unserviceable consists mostly of some 10,000 1-ton drums of mustard gas, smaller numbers of nerve gas drums, and shells, rockets, and land mines that have deteriorated or become obsolete.

Deterrence by defense. *Current chemical defenses have plenty of room for improvement. Congress appropriated $1 billion for defense in FY 1986.*

Whether the existing number is adequate is, of course, the rub; answers have tended to reflect politics more than analysis. If the objective of chemical retaliation is to force the Soviets to don their protective gear, there is clearly some optimal mix between chemical rounds and high-explosive rounds; yet virtually no studies have been done to establish that number. A 1983 GAO survey found no rigorous basis for DOD's assertions of stockpile requirements. Those who argue against the binary assert with equally little evidence that current stocks are adequate. The Stoessel commission said only that "if the sole measure of deterrence were to be able to force the enemy to the impediment of wearing protective clothing, to a degree that exists now."

There is little disagreement among experts, however, that some retaliatory capability is needed as a deterrent; defense alone is not sufficient to deter an attack because even a defense that protects troops completely against the lethal effects of chemicals would impair their performance. On the other hand, with current U.S. chemical defenses falling far short of perfection, there is plenty of room for enhancing deterrence through improved defensive measures that will diminish the payoff of a Soviet chemical attack. Congress has in effect chosen this course; nearly $1 billion was approved for chemical defenses for FY 1986.

Deterring attacks upon NATO ports and airfields is a more complicated proposition. If retaliation in kind is the chosen strategy, it quickly raises the question of the actual military effectiveness of chemicals as opposed to conventional weapons. The Pentagon commissioned a study by the Institute for Defense Analyses that looked at the relative effectiveness of the Bigeye in reducing sortie rates from airfields; the Bigeye is said to have come off favorably. But sources who have seen the classified report say that the only conventional weapon that the Bigeye was compared against was the Rockeye, an obsolete cluster bomb designed to attack soft targets such as light vehicles, unsheltered aircraft, and personnel. Advanced airfield attack weapons that blow a series of craters in runways and then sprinkle mines to hinder repair efforts are now being produced by Britain and France and are under development in the United States and West Germany, but were not considered in the study.

In any event, the United States lacks the means to deliver chemical weapons at long range. Artillery is limited to a range of about 17 kilometers. Existing air-delivered bombs in principle could be used to strike deep, but are loaded with the nerve agent GB, which the Air Force considers inappropriate for deep-strike targets because it is nonpersistent, dissipating within a few hours. A few hundred aircraft spray tanks containing the persistent agent VX are in stock, but the F-4 aircraft carrying them would have to fly at low speed, directly over the target—making them sitting ducks for the heavy Soviet air defenses.

Currently planned improvements add little to deep-strike capabilities. Operational constraints on the Bigeye—such as the requirement that the aircraft fly at high altitudes for much of their approach to avoid overheating the bomb—may not make it much better suited than existing chemical munitions for missions into enemy territory.

The Stoessel commission recommended an unmanned delivery system for deep strike, such as an air-launched cruise missile, and the Pentagon is studying two concepts: an extended-range, TV-guided "Boosted Big-eye," and a chemical warhead for the soon-to-be-deployed ATACMS missile, a battlefield ballistic missile with a range of more than 100 kilometers. But these are years away even from initial development. For now, the only concrete development work is on a semi-persistent chemical warhead for the Multiple Launch Rocket System, a battlefield artillery rocket with a range of 40 kilometers or so.

