New Technologies for Nonproliferation

Remote monitoring via a dial-a-safeguard RECOVER system is one of the technical aids for verification under development

When President Reagan visited New York to speak at the United Nations special session on disarmament on 17 June he called at the U.S. mission across U.N. plaza and swung through an exhibit on disarmament set up in the mission courtyard. Centerpiece of the exhibit is an array of electronic hardware with a potential for meeting some of the technical and political problems that beset nuclear nonproliferation efforts.

On display are the main elements of a system dubbed RECOVER (for REmote COntinuous VERification). The system is designed to bolster the safeguards regimen of the International Atomic Energy Agency (IAEA) in Vienna, which is aimed at deterring the diversion of weapons-usable nuclear materials. A yearlong test of RECOVER at nuclear installations in seven countries* has recently been completed.

If successful, these efforts could lead to more reliance on remote methods of detecting diversion of critical nuclear materials. The technologies for which remote monitoring could be developed range from surveillance equipment in sensitive areas of nuclear facilities to radiation detectors designed to spot any loss of potential nuclear explosive from reprocessing facilities. In each case, the idea is to transmit data from these remote monitoring devices direct to IAEA's Vienna headquarters or to regional centers. The hope is that remote monitoring will provide more timely and accurate information than the current system, which relies on periodic on-site inspection by IAEA inspectors. Some countries, however, are likely to object that the new technologies will be too intrusive.

RECOVER, sponsored by the Arms Control and Disarmament Agency (ACDA), is only one of several research efforts by the United States and other countries to provide technical assistance to IAEA to strengthen its safeguards measures. The need for such efforts is seen as urgent by some observers who fear that the expected increase in the number of nuclear reactors operating worldwide and the possible spread of sensitive nuclear technology such as uranium enrichment and reprocessing plants could overload the IAEA safeguards program.

RECOVER had its origins during the Carter Administration. The system was designed by Atlantic Research Corporation, but when the contract for the prototype system was put out for bids the contract was won by TRW.

With the current system, a central unit in Vienna can be used to interrogate on-site equipment on a regular schedule or on demand over the international telephone system. Data from the remote units are stored and can be displayed on the central unit's screen. At the sites, sensors on surveillance equipment are connected to monitoring units that, in turn, feed information to a multiplexer capable of transmitting data to Vienna in encrypted form.

The sensors report on the operating status of surveillance and containment equipment supporting the safeguards program. In the recent test, for example, attention was centered on the standard dual cameras installed by IAEA to monitor reactor fuel loading and storage areas. Sensors on the cameras are capable of indicating, for example, whether film is intact, power in the emergency batteries is adequate, or the camera case has been tampered with. Other sensors were placed on fiber optic seals developed in the United States especially for the safeguards test. Sensors were also rigged on portal monitors developed by the Japanese; the monitors are capable of detecting motion or changes in radiation.

The current RECOVER system, still in the experimental stage, is designed for limited use at reactor sites. Broader applications for RECOVER are envisioned, however, in nuclear facilities and beyond. For example, use of a RECOVER type system in the verification of chemical warfare agreements is being considered, specifically, to monitor mothballed facilities capable of producing chemical warfare agents.

On his visit to New York the President spent about 5 minutes at the RECOVER exhibit getting a demonstration of its capabilities. The pause cannot be construed as a presidential laying on of hands for RECOVER, but, considering how presidential itineraries are made, it did signify Administration support for IAEA safeguards and interest in verification technology.

Verification has been an American priority in nuclear negotiations since World War II. At the U.N., Reagan devoted much of his speech to assessing Soviet actions in terms heard more often from American presidents on the campaign trail than on the U.N. podium, but, nonetheless, he called on the Soviets to cooperate with the United States in making meaningful progress on arms control, adding, "let me stress that for agreements to work, both sides must be able to verify compliance."

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Verification measures in the nuclear nonproliferation field involve a set of problems different from those for strategic arms. In arms control negotiations, the Soviets have consistently resisted on-site inspections to monitor agreements. Soviet attitudes have been attributed usually to an ingrained disposition to secrecy in a closed society and a view that the presence of foreign inspectors on Soviet soil opens the way to espionage.

Alternatives to on-site inspection, such as satellite reconnaissance, seismic monitoring, and air-sampling techniques proved satisfactory to the two nuclear superpowers for verifying strategic arms agreements. These so-called "national technical means" of verification are inadequate, however, for nonproliferation verification. The most likely violations of nonproliferation safeguards would in-

*Australia, Britain, Bulgaria, Canada, West Germany, Japan, and the United States.

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volve the diversion of quantities of nuclear material too small to be detected by such means. (The Soviets have recently encouraged partisans of nonproliferation policies by agreeing to place some of their nuclear facilities under safeguards.)

