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PROLIFERATION CONTROL

Iraq's military capabilities have focused attention on the spread of advanced military technology to conflict-prone regions of the world, particularly weapons of mass destruction and missiles.

This briefing reviews technical aspects relevant to improving international control over the spread of such sophisticated weaponry.

THE MIDDLE EAST

Much concern over proliferation is centred on nuclear, chemical and biological weapons, and on the ballistic missiles which provide a means of delivery over ranges sufficient to threaten whole regions. While there are difficulties in making precise assessments, Table 1 presents an estimate of capabilities in such systems for seven Middle East states. Such states are greatly dependent on the leading industrial nations for obtaining equipment, technology and materials for these weapons. Industrial states have therefore been applying export restrictions, and 'proliferating' states have begun to increase their autonomy by building up their own manufacturing capabilities. Although it is possible to restrict many items needed to produce each type of weapon, as recent experience with Iraq has demonstrated, determined purchasing of components (both legally and illegally) by front companies operating in different countries can circumvent controls.

INTERNATIONAL AGREEMENTS

Proliferation control agreements have evolved piecemeal as perceptions of the problem have changed (Table 2).

Nuclear Weapons. The cornerstone of the present nuclear control regime is the Non-Proliferation Treaty (NPT). This divides states into nuclear weapon states(NWS) and non-nuclear weapon states(NNWS). The latter undertake not to manufacture or acquire nuclear weapons, and accept verification safeguards on their (civil) nuclear activities, administered by the International Atomic Energy Agency (IAEA). Both NWS and NNWS parties agree not to export certain materials and equipment to non-parties without requiring IAEA safeguards on those items. These measures have been supplemented by a series of agreements between exporting countries on the conditions of supply. The effectiveness of the NPT is however limited by the non-participation of several near-nuclear states (e.g. India, Israel, Pakistan and South Africa).

Table 1 : PROLIFERATION IN THE MIDDLE EAST (US Sources)

Capability in:	Nuclear Weapons	Chemical Weapons	Biological Weapons	Ballistic Missiles
Egypt	–	+	–	+
Iran	–	+	?	+
Iraq	–	+	+	+
Israel	+	+	?	+*
Libya	–	+	?	+
Saudi Arabia	–	–	–	+
Syria	–	+	?	+

* Israel also has an anti-ballistic missile system ('Arrow') under development with assistance from the US Strategic Defense Initiative.

Table 2 : MAJOR AGREEMENTS ON PROLIFERATION CONTROL

Title	Entry into Force	No. of Parties (Dec. 1989)
Non-Proliferation Treaty (NPT)	1970	141
Geneva Protocol	1925	122
US/USSR Bilateral Agreement on Destruction and Non-Production of CW	1990	2
Chemical Weapons Convention (CWC)	(Under negotiation)	
Biological Weapons Convention (BWC)	1975	111
Missile Technology Control Regime (MTCR)	1987	8

Chemical Weapons. Currently, the only multilateral agreement on chemical weapons is the 1925 Geneva Protocol, which bans their use rather than their possession (because of reservations expressed by a few states, it is effectively a no-first-use agreement). This is supplemented by an informal arrangement of some OECD states (meeting since 1985 as the Australia Group), whereby export controls are applied according to agreed lists of sensitive chemicals and equipment.

This year, the US and USSR signed a Bilateral Agreement on Destruction and Non-Production of Chemical Weapons, in which production of chemical weapons will cease and stocks will be reduced to 5000 agent tonnes by 2002. Negotiations are also underway to augment the Geneva Protocol with a multilateral Chemical Weapons Convention (CWC). This complex new Convention will include a universal ban on chemical weapons and production facilities under tight verification conditions. It will be backed by an international agency to ensure its effective operation.

Biological Weapons. The Geneva Protocol applies to biological as well as chemical weapons. Additionally, the Biological Weapons Convention (BWC) was agreed in 1972, but contains no verification provisions. Largely as a result of the new techniques of genetic manipulation, concern over the possibility of developing militarily useful biological weapons has increased. At the BWC's second Review Conference in 1986, some new confidence-building measures were there-

Table 3 TECHNOLOGICAL TARGETS FOR CONTROL

Type	General Category	Examples
Nuclear		
	Fissile Material	Enriched uranium
	Components of enrichment plants	Gas centrifuges
	Components of reactors	Pressure vessels
	Components of reprocessing plants	Fuel element chopping machines
	Components of weapons	Electronic triggers
Chemical		
	Chemical weapons agents	Mustard gas
	Chemical raw materials	Thiodiglycol
	Components required in chemical weapons plant	Large activated carbon filter units
Biological		
	Biological agents	Anthrax bacilli
	Materials used in manufacture of agents	Culture media
	Components required in manufacture of agents	Fermentation and containment eqpt.
Missile		
	Missiles	Complete rockets
	Materials used in manufacture of missiles	Heat shields
	Components required in manufacture of missiles	Specially designed production facilities

fore agreed, but compliance has been only partial. The Australia Group is also extending its export control co-ordination activities into this area.

