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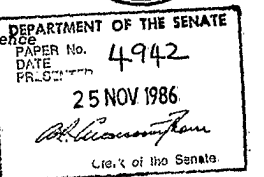

DISARMAMENT AND ARMS CONTROL IN THE NUCLEAR AGE

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TERMS OF REFERENCE

On 8 December 1983 the Joint Committee on Foreign Affairs and Defence resolved to inquire into, and report upon:

'Disarmament and Arms Control'

The Committee referred this inquiry to its Sub-Committee on Disarmament and Arms Control.

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DISARMAMENT AND ARMS CONTROL
IN THE NUCLEAR AGE

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ABM	Anti-Ballistic Missile
ACDA	Arms Control and Disarmament Agency
ALCM	Air-Launched Cruise Missile
ASAT	Anti-Satellite
ASROC	Anti-Submarine Rocket
ASW	Anti-Submarine Warfare
ATB	Advanced Technology Bomber
ATBM	Anti-Tactical Ballistic Missile
AWACS	Airborne Warning and Control System
BMD	Ballistic Missile Defence
BMEWS	Ballistic Missile Early Warning System
BW	Biological Weapon (Warfare)
C^3	Command, Control and Communications
C^3I	Command, Control, Communications and Intelligence
CBW	Chemical and Biological Weapon (Warfare)
CD	Conference on Disarmament (Geneva)
CDE	Conference on Disarmament in Europe (Stockholm)
CEP	Circular Error Probable
CMP	Counter Military Potential
CSCE	Conference on Security and Cooperation in Europe
CTB	Comprehensive Test Ban
CW	Chemical Weapon (Warfare)
DARPA	Defense Advanced Research Projects Agency
DC	Disarmament Commission
DCS	Defense Communications Systems
DSP	Defense Support Program
ELF	Extremely Low Frequency
EMP	Electromagnetic Pulse
EMT	Equivalent Megatonnage
GLCM	Ground Launched Cruise Missile
GPS	Global Positioning System
HF	High Frequency
IAEA	International Atomic Energy Agency
ICBM	Intercontinental Ballistic Missile
INF	Intermediate-Range Nuclear Forces
IRBM	Intermediate-Range Ballistic Missile
ISMA	International Satellite Monitoring Agency
KT	Kiloton
LRTNF	Long-Range Theatre Nuclear Forces
MAD	Mutual Assured Destruction
MARV	Manoeuvrable Re-entry Vehicle
MIRV	Multiple Independently Targetable Re-entry Vehicle
MRBM	Medium-Range Ballistic Missile
MRV	Multiple Re-entry Vehicle
MT	Megaton
MX	Missile Experimental
NATO	North Atlantic Treaty Organisation
NPT	Non-Proliferation Treaty
NORAD	North American Aerospace Defense Command

PNET	Peaceful Nuclear Explosions Treaty
PTBT	Partial Test Ban Treaty
R&D	Research and Development
RPV	Remotely Piloted Vehicle
RV	Re-entry Vehicle
SAC	Strategic Air Command
SACEUR	Supreme Allied Command Europe
SALT	Strategic Arms Limitation Talks/Treaty
SAM	Surface-to-air Missile
SCC	Standing Consultative Commission
SDI	Strategic Defense Initiative
SIOP	Single Integrated Operations Plan
SLBM	Submarine-Launched Ballistic Missile
SLCM	Sea-Launched Cruise Missile
SRAM	Short-Range Attack Missile
SRBM	Short-Range Ballistic Missile
SSBN	Nuclear-Powered Ballistic Missile Submarine
SSM	Surface-to-surface Missile
SUBROC	Submarine Rocket
START	Strategic Arms Reductions Talks
TERCOM	Terrain Contour Matching
TLAM/C	TOMAHAWK Land-Attack Missile (Conventional)
TLAM/N	TOMAHAWK Land-Attack Missile (Nuclear)
TNT	Tri Nitro Tolene
TTBT	Threshold Test Ban Treaty
WTO	Warsaw Treaty Organisation

GLOSSARY OF TERMS

Note: An underlined term in the 'explanation' column indicates that there is a separate entry for that term, either in the Glossary of Terms or in the Glossary of Abbreviations and Acronyms.

