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Enhanced Peacekeeping with Monitoring Technologies

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Preface

In the spring of 2000, the Secretary General of the United Nations (UN) convened a panel of international experts to assess the performance of past and ongoing UN peace operations as well as to make recommendations for improving future operations. Sandia National Laboratories' Cooperative Monitoring Center (CMC) is concurrently conducting a systems analysis of the potential role of monitoring technologies in peacekeeping operations. The CMC specializes in the development of monitoring techniques, the integration of commercially available technology into monitoring systems, and the application of those systems to security problems worldwide. It promotes the concept of cooperative monitoring, which is the use of monitoring and security technology to acquire and share objective information. The important principle of impartiality in both cooperative monitoring and peacekeeping motivated Sandia to pursue this study.

Monitoring technology has seldom been deployed in peacekeeping operations. On rare occasions, technology in general peace operations has been the subject of conferences.[1] Yet no group or publication has specifically addressed how monitoring technologies could alleviate the operational pressures of UN peacekeeping.[2,3] The purpose of the Sandia study is to fill this gap.

During this study, the office of the UN Secretary General asked Sandia to provide an advance summary of its study to the panel of international experts. Sandia was also asked to provide a similar synopsis to the Mission of the United States to the United Nations, which is participating in a U.S. Government review of peacekeeping.

This paper provides the summary requested by the United Nations and the U.S. Mission. It describes how the integration of appropriate monitoring technologies into UN peacekeeping missions could improve operational capabilities and enhance personnel and public security.

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[1] One conference addressed the application of technologies to peacekeeping in the broadest sense: Alex Gliksman, ed., proceedings of "Meeting the Challenge of International Peace Operations: Assessing the Contribution of Technology," a conference held in Livermore, CA, September 9-10, 1996 (Lawrence Livermore National Laboratory, Center for Global Security Research, 1998).

[2] Another study focused almost exclusively on the use of ground sensors in peacekeeping: Jürgen Altmann, Horst Fischer and Henny van der Graaf, eds., *Sensors for Peace* (Geneva: United Nations Institute for Disarmament Research, 1998).

[3] A staff member of the U.S. National Security Council has claimed that there is too little information available on the possible use of technologies in peacekeeping: Steven N. Simon, "Technology and Peacekeeping: Too Good to be True?" in *Improving the Prospects for Future Peace Operations*, Office of Technology Assessment, U.S. Congress, OTA-BP-ISS-167 (Washington, DC: U.S. Government Printing Office, 1995)

Introduction

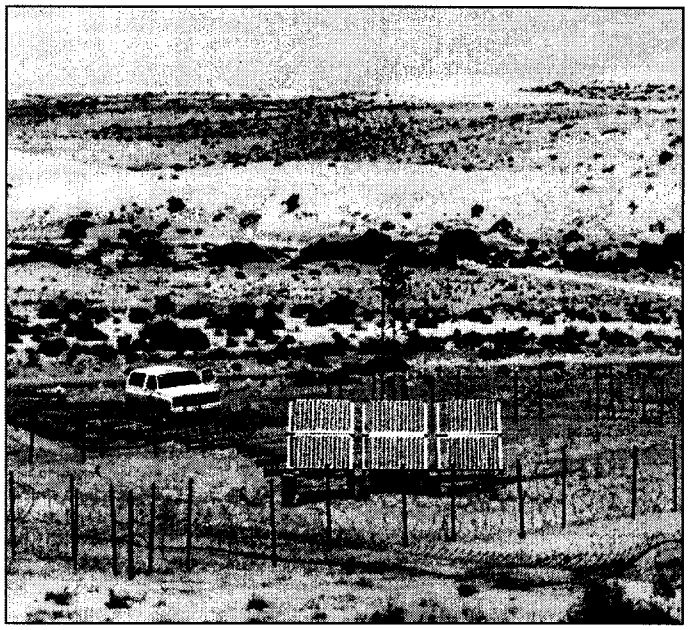
As a result of rising expectations and shrinking resources, the United Nations is often placed in extremely difficult peacekeeping situations without the means to make, keep, or build peace. UN peacekeepers have been asked to achieve a variety of challenging tasks in large areas, with few highly trained soldiers or military observers, and without the full consent of all parties to a conflict. These situations have created operational difficulties and a demand for the UN to improve the effectiveness, efficiency, and safety of the forces it deploys.

