Appendix 1

United Nations peacekeeping operations, 1948–2010, organized into four categories: Observer missions; Interposed forces; Multidimensional operations; Transitional administrations

Current operations are indicated by bold abbreviations, which can be found on the map in Figure 2.1 (page 9).

Keeping watch: Monitoring, technology and innovation in UN peace operations, Dorn, United Nations University Press, 2011, ISBN 978-92-808-1198-8

Table A1.1 Observer missions

Name	Abbreviation (current missions in bold)	Main location(s)	Mandate	Initial Security Council Resolution	Year(s)
UN Truce Supervision Organization	**UNTSO**	Palestine, later other areas[a]	Observe cease-fire and later the armistice between Israel and neighbouring Arab states	50 (1948)	1948–
UN Military Observer Group in India and Pakistan	**UNMOGIP**	State of Jammu and Kashmir	Observe cease-fire and cease-fire line;[b] investigate complaints of violations	47 (1948)	1949–
UN Observation Group in Lebanon	UNOGIL	Lebanon	Identify infiltration of personnel or arms; keep Security Council informed	128 (1958)	1958
UN Yemen Observation Mission	UNYOM	Yemen (especially Demilitarized Zone along section of Saudi border)	Observe Disengagement Agreement between Saudi Arabia, United Arab Republic and Yemen	179 (1963)	1963–1964
Mission of the Representative of the Secretary-General in the Dominican Republic	DOMREP	Dominican Republic	Observe situation and report on breaches of cease-fire	203 (1965)	1965–1966
UN India–Pakistan Observation Mission	UNIPOM	India–Pakistan border	Supervise cease-fire and observe withdrawal	211 (1965)	1965–1966
UN Iran–Iraq Military Observer Group	UNIIMOG	Iran and Iraq (border areas)	Monitor cease-fire and supervise withdrawal of forces at end of Iran–Iraq war	588 (1987)	1988–1991
UN Good Offices Mission in Afghanistan and Pakistan	UNGOMAP	Afghanistan and Pakistan	Observe Soviet troop withdrawals from Afghanistan; investigate and report violations of Geneva Accords and non-intervention agreement	622 (1988)	1988–1990

UN Angola Verification Mission	UNAVEM I	Southern Angola	Verify departure of Cuban troops	626 (1988)	1988–1991
UN Observer Group in Central America	ONUCA	Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua	Oversee regional peace plan, including demobilization of Contras	644 (1989)	1989–1992
UN Mission for the Referendum in Western Sahara	**MINURSO**	Western Sahara	Observe cease-fire and confinement of Moroccan troops and, later, Polisario forces; organize referendum	690 (1991)	1991–
UN Observer Mission in El Salvador	ONUSAL	El Salvador	Monitor agreements between Government of El Salvador and FMLN[c]	693 (1991)	1991–1995
UN Angola Verification Mission II	UNAVEM II	Angola	Verify various Angolan Peace Accords and supervise 1992 elections	697 (1991)	1991–1995
UN Advance Mission in Cambodia	UNAMIC	Cambodia	Supervise cease-fire prior to establishment of UNTAC; provide mine-awareness training to civilians	717 (1991)	1991–1992
UN Observer Mission Uganda–Rwanda	UNOMUR	Uganda–Rwanda border	Monitor border to verify no passage of military aid	846 (1993)	1993–1994
UN Observer Mission in Georgia	UNOMIG	Georgia (Abkhazia)	Observe cease-fire; monitor Abkhazian and Georgian forces as well as Russian military contingents	849 (1993)	1993–2009
UN Observer Mission in Liberia	UNOMIL	Liberia	Work with ECOMOG[d] for implementation of Cotonou Peace Agreement	866 (1993)	1993–1997
UN Aouzou Strip Observer Group	UNASOG	Republic of Chad	Verify withdrawal of Libyan administration and forces	915 (1994)	1994

Table A1.1 (cont.)