Term	Explanation
Anti-Ballistic Missile (ABM)	Missile intended to intercept and destroy re-entry vehicles (including warheads) from attacking ICBMs or SLBMs.
Air burst	Detonation of a nuclear weapon in the air above the target. This causes destruction over a wider area than a ground burst, but generally creates less fall-out.
Atomic bomb	See fission weapon.
Ballistic missile	Any missile designed to follow the trajectory that results when it is acted upon predominatly by gravity and aerodynamic drag after thrust is terminated. Ballistic missiles typically operate outside the atmosphere for a substantial portion of their flight path and are not powered for most of the flight.
Battlefield nuclear weapons	See tactical nuclear weapons.
Biological Weapon (BW)	Living organisms, or material derived from them, which are intended for use in warfare to cause disease or death in man, animals or plants, and the means of their delivery.
Chemical Weapon (CW)	Chemical substances which might be employed as weapons in combat because of their direct toxic effect on man, animals and plants, and the means of their delivery.
Circular Error Probable (CEP)	A measure of the delivery accuracy of a weapon system. It is the radius of a circle around a target of such size that a weapon aimed at the centre has a 50 per cent probability of landing within the circle.

Term	Explanation
Collateral damage	Damage incidental to that caused to the actual target.
Conventional	Non-nuclear: thus, conventional warhead.
Counterforce	A nuclear warfare strategy intended to inflict maximum damage to military targets such as ICBM silos, strategic bomber bases, key communications facilities and so on.
Countervalue	A nuclear warfare strategy intended to maximise damage to society and the economy; targets are usually cities, industrial areas and installations such as dams and power stations.
Cruise missile	Any missile which flies under its own jet power to its target. An early example is the German V-1 ('buzz bomb') of the Second World War. In the nuclear context, refers mainly to cruise missiles launched from aircraft (ALCM), ships/submarines (SLCM) or ground installations (GLCM): these missiles fly under jet power and navigate to target by computer.
Dual-capable	An aircraft, ship, artillery piece or other weapons launcher capable of delivering both nuclear and conventional munitions.
Electromagnetic Pulse (EMP)	High-energy pulse of electromagnetic radiation produced by nuclear explosion. A weapon air burst at, say, an altitude of 100km, will produce EMP effects over a radius of about 1 200km from ground zero. EMP can damage or destroy sensitive electronic equipment, communications systems, power distribution networks and even railway systems.
Enhanced radiation warhead	See neutron bomb.

Term	Explanation
Equivalent Megatonnage (EMT)	A measure of the destructive potential of nuclear warheads against soft countervalue targets. EMT is calculated from the equation $EMT = NY^{2/3}$ where N is the number of warheads of yield Y.
Fall-out	Particles of dirt, dust, etc thrown up and made radioactive by a nuclear detonation: distribution of fall-out after an explosion usually depends on weather and local geography.
First strike	Pre-emptive nuclear attack intended to defeat the enemy by destroying his ability to hit back effectively. See also Second strike, Mutual Assured Destruction.
Fission weapon	An 'atomic' bomb; one deriving its power from the splitting ('fission') of atoms, usually of uranium-235 (U-235) or plutonium-239 (Pu-239). See also fusion weapon, trigger.
Forward-based systems	Soviet-coined term for U.S./NATO nuclear systems with less than intercontinental range but which, because of location, can threaten targets deep in Soviet territory.
Fusion weapon	The 'hydrogen' or 'thermonuclear' bomb. Derives most of its power from the forced joining ('fusion') of atoms of hydrogen or other light elements. Requires a trigger before detonation is possible.
Ground burst	Detonation of a nuclear weapon on or just below the ground at the target. Maximises destruction at this point and produces much fallout, but reduces damage away from the target. See air burst, ground zero.
Ground zero	The point on the ground at or above which a weapon detonates. See air burst, ground burst.