Ballistic Missiles. In 1987, seven industrial states agreed to operate a Missile Technology Control Regime (MTCR). This aims to prevent the spread of key components required for the production of ballistic and cruise missiles by applying an agreed set of export controls. Although not a party to the MTCR, the USSR has agreed to apply the same principles, and other states have joined the regime.

National Implementation. The UK implements the above agreements largely through the Export of Goods (Control) Order 1989, a Statutory Instrument under the Import, Export and Customs Powers (Defence) Act of 1939, administered by the DTI. This is supplemented by a more informal system of providing information and advice to companies which allows the broader Australia Group listings to be applied.

TECHNOLOGIES FOR PRODUCTION AND VERIFICATION

The weapons systems under discussion require a wide range of technologies for their assembly. These range from everyday chemicals and equipment to highly specialised materials whose use is unambiguous. Non-proliferation controls can seek to restrict key technological and material requirements - for instance those listed in Table 3. However, it is equally important to be able to detect if an attempt is being made to produce and test a new weapon system. Verification technologies and their capabilities are summarised in Table 4 for specific types of weapons, and discussed further below.

Nuclear Weapons

Nuclear weapons can be based on fission (atom bombs) or fusion (hydrogen bombs). Since the latter require a fission bomb to trigger them, the basic requirement for all nuclear weapons is clearly fissionable material - either highly enriched uranium or plutonium[1].

Uranium requires enriching to at least 93% U-235 by one of three techniques. The old technology of gaseous diffusion is still used by the major powers (US, USSR), but these plants are large and readily detectable by satellite. 'Proliferating' states are likely to favour smaller gas centrifuge plants which are nevertheless still likely to be detected by normal intelligence methods. If successfully developed, laser enrichment methods could allow small-scale use and would be more difficult (though still possible) to detect. Plutonium, on the other hand, is produced as a by-product of reactor operation, and would have to be recovered by reprocessing spent fuel. While power reactors are easy to detect, research reactors may be concealed. Large-scale reprocessing plants would be detectable, but pilot-scale plants might be possible to conceal.

If a state lacks the ability to enrich uranium or recover plutonium, an alternative would be to divert fissionable material (if the state has any) from civil use. However, NPT parties (including Iraq) would have to evade the IAEA safeguards system which is designed to identify any material unaccounted for in key areas. IAEA inspectors review the design of plants, maintain records of operations, receive reports and make on-site inspections which include sampling and non-destructive testing of radioactive materials.

If a state assembled a fission weapon, it would not be essential to test it. However, in the absence of testing, uncertainty over performance would remain, providing a motive for testing if the state believed the test could be concealed.

Chemical Weapons

Chemical weapons include choking agents (e.g. chlorine, phosgene), blood agents (e.g. hydrogen cyanide), blister agents (e.g. mustard gas) and nerve agents (e.g. Sarin and VX). The latter can be made in 'binary' form whereby two relatively innocuous chemicals only react together after firing. Effective verification of chemical weapons is difficult because of the comparative ease of their production and storage; many of the key materials and equipment are widely available in the civil chemical industry. Export controls attempt to restrict access to specific chemicals which are essential raw materials (e.g. thiodiglycol, a precursor for mustard gas, and phosphorus trichloride and hydrogen fluoride, precursors for nerve gas). Additionally, certain special production equipment can be restricted (e.g. equipment which is highly resistant to corrosion).

1. IAEA estimate that a 'proliferating' state would require 25 kg of highly enriched uranium or 8 kg of plutonium to produce a fission bomb. Iraq has 12.3kg of weapons-grade uranium (93% U-235) and a further 8kg which is less enriched (80-85% U-235); these have recently been inspected and accounted for by the IAEA. US sources estimate that Israel may possess 50-100 nuclear weapons, based on plutonium produced outside IAEA safeguards, since Israel is not a party to the NPT.

