

U.S. Support Program Contributions to Remote Monitoring

Susan E. Pepper
 International Safeguards Project Office
 Brookhaven National Laboratory
 Upton, NY 11973-5000 USA

ABSTRACT:

The IAEA's Programme 93+2 identified remote monitoring as one of a number of technical measures that could be used to strengthen the safeguards system. Since that time, the U. S. Support Program (USSP) has given high priority to support to the IAEA's remote monitoring efforts. The implementation of remote monitoring, which allows the IAEA to gather inspection data from facilities without an on-site presence, is used by some member states as justification for a reduced number of inspections at certain facilities under an integrated safeguards regime.

Since 1993, the USSP has sponsored a wide variety of tasks to assist the IAEA in its investigation and implementation of remote monitoring. In the mid-1990's the USSP helped to familiarize the IAEA with remote monitoring by sharing results from and encouraging IAEA participation in the International Remote Monitoring Project (IRMP), which involved field trials in several member states including the United States. Additionally, the USSP assisted the IAEA by developing instrumentation required for remote monitoring. The USSP sponsored projects aimed at developing digital equipment and modifying Category A equipment for use in remote monitoring. In 1997, the U.S. provided a cost-free expert to assist the IAEA in its evaluation of equipment for remote monitoring.

The USSP continued to support the IAEA during the implementation of remote

monitoring. The aforementioned cost-free expert is now assisting in the installation of remote monitoring equipment. Due to the aggressive installation schedule, the USSP agreed in 1999 to sponsor a second cost-free expert for remote monitoring installations. The USSP also provided funding for the construction of a Remote Monitoring Test Facility at the Vienna International Centre.

Remote monitoring is a complex technology and brings several challenges to the IAEA and its staff. These challenges will have to be overcome before the implementation of remote monitoring can be considered complete. First, the cost of the capital equipment required for the implementation of remote monitoring cannot be met by the IAEA's regular budget. USSP representatives are helping the IAEA gain access to sources of funding within the United States that can be used to procure the necessary equipment. Second, the digital equipment utilized by the IAEA for remote monitoring requires skills not previously required by the technical staff. The USSP is developing a training program to help the technical staff acquire the necessary skills. Third, the transmission of remote monitoring data from the facility to IAEA Headquarters requires the use of sophisticated communications technologies. To encourage expert review of the various communications options, the USSP sponsored a workshop in 1999 for the discussion of the advantages and disadvantages of the various communications technologies and the introduction to the IAEA of the U.S. companies that can provide communications services. Resolution of these challenges will help the IAEA to successfully implement

remote monitoring and assure the member states that remote monitoring can reliably replace some on-site inspections.

Introduction:

The IAEA's Programme 93+2 identified remote monitoring, environmental sampling and information technology as technical measures that can be used to strengthen the safeguards system. Since that time, the U. S. Support Program (USSP), while aiding the IAEA in all three areas, has given high

priority to supporting the IAEA's remote monitoring efforts.

Remote monitoring systems combine unattended monitoring systems, including surveillance, seals and measurement systems, with a communications system. The systems allow collection of inspection data at a facility and interrogation of the systems themselves from off-site. IAEA safeguards inspectors can verify that a monitoring system is working properly and gather inspection data without being physically present at the facility. A representative system is shown in Figure 1.