Name	Abbreviation (current missions in bold)	Main location(s)	Mandate	Initial Security Council Resolution	Year(s)
UN Mission of Observers in Tajikistan	UNMOT	Tajikistan	Monitor cease-fire on Tajik–Afghan border; investigate cease-fire violations and report them to UN	968 (1994)	1994–2000
UN Mission of Observers in Prevlaka	UNMOP	Prevlaka Peninsula, Croatia	Monitor demilitarization of Prevlaka Peninsula	1038 (1996)	1996–2002
UN Verification Mission in Guatemala	MINUGUA	Guatemala	Verify fulfilment of cease-fire provisions of 1996 Peace Accords; later verify disarmament, human rights and other tasks	1101 (1996)	1997–2003
UN Observer Mission in Angola	MONUA	Angola	Assist in consolidating peace and national reconciliation; enhance democratic development	1118 (1997)	1997–1999
UN Observer Mission in Sierra Leone	UNOMSIL	Sierra Leone	Monitor and advise on disarmament of combatants and restructuring of national security forces; report on human rights abuses	1181 (1998)	1998–1999

Notes:
[a] Later Suez Canal area, Golan Heights, Lebanon and the Sinai.
[b] The cease-fire line later became the "Line of Control".
[c] Frente Farabundo Martí para la Liberación Nacional: a rebel group in opposition to the El Salvador government. Later, ONUSAL was mandated with election supervision.
[d] Economic Community of West African States Military Observer Group: a separate peacekeeping force composed of 4,000 troops from Nigeria, Gambia, Ghana, Guinea, Algeria and Sierra Leone.

Table A1.2 Interposed forces

Name	Abbreviation (current missions in bold)	Main location(s)	Mandate	Initial Security Council Resolution	Year(s)
UN Emergency Force	UNEF I	Sinai Peninsula and Gaza Strip	Secure cease-fire and removal of foreign (France, Israel, UK) forces from Egypt; serve as buffer between Israeli and Egyptian forces	General Assembly (GA) Resolution 998 (ES-1)	1956–1967
UN Peacekeeping Force in Cyprus	**UNFICYP**	Nicosia	Maintain cease-fire zones and, after 1974, supervise "buffer zone"	186 (1964)	1964–
UN Emergency Force II	UNEF II	Sinai Peninsula and Suez Canal	Supervise cease-fire after Yom Kippur War and later 1974 and 1975 Egyptian/Israeli agreements; deploy troops to buffer zone	340 (1973)	1973–1979
UN Disengagement Observer Force	**UNDOF**	Syrian Golan Heights	Maintain cease-fire between Israel and Syria; supervise disengagement of forces and areas of limitation and separation	350 (1974)	1974–
UN Interim Force in Lebanon	**UNIFIL**	Southern Lebanon	Confirm withdrawal of Israeli forces from southern Lebanon; assist Lebanese government to return to authority; after 2006, monitor cease-fire, Lebanese forces and humanitarians	425 (1978)	1978–

Table A1.2 (cont.)

Name	Abbreviation (current missions in bold)	Main location(s)	Mandate	Initial Security Council Resolution	Year(s)
UN Iraq–Kuwait Observation Mission	UNIKOM	Iraq/Kuwait border	Monitor Khawr 'Abd Allah waterway and Demilitarized Zone along border; observe any hostile acts; deter border violations	687 (1991)	1991–2003
UN Preventive Deployment Force	UNPREDEP	Former Yugoslav Republic of Macedonia	Replaced UNPROFOR in Macedonia; monitor border area for events that could undermine stability and threaten Macedonia; act as "trip-wire"	983 (1995)	1995–1999
UN Mission in Ethiopia and Eritrea	UNMEE	Ethiopia, Eritrea	Monitor cessation of hostilities and temporary security zone; assist in ensuring observance of security commitments agreed by parties	1320 (2000)	2000–2008

Table A1.3 Multidimensional operations

Name	Abbreviation (current missions in bold)	Main location(s)	Mandate	Initial Security Council Resolution	Year(s)
UN Operation in the Congo	ONUC	Republic of the Congo	Ensure withdrawal of Belgian forces; assist government with law and order; later, prevent civil war and secure removal of all foreign mercenary personnel	143 (1960)	1960–1964
UN Transition Assistance Group	UNTAG	Namibia	Supervise transition of Namibia from South African rule to independence	435 (1978)	1989–1990
UN Protection Force – later UN Peace Forces, UN Confidence Restoration Operation	UNPROFOR – later UNPF, UNCRO	Bosnia and Herzegovina, Croatia, Fed. Rep. of Yugoslavia (Serbia and Montenegro), Macedonia	Create a secure environment for negotiation of overall settlement to Yugoslav crisis; ensure demilitarization of UN Protected Areas by conflicting parties; support humanitarian relief	743 (1992)	1992–1995
UN Transitional Authority in Cambodia	UNTAC	Cambodia	Ensure implementation of 1991 peace agreements;[a] supervise government, disarmament, refugee return; organize election	745 (1992)	1992–1993
UN Operation in Somalia I	UNOSOM I	Somalia	Monitor cease-fire; later, work with the USA's Unified Task Force for humanitarian assistance	751 (1992)	1992–1993
UN Operation in Mozambique	ONUMOZ	Mozambique	Help implement peace agreement; monitor cease-fire and withdrawal of foreign forces, also elections and humanitarian assistance	782 (1992)	1992–1994
UN Operation in Somalia II	UNOSOM II	Somalia	Establish a secure environment for humanitarian relief operations; disarmament, reconciliation, arrest of warlord	814 (1993)	1993–1995

Table A1.3 (cont.)