A system like RECOVER, which has the capacity to keep tabs continuously on nuclear facilities and report anomalies that might indicate attempts at small scale diversion, is thought by its proponents to promise to enhance the power of safeguards to detect and deter diversion.

The IAEA safeguards program was created as a result of the Treaty on the Nonproliferation of Nuclear Weapons (NPT) of 1968. Signatory nations that did not have nuclear weapons accepted safeguards on their nuclear installations in exchange for assistance with development of peaceful uses for nuclear energy.

The present safeguards system is essentially a fuel-accounting system depending on IAEA inspectors making periodic visits to nuclear facilities to ascertain that the amount of fuel on hand accords with the records. The adequacy of the inspection system has been questioned, particularly in respect to providing timely warning of diversion. Criticism of the safeguards increased after the Israeli attack on Iraq's Osirak reactor in June of 1981. In the United States, questions centered mainly on lack of information obtainable from IAEA.

Last month, IAEA conceded that it could not certify that nuclear material was not being diverted in two nations, but said "it was reasonable to conclude" that such diversion had not occurred. The two nations were not identified by IAEA, but informed observers said that they were India and Pakistan.

As the number of nuclear facilities increases, IAEA is expected to encounter difficulties in finding sufficient funds and qualified inspectors to carry out the required inspections. Potentially, RECOVER could reduce costs and also limit the intrusiveness of inspections about which some countries complain.

An evaluation of RECOVER by a Brookhaven National Laboratory team gave qualified approval to the system. RECOVER was found to be cost-effective and technically adequate for use in reactor fuel storage areas and for monitoring the Canadian CANDU reactor and certain research reactors that afford more or less continuous access to fuel areas while the reactors are operating. The evaluation team found RECOVER less than cost-effective for pressurized water reactors (PWR's), the dominant commercial reactor type. The chief reason was that the danger of diversion from PWR's is greatest when the reactor is shut down for refueling, a time when inspectors are presumably present anyway.

ACDA director Eugene V. Rostow gets hands-on demonstration of RECOVER.

Officials from ACDA and the six other countries that cooperated in the test met in Vienna late last month to review the experience gained in the test. Carl Thorne, the ACDA project officer for RECOVER who attended the meeting, says that the participants agreed that the test had been sufficiently promising to warrant development of a working version of the system. The next step will be to test improved interface hardware for the camera sensors. The current hardware produced too many anomalous signals during the test period. Those attending the meeting were optimistic about the prospects for achieving reliability, and IAEA officials are encouraging the project forward. Sensors are available to monitor additional safeguards functions more extensively; what remains is to make them remotely monitorable.

RECOVER, on which ACDA has spent a total of about $3 million, is only one of the technologies being worked on to back up IAEA safeguards. The Canadians are developing a closed-circuit television total monitoring system for their CANDU reactor. At Los Alamos National Laboratory a massive radiation detector is nearing completion. Called "Shuffler," it will be used in a new federal facility for reprocessing spent naval reactor fuel in Idaho Falls. Shuffler is probably too large and expensive to be used for commercial nuclear plant safeguards, but its technology for providing waste accountability and criticality measurement could prove useful in the IAEA context. Also at Los Alamos, work is going forward on a so-called Cherenkov counter, named after the Soviet scientist who observed the glow given off by fission products from nuclear fuel assemblies submerged in water in operating reactors. Both the counter and another device, a combination gamma ray and neutron detector being worked on at Los Alamos, promise to be of practical help to IAEA inspectors checking to see that fuel assemblies in use or in storage have not been tampered with. The Japanese portal monitor and a fiber optic seal devised in Germany are examples of relevant projects being carried on in other countries.

In the case of RECOVER and other technologies with safeguards potential, much technical ground remains to be covered before foolproof, cost-effective systems are available. Even when that occurs, formidable hurdles will remain. The countries involved in the RECOVER test are strongly committed to the safeguards idea. Other NPT signatory countries may object that installation of the new technology could lead to unnecessary and expensive plant shutdowns or might resist giving IAEA access to the kind of data that the new technology provides. IAEA and its partisans will, therefore, face a task of political persuasion if the technical problems are solved.

Is the new safeguards technology worth pursuing? Cornell professor Hans Bethe, a nuclear pioneer who has followed arms control and nonproliferation matters closely, says he is "impressed by the great sensitivity" of the radiation detectors being developed at Los Alamos and regards RECOVER as "also a useful system." Bethe goes on to say that "The point I want to emphasize is that IAEA should be putting emphasis on technical systems rather than on people. People, especially if they are nationals of a country involved, may lie. Technical systems do not. The technical systems are there. They should be used and IAEA given money for them—never mind the cost effectiveness."

—JOHN WALSH