In some countries, military organizations have occasionally depended on technology to multiply the effectiveness of their armed forces. In its current and previous missions, the UN has not widely used technology to monitor peace agreements and assist peacekeepers. What technology the UN has deployed—hand-held radios, night-vision goggles, global positioning system receivers—has been brought to the missions by national contingents. Moreover, concerns related to cost, operational difficulties, maintenance requirements, and other factors have discouraged the UN from considering the systematic use of monitoring technology in its peacekeeping operations.

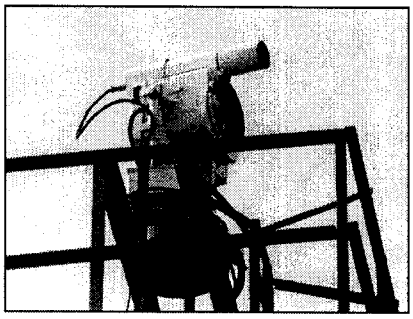
Yet the international community has developed and implemented many affordable, available, simple, sharable, and reliable technical systems to monitor various aspects of arms-control agreements. Many of these technologies are applicable to many peacekeeping tasks.

Monitoring technology cannot replace the essential human component of any peacekeeping operation, nor is it a panacea for the challenges of contemporary peacekeeping. However, cooperative monitoring principles could enhance core peacekeeping functions. Monitoring technologies could improve a mission's ability to observe, assess, report, and respond to events, demonstrating the credibility and impartiality of UN peacekeeping and bolstering local acceptance of the mission. In addition to strengthening the effectiveness of an operation, monitoring technologies could also enhance the safety of UN personnel and civilians. Finally, technologies could allow fewer peacekeepers to monitor larger territories and thus reduce the cost of peacekeeping.

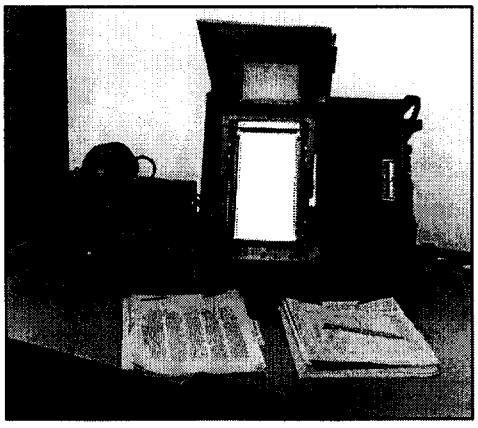
This paper begins with an historical example of how technical monitoring systems helped to maintain a cease-fire in the Sinai Peninsula and then suggests ways in which monitoring technologies could augment both security and monitoring tasks in a peacekeeping mission. The applications of monitoring technologies to peacekeeping tasks are summarized in two tables. The concluding section addresses methods for obtaining, deploying, and maintaining comprehensive monitoring systems.



Remotely Operated Video



The SFM technical system provided consistent and effective monitoring at all times and in all weather conditions, augmenting the value of UN observers. Most of the events detected by the sensors were permitted activities by the parties and the monitors, as well as movements by animals and nomadic Bedouins. The system successfully distinguished between these routine events and actual unauthorized incidents. In nearly four years of operation (1976-1980), only 90 minor violations of the agreement were reported; all were quickly and easily resolved at least in part because of the SFM's definitive record of the event. The SFM operation was conducted by only 150 operators and support staff—many fewer people than would have been required to monitor those passes as comprehensively without technology.



Watch Station Data Recorder

Peacekeeping Tasks That Monitoring Technology Can Address

Peacekeeping relies on the collection and unbiased reporting of information. The use of monitoring technology at checkpoints, ports of entry, and international lines of control and in disarmament activities could enhance the peacekeepers' abilities to implement a peace agreement. In addition, technologies could improve the security of peacekeepers and civilians by monitoring individuals or shipments in transit. It could also enhance the security of temporary or permanent facilities. Table 1 summarizes potentially applicable monitoring systems.