Name	Abbreviation (current missions in bold)	Main location(s)	Mandate	Initial Security Council Resolution	Year(s)
UN Mission in Haiti	UNMIH	Haiti	Help implement Governors Island Agreement; later, help security, professionalize Haitian armed forces and create police force; help with elections	867 (1993)	1993–1996
UN Assistance Mission for Rwanda	UNAMIR	Rwanda	Ensure the security of cease-fire zone; assist with mine clearance, election preparation and humanitarian concerns	872 (1993)	1993–1996
UN Angola Verification Mission III	UNAVEM III	Angola	Assist in establishing peace and national reconciliation between the government and rebel force	976 (1995)	1995–1997
UN Confidence Restoration Operation in Croatia	UNCRO	Croatia	Replaced UNPROFOR in Croatia: facilitate humanitarian assistance throughout Croatia; monitor demilitarization of Prevlaka Peninsula	981 (1995)	1995–1996
UN Mission in Bosnia and Herzegovina	UNMIBH; established IPTF[b] and UN civilian office	Bosnia and Herzegovina	Assist with law enforcement activities and police reform; coordinate UN and NATO activities for humanitarian relief and refugees, de-mining, human rights, elections, infrastructure and economic reconstruction	1035 (1995)	1995–2002
UN Support Mission in Haiti	UNSMIH	Haiti	Help maintain secure and stable environment; assist with establishment and training of national police force; support economic rehabilitation	1053 (1996)	1996–1997

UN Transition Mission in Haiti	UNTMIH	Haiti	Assist in professionalization of Haitian National Police; promote economic rehabilitation	1123 (1997)	1997
UN Civilian Police Mission in Haiti	MIPONUH	Haiti	Oversee technical assistance to Haitian National Police (funded by the UN Development Programme)	1141 (1997)	1997–2000
UN Civilian Police Support Group	UNPSG	Eastern Slavonia, Baranja and Western Sirmium (Croatia)	Monitor Croatian police in Danube region; ensure safe return of displaced people	1145 (1997)	1998
UN Mission in the Central African Republic	MINURCA	Central African Republic	Promote national reconciliation, security and safety; provide advice on development of police programme and for elections	1159 (1996)	1998–2000
UN Mission in Sierra Leone	UNAMSIL	Sierra Leone	Cooperate with government and other parties in implementing Lomé Peace Agreement; assist with disarmament, demobilization and reintegration of ex-combatants	1270 (1999)	1999–2005
UN Organization Mission in the Democratic Republic of the Congo	MONUC / **MONUSCO**[c]	DRC	Monitor cease-fire; facilitate disengagement; later, protect civilians, support DRC government in stabilization and peace consolidation	1291 (2000)	1999–
UN Assistance Mission in Afghanistan	**UNAMA**	Afghanistan	Promote national reconciliation; various peacebuilding tasks entrusted to UN in Bonn Agreement, including human rights, rule of law and gender issues; manage all UN humanitarian, relief, recovery and reconstruction activities	1401 (2002)	2002–
UN Mission of Support in East Timor	UNMISET	East Timor (Timor-Leste)	Provide assistance to East Timor as operational responsibilities are fully devolved to East Timor authorities	1410 (2002)	2002–2005

Table A1.3 (cont.)

Name	Abbreviation (current missions in bold)	Main location(s)	Mandate	Initial Security Council Resolution	Year(s)
UN Mission in Liberia	**UNMIL**	Liberia	Support implementation of Ceasefire Agreement and peace process; protect civilians; support humanitarian and human rights and security reform	1509 (2003)	2003–
UN Operation in Côte d'Ivoire	**UNOCI**	Côte d'Ivoire	Monitor cessation of hostilities, armed groups and arms embargo; support DDRRR,[d] law and order, elections, security sector reform; protect civilians; humanitarian assistance and human rights	1528 (2004)	2004–
UN Stabilization Mission in Haiti	**MINUSTAH**	Haiti	Foster secure and stable environment and security sector reform; protect civilians; support national dialogue and reconciliation, elections, human rights; assist in promoting good governance; support disaster recovery	1542 (2004)	2004–
UN Operation in Burundi	ONUB	Burundi	Help restore peace; ensure cease-fire; support national reconciliation and Arusha Agreement; contribute to disarmament, humanitarian assistance and elections; monitor arms flow and borders; facilitate return of refugees; protect civilians; support security sector and judicial reform; protect human rights	1545 (2004)	2004–2006