Term	Explanation
Hydrogen bomb	See fusion weapon.
Kiloton (KT)	Thousand tons; as measure of nuclear weapon explosive power, one kiloton equals one thousand tons of TNT. The bomb used on Hiroshima rated around 12kt, i.e. 12 000 tons of TNT. See also megaton, yield.
Megaton (MT)	Million tons; as a measure of nuclear weapon explosive power, one megaton equals one million tons of TNT. See kiloton, yield.
Multiple Independently Targetable Re-entry Vehicle (MIRV)	Several warheads are placed on a single missile and each can be directed to a separate target. See also MRV, Re-entry vehicle.
Multiple Re-entry Vehicle (MRV)	Several warheads on a single missile, but not capable of guidance to individual targets.
Mutual Assured Destruction (MAD)	Sometimes referred to as mutual assured deterrence. It refers to the ability to inflict massive damage on an enemy even if the enemy launches a first strike. MAD depends on a secure second strike capability.
Neutron bomb	Also called the 'Enhanced radiation warhead' (ERW). Nuclear weapon designed to yield maximum radiation and minimum blast. Used to disable armoured vehicle concentrations without destroying other facilities.
Overkill	Term for alleged excess capacity of each superpower's nuclear arsenal vis-a-vis the other's. Also used in the context of employing excessive force to achieve a goal.
Overpressure	Measure of blast from an explosion, usually still expressed in pounds per square inch (psi).
Re-entry vehicle (RV)	That part of a Ballistic missile designed to carry a nuclear warhead and to re-enter the earth's atmosphere in the final phase of the missile's trajectory.

Term	Explanation
Second strike	In nuclear war, the retaliation promised as inevitable in response to a first strike. A 'secure second strike capability' is essential to MAD. Both the U.S. and the Soviet Union depend on SLBM to deliver their second strike.
Silo	Underground housing for ICBMs. Silos are usually designed to withstand high overpressures so that the missile can be launched after a first strike.
Strategic bomber	Aircraft capable of inter-continental flight and nuclear weapons delivery.
Strategic nuclear weapons	Long range delivery systems for attackon enemy homeland. ICBM, SLBM and weapons delivered by strategic bombers fall into this category.
Tactical nuclear weapons	Also 'battlefield' nuclear weapons; short range - under 200km - nuclear weapons designed for use in land or sea battle. Distinct from both strategic and theatre weapons.
Theatre nuclear weapons	'Theatre' refers to an area such as Europe; thus, theatre weapons refer to those whose use has European, not local or global implications in the operational sense. Ranges vary from 200km to about 1 700km, though definitions are somewhat arbitrary.
Thermonuclear weapon	See fusion weapon.
Throw weight	Payload weight of a missile, including all re-entry vehicles.
Trigger	A fission bomb used to set off a fusion weapon. The fusion reaction will only proceed at extreme temperatures (about 20 million degrees Celsius), and thus all fusion bombs are in fact 'triggered' by a fission bomb which creates the heat needed to start the fusion reaction. See fission weapon, fusion weapon.

Term	Explanation
Warhead	That part of a weapon which contains the explosive or other material intended to inflict damage.
Yield	The energy released in an explosion. The explosive power of nuclear weapon, is usually measured in kilotons or megatons of TNT required to produce the same energy release.

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FOREWORD

1. This Report has been prepared to facilitate more informed public debate in Australia over the dangers of nuclear war and ways of reducing its likelihood in the future. It is the culmination of nearly three years work in which the Sub-Committee considered a large number of submissions from interested groups and individuals, conducted public hearings across Australia, and held detailed discussions with Australian government officials, delegations from both the United States and the Soviet Union, and numerous Australian and internationally-known arms control specialists.

2. Distinguished overseas visitors included Mr Jan Martenson, the United Nations Under Secretary-General for Disarmament; Mr Asbjorn Eide, Executive Director of the International Peace Research Institute in Oslo; Dr Hans Blix, the Executive Director of the International Atomic Energy Agency; Ms Inga Thorsson, a former Swedish Disarmament Ambassador; Mr Josef Goldblat and Dr Sverre Lodgaard, Members of the Stockholm International Peace Research Institute; Dr Kenneth Adelman, Director of the United States Arms Control and Disarmament Agency; Dr Vladimir Petrovsky, a senior Soviet Foreign Ministry official; Mr Robert Lindhard, Acting Senior Director for Defense and Arms Control Issues, US National Security Council; and Professor Michael Howard, Regius Professor of Modern History at the University of Oxford.