Table 1. Survey of Monitoring Technologies

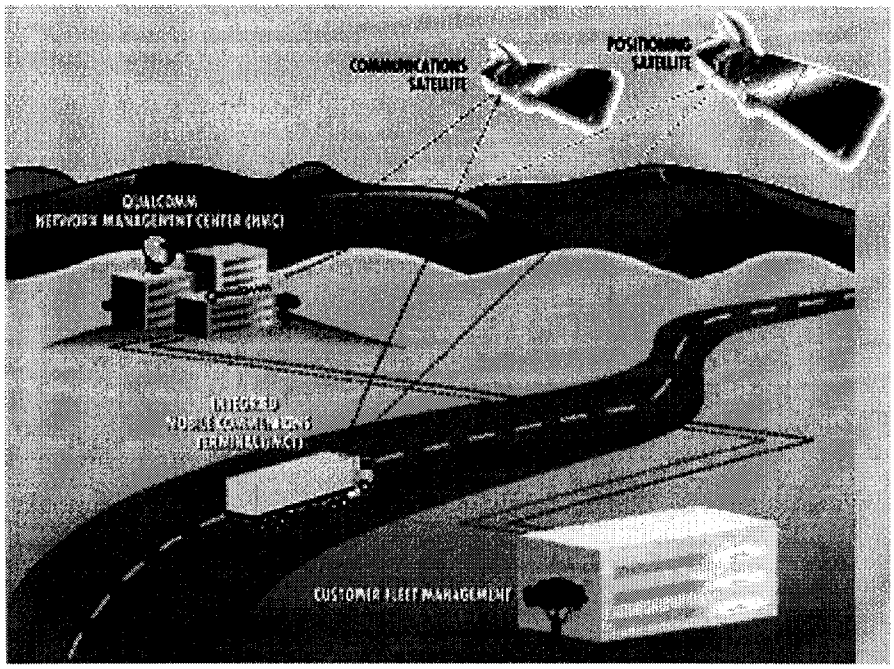
System	Technology	Explanation	Purpose
Tracking Systems	Commercial Transport Tracking System	Portable, GPS-linked device determines/broadcasts location	Monitor location of patrol, vehicle, or cargo; record route taken
Seals	Passive Seals	Tape, wire, fiber-optic cable, plastic shrink-wrap, other means of sealing doors or containers	Reveal whether sealed item has been opened or altered since closure
	Active Seals	Seals linked to audible/visual alarm or radio transmitter	Provide immediate alert of tampering with sealed item
Access Control Systems	Alarmed Fences	Standard security fence with pressure-sensitive wires linked to alarm, camera or transmitter	Provide visible access barrier, intrusion warning
	Buried Fiber-optic Cable	Pressure-sensitive buried cable linked to alarm, camera, or transmitter	Detect people or vehicles crossing a line of control
	Personal Entry Identifiers	Code locks, magnetic badges, palm scanners, other ID devices	Limit access to authorized people
Detectors	Metal Detectors	Walk-through and hand-held magnetic sensors	Locate concealed weapons or other metallic items
	Chemical Detectors	Detection of traces of specific chemicals on vehicles, people, or cargo	Locate concealed drugs, ammunition, or explosives
	Portable X-Ray Machines	Standard airport baggage viewers	Identify contents of bags and small boxes
Unattended Ground Sensors	Seismic, Magnetic, Acoustic Sensors	Transmitter activated by vibration, ferrous metal, or sound waves	Detect people, weapons, or vehicles
	Infrared and Microwave Break-Beam Detectors	Alarm or transmitter activated when line-of-sight beam interrupted	Detect people or vehicles crossing a line of control
Aerial Imagery	Visual Photography	Standard photography, variable resolution and quality	Provide video or still photography, real time or recorded
	Infrared, Radar Imagery	Multi-spectral imagery	Image through darkness, clouds, vegetation; detect objects, terrain not visible to the human eye
Tags	Bar Codes	Adhesive tape with readable bar code; bar code scanner	Identify individual pieces of equipment; facilitate inventory
	Reflective Particle Tag	Metallic particles suspended in polymer coating form unique pattern on equipment	Identify individual pieces of equipment

Providing for Personnel and Public Security

Monitoring Movement

Peacekeepers on patrol or travelling in a convoy need a reliable means of determining their location and communicating with their headquarters. Most UN missions currently depend on locally provided maps, which are often out of date, and insecure two-way radios for communications with patrols. Such a circumstance often places peacekeepers at risk. Occasionally, a troop-contributing country will equip their contingent with global positioning system (GPS) receivers, which allow the peacekeepers to use satellites to track their position, velocity, and time. Although GPS can determine location, the peacekeepers on patrol still must report their positions to mission headquarters on a regular basis.