With no immediate plans for deploying any new binary munitions in Europe, though, critics charge that it is unclear how any of the proposed modernization steps can bolster deterrence. The price paid for European acceptance of the new weapons was a U.S. agreement that they would not be stored there. The existing stocks of unitary munitions, stored at a single site in West Germany, are to be removed in the early 1990's, while the new weapons, the plan goes, would be stored in the United States and airlifted to Europe in time of crisis. Proponents say that in principle binaries are much better suited to that role: "The idea is that they know we're not coming over with a C-5 full of live nerve gas that will blow up on the runway and wipe out Frankfurt," says one analyst. But a House Foreign Affairs Committee staff member says, "In a time of crisis, we're going to fly these to Europe—instead of putting troops on the planes?" Flying the equivalent of the estimated 100,000 unitary chemical artillery shells now in place in Germany would require moving a payload on the order of 10 million pounds.

For the most part, though, the case for the binary has not been distinguished from the general argument that the U.S. retaliatory capability needs to be bolstered. The binary has become a symbol of U.S. resolve to "modernize" its chemical warfare capability. And indeed a 1981 study by the Defense Science Board didn't even bother to consider the possibility of renewed production of unitary munitions: that option, the board said, was "politically unacceptable." Although the board was referring to public worries over an accident if live nerve gas were to be produced and transported once again, it might as well have been referring to the Administration's political decision to present Congress with an all-or-nothing choice for the binary program as currently conceived. ■ STEPHEN BUDIANSKY

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Office of Naval Research Marks 40th Anniversary

Set up at end of World War II to keep link with scientists, ONR pioneered postwar government-university partnership

THE Office of Naval Research celebrated its first 40 years recently with a public symposium titled "Forty Years of Excellence." If the assertion made in the title seems more than a shade self-congratulatory, it was supported by a blue-ribbon lineup of speakers who reminded the audience that ONR has made substantial contributions not only to U.S. science but also to shaping science policy.

ONR takes pride in being the first federal agency with statutory authority to contract for basic research. In getting started in 1946, it invented the machinery that still largely governs the research partnership between government and universities.

A first-hand account of the establishment of ONR was provided at the symposium by Bruce S. Old, who not only was present at the creation but had a direct hand in the process. Old, who went on to be a vice president of Arthur D. Little and now runs his own consulting firm, was one of a small group of young Naval Reserve officers who served during World War II in the office which advised the Secretary of the Navy on naval research.*

Old and his colleagues were charged with getting out, "to scout various situations," and their free-ranging style earned them the nickname "Bird Dogs." In their off-duty hours, the Bird Dogs began the discussions about postwar research that evolved into the proposal for ONR.

Old said in an interview that the Bird Dogs recognized the impact science and technology were having on the course of the war and "began to study the question of how we can maintain the liaison with the scientific community after the war." They started with "the feeling that the Navy was the best educated service." It had established its own laboratories and postgraduate school. "The Navy thought of itself as an elite service." Between the two world wars, however, funds to run the naval laboratories had dwindled and the Navy's science capabilities declined.

*The original Bird Dogs, besides Old, were H. Gordon Dyke, Ralph A. Krause, and Thomas C. Wilson. Later arrivals were John T. Burwell and James H. Wakelin.

Bruce Old, *one of the "Bird Dogs" for ONR in the early days.*

The Bird Dogs faced a problem not only in convincing Navy brass that the wartime liaison should be continued, but also of persuading university scientists to cooperate. "The scientists couldn't wait to get home," said Old. "The last thing they wanted to see was another naval officer. But when they got back, they took one look and found that the universities had no money for graduate students and badly needed equipment." The discovery made them more receptive and the way was further smoothed by visits by the Bird Dogs and other Navy officers to major research institutions such as Berkeley, Caltech, Chicago, Columbia, Harvard, and MIT.

"The key," says Old, "was the invention of a contract the scientists would accept." A substitute had to be found for the standard Navy procurement contract awarded through competitive bidding. In designing the new instrument, the Navy got lots of help from the university scientists. The result, says Old, was "a fairly simple basic contract to perform research and development without very definite scope." It was the prototype for the unsolicited research proposal that has enabled university scientists to compete for federal support of basic research and permitted them to publish the results.

During the war, the Bird Dogs had gotten to know many of the scientists working