3. I would like to record my appreciation to my fellow Sub-Committee members, particularly Senator Baden Teague, the Sub-Committee Deputy Chairman, for their perseverence and hard work; and Dr Graeme Cheeseman, who served as specialist adviser to the Sub-Committee throughout its inquiry.

4. I wish also to thank Australia's Ambassador for Disarmament, Mr Richard Butler, for his valuable briefings; and the officers from the Departments of Foreign Affairs and Defence who contributed significantly to briefing the Sub-Committee as well as giving evidence and providing submissions; also Dr Desmond Ball and Mr Andrew Mack of the Australian National University.

5. The elimination or reduction of the risk of nuclear war is unquestionably the most important issue facing us today. While public debate over the nuclear issue is well advanced in Europe and North America, it is only just starting to take place here as more and more Australians are becoming aware that we would not be immune from the effects of a large-scale nuclear war. Despite this growing awareness, very little has been published in Australia on the nuclear debate, particularly on our role in contributing to the maintenance of global peace and security. Indeed, the debate that has occurred so far has tended to be simplistic and has not tackled the real issues at the heart of our nuclear age.

6. This report seeks to address this deficiency by providing a summary of the basic facts and issues that underly the nuclear debate as well as provide an assessment of Australia's contribution to disarmament and arms control. It begins with a description of our current international nuclear circumstances, then examines a number of specific issues of interest to Australia, and finishes with a discussion of what should be done to eliminate or minimise the risk of nuclear war in the future. It is our intention that the Report would be read right through as a series of linked arguments describing where we are now and where we should be heading in the future. Because of the complexity of the subject, the Report has been structured so that individual chapters can be read in isolation.

7. In addition, those who are already familiar with or wish to avoid the largely descriptive and, in parts, technical discussions contained in the early sections of the Report may wish to read only Part 5. This begins with a broad overview of our current and prospective circumstances and examines some possible future options. Part 5 then continues setting out the Committee's own views on what should be done in both the short and longer term to avoid the risk of nuclear war and to bring stability and peace to our world. This is followed by the Committee's summary and recommendations, which we submit for acceptance by the Australian Parliament and for implementation by the Australian Government.

8. The last two chapters of Part 5 - 'Recommended Strategies and Policies' and 'Summary of Committee Conclusions and Recommendations' - have also been issued in a separate 'summary' report entitled 'Recommended Strategies and Policies'.

9. We trust that the Report will add to and stimulate awareness and discussion within Australia of this very important subject. We also hope that the Report becomes a useful document for the many people around the world interested in the Australian perspectives on disarmament and arms control in the nuclear age. If the Report achieves these objectives, it will have fulfilled an important role.

David Charles, MHR
Chairman
Disarmament and Arms
Control Sub-Committee

The Disarmament and Arms Control Sub-Committee Chaired by Mr D.E. Charles, MP, meeting with a United States arms control delegation led by Mr Kenneth L. Adelman, Director of the U.S. Arms Control and Disarmament Agency, on 3 May 1985.

Meeting between the Disarmament and Arms Control Sub-Committee, headed by Mr D.E. Charles, MP, and a Soviet arms control delegation led by Dr Vladimir Petrovskii, a senior Soviet Foreign Ministry official, on 20 May 1985.

Members of the Disarmament and Arms Control Sub-Committee being briefed by Australia's *Ambassador for Disarmament* on 20 May 1985.

From left to right: Mr D.E. Charles, MP (Chairman), Senator B.C. Teague (Deputy Chairman), Dr R.E. Klugman, MP, Mr P.J. Baldwin, MP, Dr A.C. Theophanous, MP, Senator G.N. Jones, Mr N.J. Hicks, MP, Senator R.C. Elstob, the Hon. I.L. Robinson, MP, Mr A.D. Campbell (Department of Foreign Affairs) and Mr Richard Butler (Ambassador for Disarmament).