UN Mission in Sudan	**UNMIS**	Southern Sudan	Support Comprehensive Peace Agreement; monitor Ceasefire Agreement and armed groups; assist with disarmament, demobilization and reintegration; help establish security and restructure police service; promote rule of law, human rights, elections and referendums; facilitate return of refugees; protect civilians	1590 (2005)	2005–
UN Integrated Mission in Timor-Leste	**UNMIT**	Timor-Leste	Support democratic governance, political dialogue, elections, national police, security sector review; assist human rights	1704 (2006)	2006–
African Union/United Nations Hybrid Operation in Darfur	**UNAMID**	Darfur (Sudan)	Support Darfur Peace Agreement; protect civilians; prevent armed attacks; monitor withdrawal of weapons; facilitate humanitarian assistance; verify cease-fire agreements; contribute to security; promote human rights and rule of law; monitor borders	1769 (2007)	2007–
UN Mission in the Central African Republic and Chad	MINURCAT	Central African Republic and Chad	Help create security; protect civilians and assist return of refugees; promote reconstruction and economic and social development; promote human rights and the rule of law	1778 (2007)	2007–2010

[a] Agreements on the Comprehensive Political Settlement of the Cambodia conflict.
[b] The International Police Task Force was created to support law enforcement.
[c] MONUC was replaced by MONUSCO on 1 July 2010.
[d] Disarmament, demobilization, reintegration, repatriation and resettlement.

Table A1.4 Transitional administrations

Name	Abbreviation (current missions in bold)	Location	Functions	Security Council Resolution	Year(s)
UN Temporary Executive Authority	UNTEA	West New Guinea (West Papua), currently part of Indonesia	For 6 months, accept governance of territory from the Netherlands before turning it over to Indonesia; act with full authority to administer territory, to maintain law and order, to protect rights of inhabitants and to ensure uninterrupted, normal services	GA 1752 (XVII)	1962–1963
UN Security Force in West New Guinea (West Irian)	UNSF	West New Guinea (West Papua)	Security arm of UNTEA: maintain law and order; monitor cease-fire area	GA 1752 (XVII)	1962–1963
UN Transitional Administration for Eastern Slavonia, Baranja and Western Sirmium	UNTAES, followed by UN Police Support Group (UNPSG)	Eastern Slavonia, Baranja and Western Sirmium (Croatia)	Govern region for 12 months; maintain security; facilitate demilitarization; ensure safe return of refugees and implementation of Basic Agreement; organize elections	1037 (1996)	1996–1998
UN Interim Administration Mission in Kosovo	**UNMIK**	Kosovo	Administer (govern) territory of Kosovo; wide-ranging tasks, such as overseeing health and education, banking and finance, post and telecommunications, and law and order; organize elections	1244 (1999)	1999–
UN Transitional Administration in East Timor	UNTAET	East Timor	Administer the territory, exercise legislative and executive authority during transition period and support capacity-building for self-government	1272 (1999)	1999–2002

Appendix 2

Special Committee on Peacekeeping (C34) annual reports: Excerpts on monitoring and surveillance technology

The United Nations Special Committee on Peacekeeping is composed of 124 member states that are past or current contributors to peacekeeping operations. The Committee is mandated to conduct a "comprehensive review of all issues relating to peacekeeping". After each annual "substantive" session, it presents a consensus report to the UN General Assembly. The following are passages from those annual reports that deal with peacekeeping technology (especially monitoring and surveillance technology). **Bold font** and underlining have been added to certain keywords for ease of scanning.

1989 (UN Doc. A/44/301)

> "With regard to the use of **high technology** in peacekeeping operations, it was indicated that, in view of its complexity, the issue needed to be **further explored**."

Annex: Working Paper No. 2, "Proposals on Peacekeeping" (submitted by delegations). B.2. High technology:

> "19. A study should be undertaken on possible uses of high technology, such as surveillance satellites, automatic sensors, radar and night-vision-equipment."