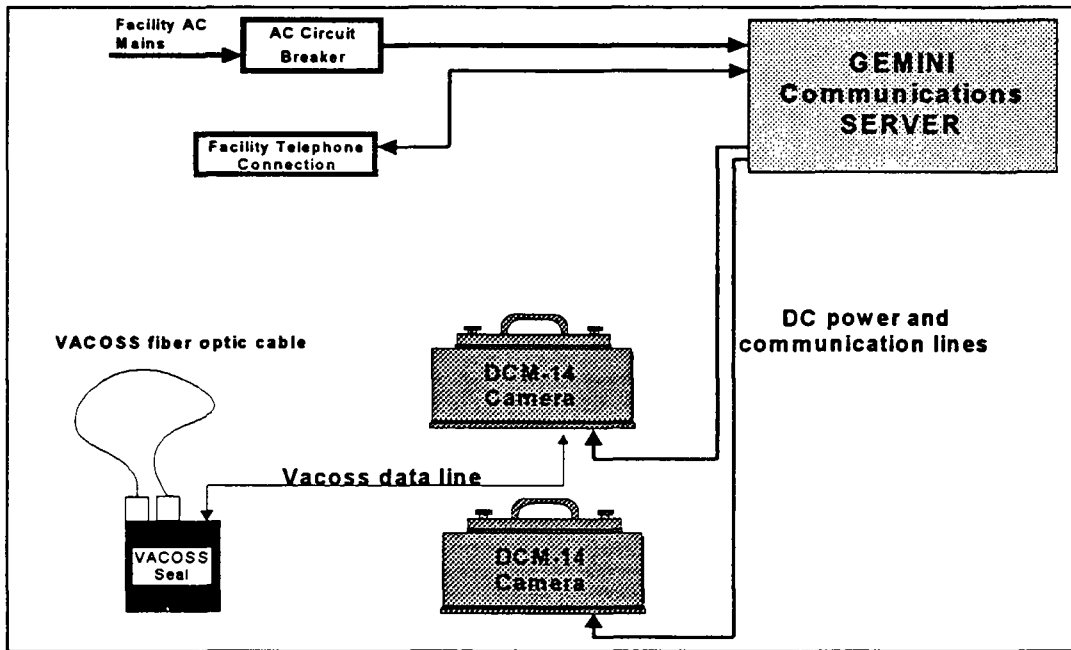


Figure 1: Example of a remote monitoring system consisting of seals and cameras attached to a communications server. [Diagram provided by Aquila Technologies Group.]

As the IAEA and the member states begin to debate the requirements for integrated safeguards, the implementation of remote monitoring is used by some member states as justification for a reduced number of inspections at certain facilities under an integrated safeguards regime. These member states currently experience a level of on-site

presence, which is intrusive and costly. These member states hope that remote monitoring can make safeguards inspections more convenient and less expensive to the member state. Other member states are not as concerned with the efficiency of safeguards as they are with safeguards effectiveness. These member states, including the United

States, want to ensure that IAEA safeguards are not weakened by the adoption of new measures to replace traditional safeguards measures.

In order to help the IAEA optimize the application of integrated safeguards, the USSP has sponsored many tasks for the investigation of various aspects of the new measures. This paper focuses on the USSP tasks related to remote monitoring.

U.S. Support Program Remote Monitoring Activities:

Since 1993, the USSP has sponsored a wide variety of tasks to assist the IAEA in its investigation and implementation of remote monitoring. In the mid-1990's the USSP helped to familiarize the IAEA with remote monitoring by sharing results from and encouraging IAEA participation in the International Remote Monitoring Project (IRMP), which involved field trials in several member states including the United States. Additionally, the USSP assisted the IAEA by developing instrumentation required for remote monitoring. Since 1997, the USSP has provided a cost-free expert to assist the IAEA in its evaluation of equipment for remote monitoring. In 1999, the USSP provided funding for a second cost-free expert for this purpose and for the construction of a Remote Monitoring Test Facility.

Field Trials of Remote Monitoring

Since 1994, the U.S. Department of Energy has funded the International Remote Monitoring Project (IRMP). Under the IRMP, U.S. national laboratories cooperate with other countries to demonstrate the feasibility of remote monitoring for safeguards purposes. IRMP field trials have

been conducted in Australia, Russia, Finland, and Japan.

In 1995, an IRMP field trial of remote monitoring at the HEU storage vault at Y-12, Oak Ridge, began. In order to provide the IAEA an opportunity to learn about the advantages of remote monitoring, the DOE invited IAEA inspectors to observe and participate in the field trial. When the system for monitoring HEU canisters was installed, IAEA inspectors participated in the testing of the system.

The USSP also assisted in IAEA field trials of remote monitoring. Most notably, the IAEA supported a field trial conducted by the IAEA in the Republic of South Africa (RSA) at an HEU storage vault at the Pelindaba Nuclear Complex. The system implemented by the IAEA included surveillance, seals and motion detection. Data transmission for this field trial was by phone line. The USSP provided funding for procurement of equipment and installation of ISDN phone lines at the facility. After a successful field trial, this system was utilized for implementation of remote monitoring and expanded to include other RSA nuclear facilities.

Remote Monitoring Test Facility

The IAEA's implementation of digital image surveillance (DIS) and other remote monitoring equipment involves the purchase of a large number of DIS systems. These systems are "burned in" by the IAEA at Headquarters prior to installation in the field. The receipt and burn in of these systems require warehouse-type space that the Section for Equipment Installation and Maintenance does not have in its current location. To support the implementation of DIS and other sophisticated instrumentation, the USSP provided funding for the renovation of an area in the basement of the G tower of the Vienna International Centre that will be

dedicated to equipment testing. The area, which will be known as the Remote Monitoring Test Facility (RMTF), will include a large open area for layout of large equipment and systems and benches for working with smaller equipment. The RMTF will include offices for co-location of relevant staff. The facility will be completed in June 2000. A plan view of the RMTF is shown in Figure 2.