Meeting with the United States SDI Consultation Team on 28 June 1986.

From left: Dr.R.E. Klugman, MP, the Hon. M.J.R. MacKellar, MP, Mr David Lambertson (U.S. Embassy), Senator K.W. Sibraa, Mr Robert Lindhard (U.S. National Security Council and SDI Consultation Team Leader), and Mr D.E. Charles, MP.

CHAPTER 1

INTRODUCTION

1.1 The number of nuclear weapons in existence now totals more than 50 000. Their combined explosive power is equivalent to around 13 000 million tons of TNT. This is more than three tons of TNT for every man, woman and child on earth, or over one million Hiroshimas.

1.2 The vast majority of the world's nuclear arsenals is controlled by the two superpowers. If one of these nations were to launch a pre-emptive nuclear attack against the other the results would be without precedent and truly horrific. A 1983 study conducted by the Royal Swedish Academy of Sciences concluded that an exchange involving less than a third of the total number of nuclear warheads would kill approximately 750 million people and seriously injure a further 340 million. A considerable proportion of those who survived the initial effects of the exchange would suffer from acute radiation sickness resulting from exposure to radioactive fallout. The study noted that the economies of the Northern Hemisphere would collapse, commodities and services currently taken for granted would no longer exist, and those in the war zone would be confronted by severe food shortages that could persist for months or even years. Post-war 'governments' would 'most likely be highly authoritarian, and of necessity dependent on Draconian laws. Surviving "societies" would have to be highly restricted, dedicated to the virtually impossible task of managing scarce resources, and closely governed by the exigencies of survival'.[1]

1.3 The results of the 1983 study were based on the then known effects of nuclear explosives. New calculations suggest, however, that several other effects could worsen these consequences considerably. By far the most important is the recently postulated 'nuclear winter' effect. Scientists have calculated that the dust and smoke generated by even a relatively small-scale nuclear exchange would be sufficient to block out the sun from the earth's surface for extended periods of time. This would probably reduce temperatures in the war zones by several tens of degrees centigrade and produce lesser, but still significant cooling in the northern subtropics and the tropics. The resultant animal and crop losses could lead to mass starvation and higher death rates, both in the already devastated combatant countries in the Northern Hemisphere and in many parts of the Southern Hemisphere as well.

1.4 These latter findings in particular place the issue of nuclear armaments in an entirely new perspective. Nuclear war not only threatens the destruction of the warring nations, it also endangers the lives and welfare of those who are neither directly involved in, nor responsible for, the hostilities. To some extent, the sheer magnitude of the consequences of nuclear war tends to act to reduce its likelihood. No sane political leader would take actions that would lead to his own nation being destroyed. But we cannot rely on fear alone to maintain peace. In some future crisis, rational expectations and ideals could give

way to irrational behaviour, or prudence could be replaced by impulsive action. More plausible still, is the possibility that the two superpowers could become caught up in a complex sequence of actions and reactions which, without fully realising it, pushes them into direct military confrontation.

1.5 The potential consequences of nuclear war and the possibility, however remote at present, that it could take place, obligate us all to ensure that the world's governments and leaders give the highest priority to following policies that will reduce and eventually eliminate its likelihood. The need for extended public awareness and debate is heightened by the fact that many of the basic features that have characterised our nuclear world to date - and have enabled us to devise ways of coping with the dangers and opportunities presented by nuclear weapons - are under challenge. The challenges to the nuclear status quo are increasing uncertainty over the continuing stability and efficacy of the present arrangements that govern the world's nuclear weapons. Coupled with the lack of progress in arms control and an awareness of the growing dangers of both nuclear and large-scale conventional war, they have produced widespread dissatisfaction and concern for 'where we are heading'. Further, they have led to increasing calls for action or change from all parts of the political and arms control spectrum.