TABLE 4: THE DETECTION OF PROLIFERATION

PROLIFERATION ATTEMPT	DETECTION POSSIBILITY	METHODS
A. Nuclear		
1. Non-NPT or NPT State attempting to produce fissile material	Detection possible; more difficult with small plant (e.g. research reactor, pilot-scale reprocessing or new separations methods)	National Technical Means (e.g. satellite observation of plant) and monitoring of attempts to obtain materials(e.g. for centrifuges)
2. NPT State attempting to divert fissile material	Detection probable at (but not between) IAEA inspections	IAEA safeguards
3. State attempting to assemble weapon without testing	Detection possible	Monitoring of attempts to obtain crucial components
4. State attempting to test nuclear weapons	Detection probable	National Technical Means (NTM) for observation of test site and international seismic monitoring
B. Chemical		
5. State attempting to produce chemical weapons now	Detection possible, but difficult	NTM (observation of plant,weapons and tests) Monitoring attempts to obtain materials
6. State, party to the CWC (when agreed), attempting to produce chemical weapons	Detection possible	CWC verification requirements including challenge inspections
C. Biological		
7. State attempting to produce human pathogens now	Detection very difficult	NTM for observation of special facilities and monitoring attempts to obtain materials
8. State attempting to produce anti-animal, anti-plant or toxin weapons now	Detection practically impossible	Only prospect would be extremely thorough verification (e.g. long-term scientific exchanges)
D. Missiles		
9. State attempting to develop missiles now	Detection probable	Monitoring attempts to obtain advanced materials/technology; National Technical Means to observe testing

In the absence of intrusive verification inspections, indirect methods must be used to monitor chemical weapons capabilities. A country attempting clandestine development would ensure that little evidence was available from its military budget or via contributions by its scientists to the specialist literature. Nevertheless, remote observation could be expected to detect field testing, production and incorporation of the weapon system into the military organization. For instance, satellites might reveal external features to a chemical plant arising from the greater safety precautions required when dealing with toxic agents. Moreover, the nearby presence of munitions-filling capabilities (to avoid bulk transport) would raise concerns.

Nevertheless, given the size of the chemical and allied industries, it will never be possible to be certain whether chemical weapons are being produced without access to the suspect facility. For this reason, on-site inspections, including un-announced challenge inspections, are an essential component of the CWC being negotiated.

Biological Weapons

Biological weapons could comprise living pathogenic microorganisms (e.g. anthrax bacilli, yellow fever virus) or toxins made by them (e.g. botulinum toxin), by plants (e.g. ricin) or by animals (e.g. snake venom). The tools of genetic manipulation which have proved so helpful in developing new pharmaceutical products, could also be used to make living microorganisms more dangerous or for bulk manufacture of toxins.

Restrictions are applied to obvious targets such as pathogenic microbes from culture collections, but the overlap between technologies used for valid civilian biotechnology activities and offensive weapons research is large and makes effective prevention very difficult. In relation to human pathogens, two points in the development cycle may be accessible to effective verification. High-security facilities - laboratories, pilot plants or manufacturing facilities - are probably still difficult to acquire and conceal. Field-testing would also possibly require sites susceptible to detection by satellites. However, the decreasing size of modern plants for the production of biological materials makes detection increasingly difficult, so that on-site inspection is essential.

Missile Proliferation

A missile's effectiveness depends on its range, accuracy and payload. Key technologies include those for rocket propulsion, re-entry, guidance and control, and for adapting warheads to missile use. These all demand technology from the industrialized world. While some missiles can be obtained by straightforward purchase, these are relatively primitive and increasingly hard to obtain. A preferred method is to develop the capability to build missiles indigenously. This opens up the possibility of further development, offers export opportunities, and is much more difficult for others to control.

The MTCR was announced in 1987 and seeks to control the export of complete missile systems, critical components (e.g. boosters, guidance systems) and production systems. There is a presumption that any systems capable of delivering payloads of 500kg over distances of 300km or more should not be transferred. The MTCR has been successful in hindering the Condor II missile by Iraq (formerly also involving Argentina and Egypt). However the effectiveness of the MTCR is limited by the low number of participating countries, the informal nature of the agreement and limited enforcement.

Detection of an emerging ballistic missile programme could follow from applying the export licensing constraints. A missile flight-test ban (i.e. on tests of ballistic missiles rather than space shots) would be readily verifiable.