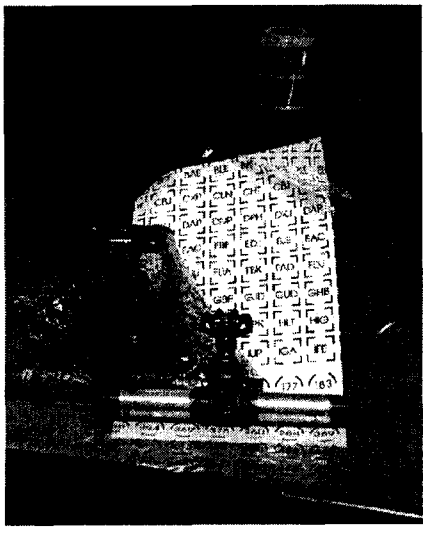
A peacekeeping operation could deploy a commercial tracking system, such as those used by trucking and shipping companies, to provide both accurate location information and secure communication for patrols. A central UN station could monitor any of a mission's patrols in real time and automatically establish a permanent record of each patrol's movements, enhancing both the safety of the peacekeepers and the reliability of any reports of a violation of an agreement. Such a system could also help create a secure environment for the movement and resettlement of civilian populations.



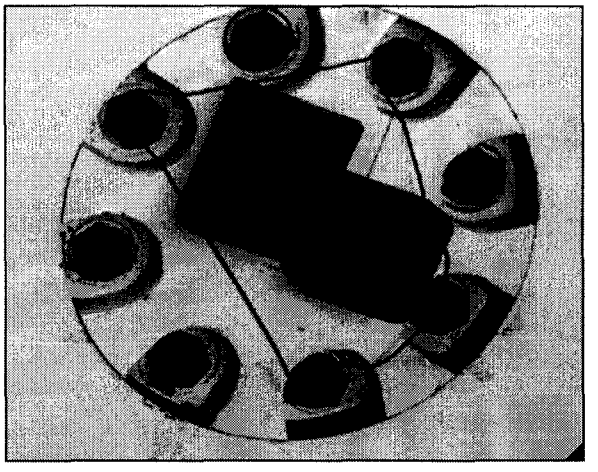
Commercial Transport Tracking System

This technology application could be extended to the monitoring of important shipments, such as humanitarian supplies or collected weapons. If the items transported were judged to be sensitive or valuable, additional technologies could be used to provide confidence to the parties as well as the UN that no one tampered with either the tracking devices or the cargo itself. In addition to locks, welding, and other standard security precautions, the cargo containers could be sealed with tape, shrink-wrap, or fiber-optic wire to reveal tampering. Active seals, which sound an alarm or

transmit an electronic signal to a receiver, could alert a central monitoring station of potential tampering and could direct peacekeepers to the location of the incident. Those active seals could be attached to a video camera, which could take a photograph every time the seal is manipulated; that image could then be instantly transmitted to and recorded by a central monitoring station or even an internet web site.