1.6 At the same time we must recognise that nuclear weapons and the continuing arms competition are integral parts of our lives, and so it will be extremely difficult to institute major changes. Moreover, there are no simple or quick solutions to the predicaments posed by nuclear weapons. And even given the necessary political will, it will take considerable time to reduce the present size of the world's nuclear arsenals to a less dangerous and more manageable level.

1.7 To be able to make sound judgements on whether certain approaches or policies are justified requires an awareness of the basic facts and issues involved. This understanding should be sought at two levels. We need first to be conscious of the nature and scope of our current predicament: how many nuclear weapons there are, who controls them, how they have evolved, how they are planned to be used and how they fit into our international political system. Secondly, we must look beyond the dimensions of our current circumstances to identify changes or broad trends that are taking place, and the basic assumptions that underly both present and proposed approaches.

1.8 Reaching this level of understanding is made difficult by a number of factors such as the technical complexity of the subject, the need for some degree of secrecy in order to preserve national security, the lack of accurate and detailed information about the policies and perceptions of both superpowers, particularly the Soviet Union, the wide divergence of expert views, and the sometimes strident opinions of minority groups. Despite these difficulties, most of the important issues and questions underlying the nuclear debate are within the grasp of any interested individual who is prepared to study them. More importantly, decisions about most of the issues involved require,

in the end, judgements to be made over conflicting values or the relative risks of alternative solutions, not a detailed and studied knowledge of the technical characteristics of nuclear weapons, strategic doctrine or military tactics.

The Aim and Structure of the Report

1.9 The Report has three basic aims as follows:

I. to provide a compendium of factual information on our current nuclear circumstances and our continuing search to control and eliminate nuclear arms;

II. to describe and analyse Australia's contributions to disarmament and arms control and the maintenance of international peace and security; and

III. to help prepare an agenda for informed debate over our future direction and policies for reducing the risk of nuclear war.

1.10 The Report is divided into five parts. Parts 1-4 deal with the world as we know it today. Part 1 provides a summary of our global nuclear circumstances. It begins with the two superpowers, describing their current military arsenals, their strategic nuclear doctrines and policies, and their past and present attempts to regulate their arms competition through the disarmament and arms control process. It then examines the spread of nuclear weapons beyond the superpowers, and the threat and consequences of nuclear war. Part 1 finishes with a brief description of the spread of non-nuclear weapons and the potential consequences of the very high and continuing world-wide military expenditure. The facts and issues described in this part have largely been presented without judgement, although the Committee's views have been given on the present strategic nuclear balance (Chapter 4) and on chemical and biological weapons (Chapter 7).

1.11 Part 2 describes Australia's current role in seeking disarmament and arms control at both the international and regional levels. It also analyses some of the major criticisms of Australia's role raised in submissions to the inquiry. These were Australia's support of and contributions to the present system of global nuclear deterrence; whether we over-emphasise arms control issues at the expense of nuclear disarmament; whether we should take a more independent stand on disarmament and arms control generally; and the question of community liaison and the provision of information.

1.12 Parts 3 and 4 deal with a number of specific issues that were raised in submissions and are of concern to the Committee. These cover both global and regional issues. The former are strategic defences and the ABM Treaty; the Strategic Defense Initiative (SDI); verification and anti-satellite

warfare; and nuclear testing and the Comprehensive Test Ban (CTB). The latter are the joint United States-Australian defence facilities; the South Pacific Nuclear Free Zone; uranium mining and Australia's role in the nuclear fuel cycle; and peace education and peace research in Australia.

1.13 Part 5 of the Report goes beyond our current circumstances to examine future options and policies. It begins with an overview of where we are at present and where we are heading. Chapter 19 brings together the trends and developments that were identified in the first part of the Report and discusses some of the basic constraints that serve to limit what we can do, particularly in the area of disarmament and arms control. Chapter 20 describes some of the possible future options and approaches that have been suggested for avoiding or reducing the risk of nuclear war. Chapter 21 presents the Committee's own views on what should be done in the short and longer terms.