1990 (UN Doc. A/45/330)

> "19. On the possible application of **high technology** to peace-keeping operations, the issues of **economic feasibility** as well as political advisability of using such technology in this field were raised. It was felt, therefore, that **further**

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discussion on the subject would be needed. In the course of the discussion, the Canadian delegation presented a study on '**overhead** remote sensing for United Nations peace-keeping,' which was highly appreciated by the working group."

1991 (UN Doc. A/46/254)

"14. Most delegations welcomed the progress made so far on the question of resources for United Nations peace-keeping operations. They felt that **further consideration** should be given to improvements in such matters as the use of civilians, training of peace-keepers, supply and stockpiling, and the **applications of high technology**."

1992 (UN Doc. A/47/253)

"96. However, while supporting reforms to enable the United Nations to assess quickly and accurately information on potential threats to international peace and security, some delegations were of the view that the United Nations **did not need** independent **high-tech means** for intelligence gathering. What was needed were better ties with national services that could provide detailed up-to-date information which would facilitate the United Nations analysis of options. In this respect, it was suggested that Member States should undertake to supply, at the request of the Secretary-General, the information which would permit an evaluation of the situation concerning international peace and security. If a Member State so requested, such information should be regarded as confidential."

2001 (UN Doc. A/55/1024)

"13. Many delegations endorsed the need expressed in the report of the Secretary-General for **additional resources**, as well as the better use of existing ones, in order to improve the functioning of the Department of Peacekeeping Operations. The same delegations underlined the **need** for an enhanced use of **information technology**."

2005 (UN Doc. A/59/19/Rev.1)

"67. The Special Committee agrees that as the United Nations enhances its capacity to gather field information and assess risks, all forms of **technical monitoring and surveillance** means, in particular **aerial** monitoring capabilities as part of United Nations missions, should be **explored** as a means to ensure the safety of peacekeepers, particularly in volatile and dangerous conditions and in situations too dangerous for visual monitoring from the ground. The Special Committee requests the Secretary-General to provide in his next report to the Committee a **comprehensive assessment** in that regard and on the basis of lessons learned."

2006 (UN Doc. A/60/19)

"56. The Special Committee stresses the **need for priority action** by the Department of Peacekeeping Operations to examine how all forms of technical monitoring and surveillance means, in particular aerial monitoring capabilities, can

be used by the United Nations to ensure the safety and security of United Nations peacekeeping personnel, particularly those peacekeepers who are deployed in volatile and dangerous conditions, and in situations too dangerous for monitoring from the ground. The Special Committee recommends that the Department of Peacekeeping Operations engage troop-contributing countries in a **dialogue** on this issue. The Special Committee reiterates yet again its request to the Secretary-General to provide the Special Committee in his next report with a comprehensive assessment in this regard."

2007 (UN Doc. A/61/19)

"45. The Special Committee **welcomes the study** launched by the Secretariat on the use of advanced monitoring and surveillance technologies to tangibly improve operational capabilities, achieve results in the field and promote the safety and security of peacekeeping personnel. Recognizing the urgent need for Peacekeeping Operations to **standardize** the use of advanced technology, particularly in missions operating in dangerous environments or mandated with challenging tasks, the Special Committee requests the Secretariat to **develop appropriate modalities** for the use of advanced monitoring and surveillance technologies with due attention to legal, operational, technical and financial considerations as well as the consent of the countries concerned with regards to their application in the field.

46. The Special Committee calls on the Secretariat to *engage* in the utilization of advanced monitoring and surveillance technologies where appropriate, particularly in more dangerous missions, and **present a report** to the C-34 in its next session on the steps taken by the Secretariat towards achieving these ends and any further suggestions for consideration by the Special Committee. The Special Committee *encourages dialogue* among member states and between member states and the Secretariat to meet the objectives stated above."

2008 (UN Doc. A/62/19)

"50. The Special Committee requests the Department of Peacekeeping Operations to present a **progress report** to it before its 2009 substantive session on the use of advanced monitoring and surveillance technologies in United Nations peacekeeping operations. The Special Committee continues to request the Secretariat to **develop appropriate modalities** for the use of advanced monitoring and surveillance technologies with due attention to legal, operational, technical and financial considerations as well as the consent of the countries concerned with regard to their application in the field."

2009 (UN Doc. A/63/19)

"42. The Special Committee notes the **progress** made towards a wider and systemic use of technology in peacekeeping operations. However, the Special Committee believes **further progress** is required. In this regard, the Special Committee requests the development of a United Nations **policy** on monitoring and surveillance technology, and looks forward to a **report** on this subject

within six months of the issuance of this Committee's findings. The Special Committee believes that due attention should be given to legal, operational, technical and financial considerations and especially the consent of the countries concerned with regard to their application in the field."