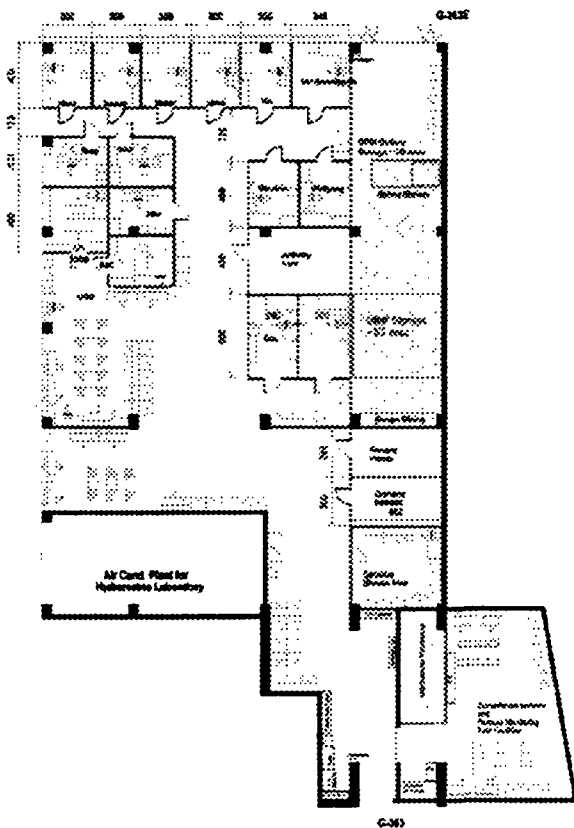


Figure 2: Plan view of the Remote Monitoring Test Facility.

Equipment Development and Expert Assistance

The implementation of remote monitoring benefits from the recent development and implementation of digital equipment. Digital image surveillance (DIS) and electronic seals

are examples of safeguards equipment that is used in remote monitoring. The USSP is sponsoring a task for the upgrade of the VACOSS seal. Initial remote monitoring field trials employing the VACOSS seal found that the VACOSS was unable to manage the frequent state-of-health interrogations that occur during remote monitoring. The VACOSS is being redesigned by Aquila Technologies Group to make it compatible with remote monitoring requirements. The upgrade is scheduled to be complete in mid-2000. The USSP has set aside funding from 1998 extrabudgetary contributions for purchase of the new seal when the upgrade complete.

The IAEA has an aggressive plan for the installation of approximately 50 DIS systems per year. However, the Section for Equipment Installation and Maintenance, which is responsible for the implementation of remote monitoring, does not have the manpower to meet this goal. The USSP is assisting the IAEA by sponsoring two cost-free experts who are responsible for system installation. One cost-free expert is provided by the U.S. Department of Defense and has been assisting the IAEA with remote monitoring since 1997. The second cost-free expert is sponsored through the U.S. Program of Technical Assistance to IAEA Safeguards (POTAS) and began his assignment in January 2000.

The USSP also provides funding for factory support for DIS systems, which are part of the remote monitoring systems. Two technical staff members from Aquila Technologies, the supplier of one of the DIS systems used by the IAEA, work full time with the IAEA to prepare systems for, and assist with, installation.

Challenges Presented by Remote Monitoring:

Remote monitoring is a complex technology that brings challenges to the IAEA and its staff. First, the cost of the capital equipment required for the implementation of remote monitoring cannot be met by the IAEA's regular budget. Second, the digital equipment utilized by the IAEA for remote monitoring requires skills not previously required by the technical staff. Third, the transmission of remote monitoring data from the facility to IAEA Headquarters requires the use of sophisticated communications technologies. These challenges will have to be overcome before the implementation of remote monitoring can be considered complete. The sections below discuss support being provided through the USSP to help the IAEA address these challenges.

Capital Equipment

The Department of Safeguards' regular budget does not provide for the procurement of all of the equipment that is required by the Department. As a result, the IAEA depends on extrabudgetary contributions from its member states to meet its equipment requirements. Extrabudgetary contributions are particularly important for the implementation of remote monitoring where a digital surveillance system costs approximately \$25,000 and a multi-camera system can cost \$250,000.