1.14 Finally, Chapter 22 provides a summary of the conclusions and recommendations contained in the preceding chapters.

1.15 The Committee wishes to make two preliminary observations which must be kept in mind when reading the Report. First, the information described has been derived from submissions and public sources. As a result, there tends to be more detail on, and scrutiny of the United States and its policies than of the Soviet Union. The Committee would prefer otherwise but has been constrained by the closed nature of Soviet society and its penchant for secrecy. Democracies are relatively open societies and especially in the United States the Executive has to justify all military expenditure to Congress and the public. In the closed society of the Soviet Union no such public scrutiny or discussion takes place. Thus the question of verification becomes important and Soviet propaganda and disinformation is much more effective in Western societies where public opinion can actually change government policies.

1.16 The Committee has found that little is known about the defence policies of the Soviet Union beyond the information released by various Western intelligence agencies or published in specialised academic journals. The Committee is conscious of the danger that unquestioning reliance on such sources involves the risk of using material distorted to achieve an ulterior purpose. The Committee suggests that a future reference of this Committee should be to examine Soviet foreign policy and defence capabilities, particularly with respect to Australia's own region of interest.

1.17 A second, and related point is that the Report attempts to take, as far as possible, an objective approach towards the problem of how to ensure peace and security in the nuclear age. The Committee recognises that it can be argued that it is not possible to discuss the threat of nuclear war and the methods of preventing it, without pointing out the vast differences between the member countries of the Warsaw Pact and Western societies. The objective approach taken in this Report is justified on the grounds that the need to reduce or eliminate the risk of nuclear

war, particularly war between the superpowers, transcends ideological or political preferences or predispositions. This is not to imply that the two superpowers are equal in all respects, or that the support of disarmament and arms control policies that are also currently favoured by the Soviet Union or the United States means any more than that. The Committee recognises that Australia is part of a community of nations that shares certain values and ideals and that we should be prepared to defend these values. Security against nuclear destruction, however, cannot be obtained unilaterally. It requires instead cooperation to eliminate nuclear weapons or at least to institute measures that minimise their possible use.

CHAPTER ONE
ENDNOTE

1. Nuclear War: The Aftermath, A Special AMBIO Publication, Permagon Press, Oxford, 1983, p.163.

PART 1

A GLOBAL PERSPECTIVE

CHAPTER 2

THE SUPERPOWER COMPETITION AND THE SEARCH FOR DISARMAMENT AND ARMS CONTROL

2.1 Our current global nuclear circumstances remain dominated by the two superpowers and their competitive accumulation of weaponry. The United States and the Soviet Union alone possess nuclear arsenals in the superpower class, lead opposing politico-military blocs of major significance and exercise political influence much greater than other world powers.

2.2 At its most fundamental level, the continuing competition between the superpowers reflects a basic difference of view over how society should be organised. This serves to limit the scope for mutual cooperation and understanding. The United States regards itself as having reaped the benefits of Western democracy, proven the success of capitalism and as having identified the nation's future well-being as dependent upon their continuation. For its part, the Soviet Union considers that it has legitimised the economic rationale that underpins Soviet communism, has confirmed the political bankruptcy of the private capital system, and believes that an historical process towards global communism is in progress and is irreversible.

2.3 As if these differences were not enough to hinder accommodations in the relationship between the superpowers, their individual decision-making processes serve to reinforce those differences. In the Soviet Union, a rigid bureaucratic system takes decisions that are not open to discussion and have very little input from public opinion. Efficient policy development has not been facilitated in recent times by a rapidly changing, aged and infirm Soviet leadership. While Mr Gorbachev has brought an element of relative youth, vigour and innovation to the leadership, in large part the Politburo is still characterised by aggressive foreign policies, a 'siege mentality' and a preparedness to use military force, cautiously, in order to maintain and extend its sphere of influence. The product of these attitudes is a general outlook from the Soviet Union which regards Soviet interests as constantly under threat, and forms of authority outside its control as hostile and menacing.