Passive Seal – Plastic Shrink Wrap

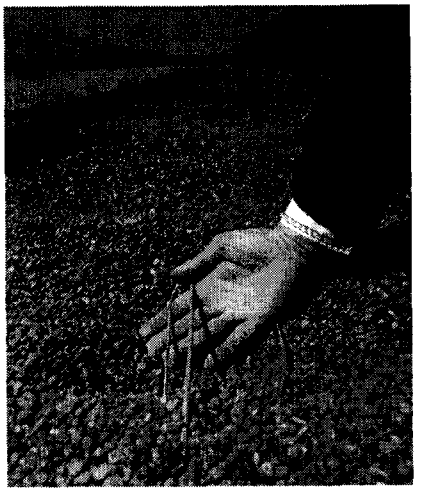


Active Seal – Wire with Transmitter

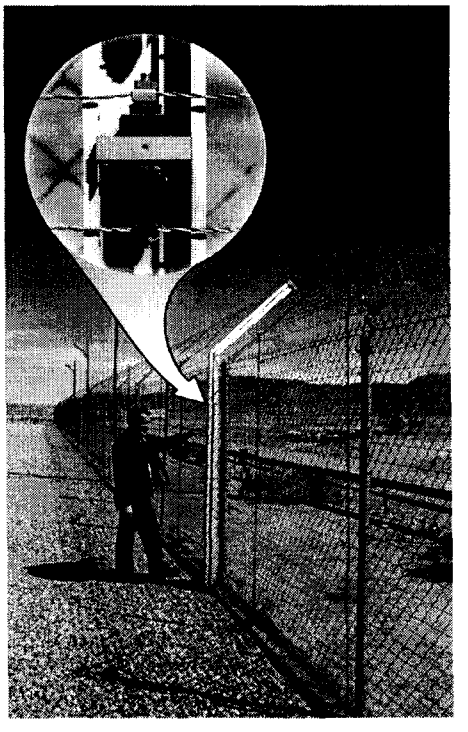
Monitoring Facilities

Every peacekeeping mission has a requirement to guard the peacekeepers' personal safety, their operational security and the physical security of their equipment. Missions also frequently require peacekeepers to protect civilians, including refugees, demobilized combatants, and UN relief workers, and humanitarian supplies within certain areas. Monitoring technologies could supplement the common steps of erecting walls, ditches, gates, and other defensive barriers, thus improving the security of peacekeeping facilities.

Alarmed fences around a compound could trigger an alert whenever an intruder attempts either to scale the fence or to tamper with its wires. Pressure-sensitive, fiber-optic cable, buried a few centimeters underground, could also send an alarm if activated by the weight of a person or vehicle.

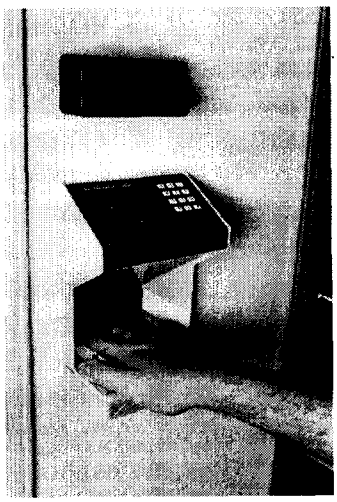


Buried Fiber-Optic Cable



Alarmed Fence

Access-control systems, such as identification-card readers and hand scanners, could regulate who could enter a certain building. All of these sensors could be linked to a camera or video system that would record an image whenever the sensor detected a suspicious event. The image could be transmitted to a central monitoring station within the secured facility or at the mission headquarters.

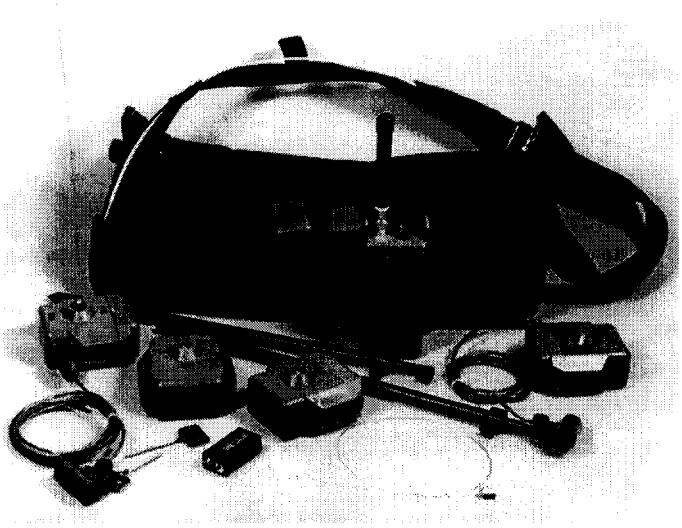


All information used to monitor and secure a facility or a defined area could be made available to the parties, either fully or selectively, through an internet web site. This web site could provide confidence to the parties that the location in question is secure and that the peacekeepers are acting impartially.