2010 (UN Doc. A/64/19)

"43. The Special Committee notes the **progress** made towards a **wider and systemic use of technology** in peacekeeping operations. However, the Special Committee believes **further effort** in this direction is required. In this regard, the Special Committee requests the Secretariat to continue its work towards the finalization of the **draft policy** for the use of monitoring and surveillance technology in the field missions, and looks forward to a **report** on this subject within six months of the issuance of this Committee's 2010 report. The Special Committee looks forward to considering the legal, operational, technical and financial considerations contained in the report and especially the element of the consent of the countries concerned with regard to the application of such means in the field."

Appendix 3

Possible sensing technologies for peacekeeping, categorized by type of signal detected

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Table A3.1 Possible sensing technologies for peacekeeping by type of signal measured

Technology	Quantity measured	Examples of use
Electromagnetic sensing (passive)	Electromagnetic radiation, emitted or reflected, of wavelength ...	
Visible light imaging (using film or charge-coupled device)	0.4–0.7 μm	Photograph or video troops, tanks, vehicles in a demilitarized/conflict zone
Infrared (IR) imaging (i.e. heat sensing)		Locate operating vehicles, warm bodies moving across cease-fire lines or prohibited areas at night, aid to patrols
Near infrared	0.7–1.4 μm	
Short wave (SWIR)	1.4–3.0 μm	
Mid wave (MWIR)	3.0–9.0 μm	
Long wave (LWIR)	9.0–12.0 μm	
Far-IR	12.0–300.0 μm	
Radio-wave monitoring	>30 cm (HF: 3–30 MHz; VHF: 30–300 MHz; UHF: 300 MHz – 3 GHz)	Receive and monitor radio and cellular communications
Electromagnetic sensing (active)	Electromagnetic radiation, originating from the sensor system and reflected by object, in the wavelength range ...	
LIDAR (Light Detection and Ranging)	0.4–1.1 μm	Determine vehicle speed, location of combatants' positions
RADAR (Radio Detecting and Ranging)		
Ground surveillance radar	3–30 cm (X-band: 8–12 GHz; K-band: 18-26 GHz; K_a band: 26–40 GHz)	Detect person entering monitored zone
Ground-penetrating radar	0.3–10 m (30–900 MHz, typically)	Find buried weapons or mass graves
Wall-penetrating radar	3–30 cm (1–10 GHz)	Detect people inside rooms (e.g. hostage situations)
Doppler radar	0.1–100 cm	Determine vehicle speed
Synthetic aperture radar	3–50 cm	Spot weapons and deployments, day and night and in all weather conditions

Aerial surveillance radar	3–50 cm	Detect planes violating no-fly zones
X-ray detection and imaging	0.03–3 nanometres	Identify weapons inside metal/wooden cases or beneath personal clothing
Magnetic (and quasi-static electric field) detection	Magnetic field perturbations due to large ferromagnetic objects	Detect mines in fields, vehicles passing on roads
Acoustic wave sensing		
Seismic sensing (long-range) using a seismometer	Elastic waves travelling through the Earth's interior and along its surface	Detect underground explosions (e.g. in explosives testing and in mining)
Seismic detection (short-range) using a geophone	Elastic waves travelling along the Earth's surface	Detect vehicle or combatant intrusion into restricted areas
Sonar (Sound Navigation and Ranging) detection	Acoustic waves, in water, of wavelength 10 cm – 1 km (passive), 0.1–30 cm (active)	Observe ship passage into restricted areas or presence of sea-mines
Ultrasound probing	Sound wave frequency >20 kHz	Probe artillery shells for chemical weapon agents
Microphone	Sound waves in air of frequency 20 Hz – 20 kHz (wavelength 1 cm – 20 m)	Determine which side/party fired first; provide alert if tanks are travelling along roads or removed from storage
Pressure and strain sensing	Pressure (or strain) applied on contact with . . .	
Strain sensitive cable	A cable (fibre-optic or piezoelectric) or pneumatic tube	Detect vehicles moving on monitored roads, e.g. before or near checkpoint
Weight scale	Pressure-sensitive plate	Weigh truck passing atop scale for sanctions monitoring

Appendix 4

Summary of the benefits of various monitoring technologies

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Table A4.1 Summary of the benefits of various monitoring technologies