Since 1994, the United States has provided funding to the IAEA for procurement of safeguards equipment. The funding is provided through the USSP, the U.S. voluntary contribution, and the Non-proliferation and Disarmament Fund (NDF) and is provided for replacement of obsolete equipment as well as for new equipment not previously used by the IAEA. Since 1994, approximately \$27 million has been provided

for the procurement of a variety of safeguards equipment. In 1999, the U.S. voluntary contribution provided funding in the amount of \$4.3 million for the purchase of digital image surveillance systems and other equipment required for the implementation of remote monitoring. The 2000 U.S. voluntary contribution for equipment will be \$5.6 million. For 2000, the USSP is also preparing a proposal to the NDF for additional funding.

Communication

The concept of remote monitoring, as defined for IAEA safeguards, requires electronic communication between IAEA Headquarters in Vienna and the instrumentation installed at facilities. To date, the IAEA has investigated the use of satellites, traditional and ISDN phone lines, and frame relays for transmission of information such as safeguards data and state-of-health messages. The IAEA has found that a technology that is successful in one member state cannot necessarily be used in all member states. For this reason, the IAEA finds itself trying to manage a number of very complex technologies.

To assist the IAEA in its effort to identify the right technology or combination of technologies for data transmission, the USSP sponsored the Workshop on International Data Communications in October 1999. This meeting provided a forum for the IAEA to meet with industry representatives to discuss the IAEA's communications needs. U.S. contractors were also afforded the opportunity to learn from and contribute to the discussions. The meeting was attended by representatives of the IAEA Department of Safeguards, four U.S. Government agencies, eight companies, six U.S. national laboratories, and four Member State Support Programs. The presentations and discussions were documented in a report.(1) As a result of the workshop, the IAEA prepared a communication requirements document

which is being circulated to qualified vendors.(2)

It is expected that the USSP will provide further support to the IAEA for final resolution of its communications requirements. For example, the USSP is currently assisting the IAEA by distributing the communications requirements document to potential service providers. Based on the responses from the contractors, the International Safeguards Project Office and the IAEA will work together to identify an appropriate approach to meeting the IAEA's communications requirements. However, eventually, communications costs must be absorbed into the IAEA's regular budget. The USSP does not desire to provide funding to cover annual communication costs.

Technician Training Program

The IAEA's transition from analog to digital surveillance systems presents new challenges for the technical staff in the Section for Equipment Installation and Maintenance. Digital systems are more complex than analog systems in that they interface with computer technologies. In order to address operational problems, the technicians must understand the structure of the instruments and associated software. The fast evolution of technology associated with digital systems and computer controlled devices means that theoretical and practical training is essential to provide technicians with the skills necessary to effectively support modern equipment. The Department of Safeguards has no formal training program to help staff members responsible for equipment maintenance meet the new requirements associated with digital instrumentation.

To help the IAEA's technical staff members maintain and upgrade their skills, the USSP sponsored a task to systematically identify the skills that are required of the technical staff

and to incorporate these requirements into a training program. This task was completed by Sonalysts with assistance from Brookhaven National Laboratory and Sandia National Laboratories in May 2000.(3) As a result of this effort, the USSP has already sponsored training in Microsoft NT Windows and installation and maintenance of the GEMINI Communications Server. In the future, it is expected that the USSP will extend the task to include the development of additional training modules. The training modules will be designed by subject matter experts, in many cases by the product manufacturer, and will address the individual skills that were identified for the training program. Training documentation will be developed so that the IAEA will have reference material for later use. There is an opportunity for other member state support programs to become involved in this task because some equipment used by the IAEA is manufactured outside the United States.

Conclusion:

Since 1993, the IAEA has made great progress in the implementation of remote monitoring. Equipment has been developed and tested, and installed systems are being used for safeguards purposes. The cost of equipment, the complexity of communication technology, and maintenance of the equipment are challenges that still face the IAEA. Resolution of these challenges will require significant effort. The USSP is committed to assisting the IAEA to overcome these challenges.

References:

1. ISPO-423, "Workshop on International Data Communications," prepared by A.D. Woodhead, January 2000.
2. "Data Communications for Remote Monitoring: Requirements Specification 1.0,"

prepared by the Division of Safeguards
Information Technology, IAEA, November
1999.

3. ISPO-439, "Report on the Needs Analysis
and Program Design for IAEA Maintenance
Technician Training," in preparation by
Sonalysts, Inc.