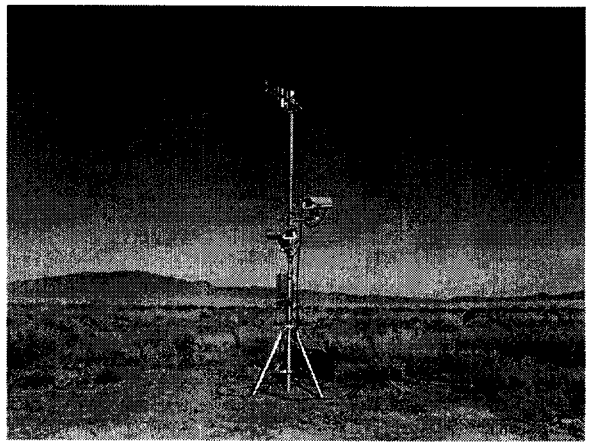
Individual Identification

Monitoring Lines of Control

Many peacekeeping missions are responsible for supervising cease-fires, demilitarized zones, disputed borders, and the disengagement of military personnel. Large distances, rugged terrain, and potentially hostile indigenous people often make these tasks extremely difficult to execute thoroughly. Today's UN missions rely on patrols and observation posts, equipped often with binoculars and occasionally with night-vision goggles, to perform these peacekeeping responsibilities. Other monitoring technologies exist that could allow the same number of peacekeepers to monitor a larger area more comprehensively.



Ground Sensors: Seismic, Magnetic, and Infrared



Breakbeam and Magnetic Sensors with Video

For example, unattended ground sensors (seismic, acoustic, weight, infrared, breakbeam, magnetic, microwave, and radar) could help peacekeepers monitor those border areas that, under normal conditions, they could only visit infrequently on patrol. Individuals or vehicles moving across a cease-fire line or border would trigger a sensor and a photograph of the event. All this information—the appearance, size, composition, speed, and direction of the suspect object as well as the date, time, and location of the event—would be instantly relayed to a monitoring center, which could, if necessary, deploy a patrol to that specific area for an inspection.

Sensors mounted in airplanes, helicopters, and unmanned aerial vehicles (UAVs) could supplement ground monitoring when the area is extremely large, inaccessible or dangerous. Cameras that use infrared or radar imagery would improve the quality of aerial monitoring at night, even through clouds or vegetation. Thermal imagers on an aerial platform could help detect and identify groups of people.

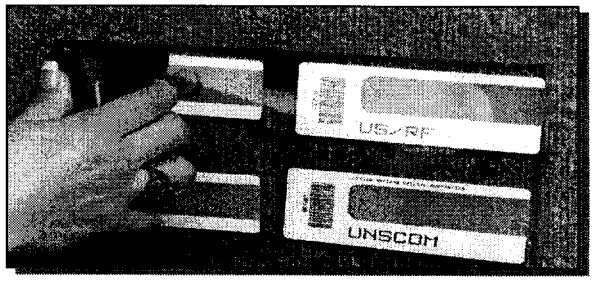
Depending on the knowledge of a site, commercial satellite imagery (now available in one-meter resolution) could provide information about physical changes in locations that are inaccessible to peacekeeping patrols. For instance, a commercial satellite could regularly survey military garrisons for significant increases or decreases in forces.

Monitoring Disarmament

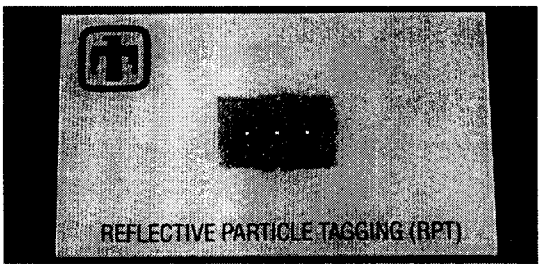
Monitoring technologies could be combined into a system to address the challenging task of disarming former combatants.[4] Technology could be the basis of a storage, inventory, and transportation system that could increase confidence among the parties that surrendered weapons —whether large arms, such as tanks and howitzers, or small arms, such as rifles and mortars— were secure and permanently removed from the conflict. Moreover, by requiring fewer peacekeepers to manage weapons storage sites and patrol ports of entry, monitoring technologies could enhance the efficiency of the disarmament process.