Monitoring technology	Benefits
Video monitors	
• video cameras • web cameras • closed-circuit television • digital video networks • aerial and space-based	• supplement observation by the human eye • zoom capability for higher-resolution imagery • monitor current conflict zones nearby, from the air or from a remote location • spot approaching threats in daytime and in illuminated areas at night (e.g. in UN compounds) • verify commitments made in peace agreements, spot violations of human rights • detect illegal activities, including malicious acts, smuggling or sanctions evasion • share imagery in real time and in reports • record events for future analysis or for use as evidence in commissions or tribunals
Night vision	
• image intensifiers • thermal imagers	• as above, but at night • allow for night patrols and monitoring of illegal movements of arms and personnel at night (including sanctions evasion and preparations for attack) • thermal imagers can operate in complete darkness whereas image intensifiers require some ambient light (e.g. moonlight or artificial illumination)
Motion detectors	• detect approaching humans or vehicles, especially at night • activate cameras, illuminators and/or alarms
Radars	
• air surveillance (ASR) • artillery locating • ground surveillance • ground penetrating (GPR) • synthetic aperture • marine • weather	• operate day and night • operate in all weather conditions • detect and/or image aircraft (ASR), ground vehicles or boats and individuals • locate the origins of artillery fire • discover buried weapons or mass graves (GPR) • warn of oncoming storms or turbulence

Table A4.1 (cont.)

Monitoring technology	Benefits
X-ray machines	• examine baggage for dangerous/ prohibited items such as weapons
Acoustic sensors	• detect and locate small arms fire • detect movement of persons or vehicles
Seismic sensors	
• geophones	• detect personnel/vehicles (geophones)
• seismic arrays	• detect explosions (seismic arrays)
Chemical sensors	• detect explosives, poisons and possible chemical weapons
Metal detectors	
• hand-held wand	• check for metal-containing weapons (hand-held wand)
• mine detector	• detect mines
Pressure transducers	
• intrusion alarms	• detect persons entering camps
• road monitor	• detect vehicles trying to circumvent checkpoints
Radio-wave monitoring	
• signal-locating equipment	• find source of radio transmission
• radio scanners / signal monitoring	• intercept calls of hostage-takers
Positioning and tracking systems	
• Global Positioning System (GPS)	• determine location of observer or of distant objects (using GPS and laser range-finders)
• transponders and tags	• relay position to remote monitors (transponders and tags)
• radio frequency identification (RFID)	• identify equipment (including stored weapons, using RFID)

Note: Technologies less likely to be used in peacekeeping include: sonar, ultrasound, LIDAR, taut-wire fences, IR break-beam detectors, seals and tags. Nuclear detectors (Geiger counters) are needed only when nuclear materials present a danger.

Appendix 5

Summary of current and potential monitoring technologies in UN peacekeeping

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Table A5.1 Summary of current and potential monitoring technologies in UN peacekeeping

Types	Current UN uses	Potential UN activities
Video		
• video cameras	• used only in an ad hoc fashion in some missions • personal equipment often employed • no systematic plans, policies or guidelines for use	• use in all missions for patrols and in observation posts • use in an unattended fashion • specialized cameras in aircraft • record peace agreement violations or human rights abuses • maintain database of important clips
• closed-circuit television (CCTV)	• used to protect UN premises • one case of "hotspot" monitoring: Green Line in Nicosia	• remote viewing of hotspots and potential flashpoints
Night vision		
• image intensifiers	• too few possessed, or deployed in insufficient numbers • inadequate COE standards	• facilitate night patrols and night operations
• thermal imaging	• not used, except in a few advanced aircraft	• night foot/vehicular patrols • border control • forward-looking infrared in aircraft
Motion detectors		
• intrusion alarms	• underexploited technology	• protect refugee/UN camps • coupled with automatic illuminators
Radars		
• aerial surveillance radar	• used only in UNIFIL	• track aircraft violating no-fly zones or sanctions or transporting illegal materials • synthetic aperture radar for imaging from satellite and/or aircraft
• artillery-locating radar	• used only in UNIFIL	• determine the source of artillery fire • remove UN personnel from fire