CURRENT ISSUES

Improving the Present Control Regimes

Some critics argue that increasing public awareness of the advanced weapons already in the Middle East merely confirms that proliferation is already out of control. Others acknowledge that technological capabilities have spread, but argue that the situation is not yet out of control, and have made suggestions for improving present control regimes. For example, the confusion over the attempted export of 'supergun' parts to Iraq and the export of chemical weapons-producing plant by West German companies suggest that there is scope for tightening application of national controls. Internationally, it is particularly important to be able to piece together the whole picture from a multitude of separate purchasing moves in different countries, which requires good collaboration between all countries applying export controls in a given field, as well as good coordination between departments in each country (DTI, MOD and FCO in the UK).

Developing the Regimes

There are also ways in which the non-proliferation regime could be developed further in specific fields.

Nuclear Weapons. The NPT had its fourth five-year Review Conference earlier this year, and will be subject to an important conference in 1995 to decide for how long it should be extended. The Review Conference considered proposals to improve the NPT's safeguards system, including:

-Currently, some nuclear supplier states do not require that non-NPT recipient countries accept IAEA safeguards on their peaceful nuclear activities. It is proposed that these 'full-scope' safeguards should be extended to all facilities in all states, whether or not they are members of the NPT.

-IAEA inspections have only taken place to date at facilities declared by the NPT state. Since there is suspicion that some states may be developing clandestine facilities, the UK proposed that 'special inspections' should be undertaken by IAEA at other suspected nuclear facilities that had not been volunteered by the state.(This would require an increase in the current IAEA safeguards budget of $53m.)

These proposals were not formally adopted, since a final conference document could not be agreed due to differences over the question of a Comprehensive Test Ban Treaty (CTBT). This issue is linked to the NPT because some parties have long seen progress towards a CTBT as a key measure of NWS' compliance with Article VI of the treaty (requiring progress towards nuclear disarmament). As a result, the resistance of the USA and UK to a CTBT[2] (based on a perceived need for continued testing to maintain and develop their nuclear arsenal) has been used as a reason for some parties to oppose progress on these other fronts.

Chemical Weapons. Much progress has been made since 1985 at the *Ad hoc* Committee on Chemical Weapons at the Geneva Conference on Disarmament. The draft Convention would ban manufacture, stockpiling and use of a wide range of chemical and toxin-based weapons. It has procedures for overseeing destruction of weapons and facilities, and includes inspection and challenge procedures. One aim is to monitor civilian chemical production to make sure that legitimate chemicals are not being diverted to weapons production. The latter provisions are particularly important since Iraq is believed to have acquired its nerve gas capability from chemicals and equipment on the open market under the guise of making organophosphorus insecticides.

While progress has been substantial, there are some issues still to be agreed. One is whether to allow states holding a stockpile of chemical weapons to retain small but militarily significant amounts pending a special review conference eight years after conclusion of the Convention. Another is how certain chemicals (e.g. herbicides and riot-control agents) should be treated. Thirdly, there is disagreement over the nature and scope of challenge inspections.

Biological Weapons. Many think that effective control of biological weapons is far more difficult and even more dependent on intrusive verification procedures than control of chemical weapons. They thus see the Biological Weapons Convention following in the footsteps of the CWC, and applying similar agreements and procedures on inspections. It is anticipated that confidence-building measures such as exchange visits will be agreed at the third review conference of the BWC next year. In the meantime, there is concern that genuine research posts in Universities offering the possibility of studying genetic manipulation techniques, could be attractive to countries wishing to establish a group of scientists competent in these techniques for military purposes. For this reason, Universities and similar bodies have been requested to remain alert for suspicious applications for such positions.

Missiles. Improving the MTCR is seen by many as requiring greater participation by both exporting and recipient nations. More industrial countries are joining the regime, but a need is still seen to include such second-tier exporters as China and Brazil. There have also been calls for the MTCR to be turned into a legally-binding treaty and extended to shorter range missiles with lighter payloads. In this respect, concern has been expressed at the potential for proliferation of anti-ballistic missile systems (such as the Israeli Arrow programme being developed with US assistance), and it has been argued that the MTCR should be extended to include such systems.

FURTHER READING

Additional details and background information are available from POST, 2, Little Smith St.,London: tel (071)-222-2688.

2. Proposals for a CTBT will next be raised at a special amendment conference of the Partial Test Ban Treaty in New York (7-18 Jan. 1991).