Peacekeepers could attach tags to weapons to identify and track each one. If a peace agreement allowed each side to maintain a certain number of arms, all legitimate arms could be tagged and included in a computer-database inventory. Even the weapons of the peacekeepers and police could be recorded and regularly checked. Any arms that were not properly tagged and registered—and thus prohibited according to the peace agreement—would be seized and disposed of appropriately.

Technologies could play an important role in monitoring the inventory of a weapons storage site. Adhesive barcodes similar to those used in many supermarkets, combined with a standard computer database, would allow peacekeepers to conduct accurate and rapid assessments of a disarmament site's inventory. Specially designed tags that frustrate efforts to compromise the integrity of the tag and/or instantly notify a monitoring center of tampering could also be used. A secure internet web site could display the status of the facility's inventory so that the parties could monitor a peacekeeping operation's weapons storage facility. The parties could also monitor the destruction of weapons by peacekeepers.



Bar Code Tags



Reflective Particle Tag

In addition to inventory control, monitoring of the disarmament process would necessarily include physically securing the weapons storage sites, controlling the transport of legitimate weapons, and supervising the ports of entry. Technologies for these applications were discussed earlier.

[4] A recent report by the Secretary General on disarmament activities in peacekeeping missions indicated that "successful disarmament may require access to considerable technical skills and institutional knowledge...the United Nations has at times experienced difficulty in locating experienced disarmament experts and trainers for service within peacekeeping operations in the field." The UN report lacks a description of a technical monitoring and security process for collecting arms in UN peacekeeping missions. See the Report of the Secretary General, "The Role of United Nations Peacekeeping in Disarmament, Demobilization and Reintegration," S/2000/101 (New York: United Nations, February 11, 2000).

Acquisition and Use of Technical Monitoring Systems

Table 2 summarizes the applicability of various categories of monitoring technology to fundamental peacekeeping functions. Although most of these technologies can be purchased in the international marketplace, the monitoring systems generally do not exist in a pre-packaged form. There are several important considerations for acquiring monitoring equipment, including systems design, field testing, field installation, maintenance, and training.

Table 2. Applications of Monitoring Technology in Peacekeeping

Types of Monitoring	Monitoring Technology	Monitoring Movement	Monitoring Facilities	Monitoring Checkpoints	Monitoring Lines of Control	Monitoring Disarmament
Ground Sensors	Seismic, Magnetic, Infrared, Acoustic, Radar, Microwave, Strain Cables, Fiber-Optic Cables, Alarmed Fences	Applicable	Very Applicable	Very Applicable	Applicable	Applicable
Ground Cameras	Optical and Infrared	Applicable	Very Applicable	Very Applicable	Applicable	Applicable
Aerial Sensors	Optical, Infrared, Radar, Thermal Imagery, Multi-spectral Imagery	Applicable	Applicable	Applicable	Very Applicable	Very Applicable
Commercial Satellite Imagery	Optical, Radar	Applicable	Limited Application	Limited Application	Applicable	Limited Application
Detectors	Metal (portal and hand-held) Chemical, Explosive, X-ray, Ultrasound, Weight Scale	Applicable	Very Applicable	Very Applicable	Applicable	Very Applicable
Tracking and Monitoring Systems	GPS, Satellite Communication, Active and Passive Seals, Tags, Shrink-wrap, Fiber-Optic Cable	Very Applicable	Applicable	Applicable	Applicable	Very Applicable
Access Control Systems	Motion Detectors, Magnetic Door Switches, Hand Geometry Readers, Key Pads, Card Readers	Applicable	Very Applicable	Limited Application	Limited Application	Very Applicable
Information Storage and Retrieval	Computer Databases, Secure Communications, Public Key Authentication	Very Applicable	Applicable	Very Applicable	Applicable	Very Applicable

Technical monitoring systems comprise a variety of commercially available technologies. A monitoring system normally consists of sensors, receiver and integration components, and an operator display, all of which must be linked by communications equipment. Many of these systems also require computer databases and an internet web site. In most cases, actions would be necessary to prevent theft or willful destruction of the monitoring system's components.