• ground-penetrating radar	• not used	• discover underground weapons caches and mass graves • detect landmines and unexploded ordinance
• ground surveillance radar	• used only in UNIFIL	• detect trespassers along line of control or demilitarized zone • catch illegal smuggling or aggression
X-ray machines		
• Baggage and shipments	• used in entrances to some buildings and UN-run airports	• examine cargo • detect human and or other forms of smuggling
Acoustic sensors		
• small arms fire location • movement of persons or vehicles	• not used (except makeshift)	• identify source of rifle fire for early warning and response • detect weapons being removed from cantonment
Seismic sensors		
• geophones/ seismometers	• not used	• detect persons or vehicles passing through a certain area
Chemical sensors		
• explosives detector	• not used (except perhaps in Middle East PKOs)	• detect weapons and ammunition
Metal detectors		
• hand-held wand • mine detector	• used to detect metal on persons entering some premises • widely used for mine detection	• detect weapons and mines • improved sensors with better detection
Electronic monitors		
• signal-locating equipment • radio scanners / signal monitoring	• not used • not used systematically (except in Congo 1960–1964 and 2006–2007)	• for electronic countermeasures, e.g. detection of bugs in UN offices or of militia signals in jungles • for tactical operations, e.g. against hostage-takers

Table A5.1 (cont.)

Types	Current UN uses	Potential UN activities
Positioning and tracking systems		
• Global Positioning System (GPS) • Transponders and tags	• GPS used extensively; devices are individually owned, contingent owned and UN owned • Carlog used in most missions for UN vehicles	• real-time tracking of vehicles • radio-frequency identification used to track weapons and UN supplies
Information analysis		
• geographic information systems (GIS) • databases	• GIS capabilities increasing • used for mapping • Joint Operations Centre and Joint Mission Analysis Centre structures developing Standard Operating Procedures	• systems allowing user interaction and input for real-time picture

Appendix 6

Unattended ground sensors: Summary of a survey

A pioneering opinion survey on the potential use of unattended ground sensors (UGS) in UN peacekeeping was conducted in 1995 by European researchers (Altmann et al. 1998) and published by the United Nations Institute for Disarmament Research. Such UGS can be left in the field to send signals to peacekeepers. A questionnaire was sent out to peacekeepers and to officials at defence headquarters in various countries, gaining 114 responses out of 185 questionnaires sent. A full 90 per cent considered ground sensors useful in principle, across the range of possible activities considered (cease-fire lines, buffer/demilitarized zones, enclosed areas, safe havens and using portable sensors). Only 27 per cent had actual experience with ground sensors, mostly from other military activities, as would be expected because of the very limited application in current UN operations.

A majority (68 per cent) believed that the efficiency of a peacekeeping operation could be increased by using ground sensors, while 29 per cent disagreed. Some 40 per cent wanted to deploy sensors in a covert fashion, 36 per cent in a purely overt fashion, and 16 per cent wanted the capability for both modes of operation. Encrypted signals were preferred by 54 per cent, while open communication was chosen by 34 per cent, with only 7 per cent desiring both. The respondents expected that the unattended sensors should operate for weeks (46 per cent), as opposed to days (31 per cent) or months (22 per cent), before human intervention was required. The optimal detection range was 100–1,000 metres for most respondents (49 per cent), although some (25 per cent) wanted a longer

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distance and the rest (9 per cent) could settle for less. The main objects of detection were considered to be: people (84 per cent), trucks (75 per cent), tanks (45 per cent), helicopters (28 per cent) and aircraft (28 per cent). Most respondents desired detection within a few seconds (not minutes or hours) and were willing to accept a false-alarm rate of one per day, but not five per day. A slim majority considered that an acceptable training time would be one week (51 per cent), while some wanted only one day (35 per cent) and others a full month (7 per cent).

A few of the many desirable features cited for UGS were: theft-proof installation; remote on/off switching (for example, to activate sensors at the beginning of a curfew); the capability to differentiate between animals and humans, as well as between armed and unarmed persons; and compatibility with existing computer and communications systems. In addition to those inferred from the above, the listed concerns were: the possibility of increased complexity in the operation; the potential need for more troops to guard or periodically check the sensors and respond to the alerts; the need for technical expertise for operation and maintenance; the degradation of sensor capabilities owing to weather, terrain and other factors; increased UN involvement necessitated as a result of increased information.

Practical suggestions included: including the use of unattended sensors in the mission's mandate (or the Status-of-Forces Agreement) to lessen any fears the parties might have of unwarranted observation, and including backup systems and methods in case the sensors fail. In considering how peacekeeping expertise with sensors should in the future be increased, most felt that cooperation among nations is the best means to develop the technologies (41 per cent). Others preferred UN ownership (30 per cent), while the remainder preferred other means (29 per cent).

The respondents were almost exclusively from the military component of peacekeeping missions; the civilian members of the peacekeeping community were under-represented (only 5 per cent of the respondents). The survey covered a much more limited set of tools than the present work.

Appendix 7

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