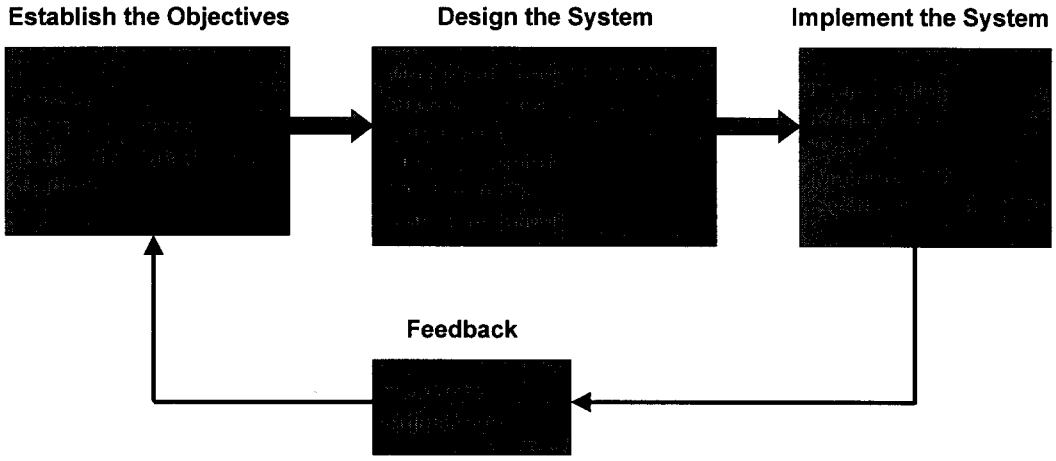
The process of technical integration and design (ensuring that the various technologies can function and communicate with each other) is a critical element for developing a reliable monitoring system. A field test of the designed system is also necessary to demonstrate that the

operator will properly receive, understand, and distribute the information provided by the technologies and that the system will perform as anticipated in the intended environment.

Technical monitoring systems require some regular maintenance. This could vary from something as simple as changing a sensor's batteries to something as technically challenging as revising a computer database. Ideally, a member of the peacekeeping mission's staff should be a technician capable of conducting this type of work and familiar with the original installation of the system.

Those individuals responsible for the system's maintenance and operation would also require initial and periodic training. A simple or sophisticated monitoring system, even if it functions correctly, would be ineffectual if those managing and controlling it do not understand how the system works and the value of the information that it provides.

With targeted professional and financial assistance from member states, the UN Secretariat could establish an operational requirement for a monitoring system, stipulate budget and other parameters, and hire a technical consultant for installation. The consultant could oversee the procurement of equipment; and design, test and install the system; as well as provide regular maintenance and training. The seamless integration of a technical monitoring system into traditional peacekeeping would require the consultant to coordinate closely with both the UN Secretariat and the peacekeepers in the field.



Monitoring System Application Process

Many of these procurement-related activities could seem daunting to an institution that is not familiar with technical monitoring systems. However, incorporating technical monitoring systems into UN peacekeeping should not require additional Secretariat staff, and the additional expense could be offset by a reduction in the number of peacekeepers needed to oversee the implementation of a peace agreement.

Summary

The integration of monitoring technologies into peacekeeping operations could improve the security, effectiveness, and efficiency of UN peacekeeping by protecting personnel, extending the peacekeepers' capabilities, providing objective and verifiable information, and saving resources. Technologies that can monitor checkpoints, ports of entry, lines of control, and disarmament activities could facilitate the implementation of a peace agreement.

The information gathered by these monitoring technologies can be readily shared (in whole or in part) with the parties to a peace agreement, assuring each side that the other is complying with its obligations and that the peacekeepers are performing their duties impartially. Monitoring technologies could enhance the efficiency of a peacekeeping operation by providing constant monitoring and allowing for the redeployment of some peacekeepers to human-intensive responsibilities. In some cases, monitoring technologies could reduce the incremental cost of peacekeeping because fewer peacekeepers would be required to perform the many monitoring tasks.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.