2.4 Of course, the decision-making process in the United States is also complex. It is complicated by very different influences, however, from those that prevail in the Soviet Union. In the United States, decision-making is affected by the plurality of the political process, by the separation of powers between the executive and the legislature and by strong electoral imperatives. These factors make it difficult to pursue a consistent policy towards the Soviet Union beyond a single four-year Administration term. U.S. policies and priorities often change, creating for both U.S. allies and the Soviet Union an image of unpredictability. This uncertainty is compounded by the very public nature of policy-making in the United States where most issues or policy decisions are subject to intense scrutiny and debate by Congress, the media and pressure groups, involving

a range of options and opinions. Consequently, while a principal goal of the United States has been to maintain, as a minimum, a balance of military power with the Soviet Union and reduce or limit the expansion of Soviet interests, how this is best achieved - by detente, containment, confrontation or a combination of all three approaches - and the implications for U.S. arms control policies, are matters of continuing debate.

2.5 The sharp contrast in policy-making procedures adopted by the superpowers is ultimately of concern because they are locked into concerted competition with each other. Their policy-making procedures serve to reinforce that competition, in particular because Soviet foreign policy goals are not exposed to conciliating influences.

2.6 Although numerous witnesses before the Committee pointed to the need for 'trust' between the superpowers, that characteristic has not appeared in their recent relationship. While trust is perhaps too ambitious a goal for the superpowers at present, it is clear that even relations that fall short of trust can foster frank and open discussions that engender a level of confidence and a willingness to reach agreements based on common interests and concerns. By contrast, poor relations can result in an intensification of the arms race, with arms control talks tending to become largely propaganda exercises involving mutual recrimination and public posturing.

2.7 After nearly a decade of detente and several important arms control agreements in the 1970s, relations between the United States and the Soviet Union have declined. There are, however, some recent signs that they are beginning to improve, albeit from a low base. The Reagan Administration has moderated its earlier public criticisms of the Soviet Union and signalled an intention to revive or strengthen economic, cultural, scientific, consular and other contacts. The United States has removed most of its earlier sanctions on the Soviet Union imposed following the Soviet invasion of Afghanistan. In March 1985, the superpowers began a new round of arms-centred talks in Geneva and an initial 'summit' meeting between the two countries' leaders took place in November 1985. For its part, the Soviet Union and its leader welcomed the talks and seemed to be seeking a level of increased contact with the West, particularly Western Europe.

2.8 Whether these moves represent a genuine attempt to improve relations between the two superpowers or are largely publicity exercises aimed at dividing the U.S. from NATO or placating an American public that is eager for arms control, remains to be seen. To a large extent, any improvement in U.S.-Soviet relations will be determined by actions as much as words. Here the prognosis remains poor. By American calculations, the differences between the U.S. and Soviet military programs by way of dollar cost are narrowing, but the Soviet military effort in important categories still surpasses that of the U.S. The Soviet Union has charged that the United States is continuing with its largest peace-time military build-up. Further, the U.S. appears determined to continue its SDI research, known as Star Wars, despite the Soviet view that the SDI program would prevent

any progress towards arms control for strategic and intermediate-range nuclear weapons. Both sides are using or threatening the use of military power to maintain their influence. The Soviet Union has been accused by the United States of violating existing arms control agreements and the U.S. is reviewing its own commitment to some arms control obligations. Judged by the lack of progress in the talks at Geneva and Stockholm, neither side has so far made concessions sufficient to stimulate progress towards new agreements.

The Political Utility of Military Power

2.9 It is clear that the arsenals possessed by the superpowers are required to perform a range of military tasks, from ensuring that they are not fired (by deterring war) through to attempting to win a war should their use in deterrence fail. There are, however, tasks other than military that arsenals perform. Military strength has always meant a level of political influence; the political utility of the military power that each possesses is currently a matter of particular concern for the superpowers.

2.10 The Soviet Union has limited scope for political influence through its economic strength because it is not an economic force of the first rank. It is therefore keenly aware of the political influence that its military arsenals provide and is accustomed to achieving some of its political ambitions through the status that its military power endows. Its military power in part maintains the domestic political status quo as well as discouraging political dissension among the Warsaw Pact allies. The U.S. by contrast, has been far more able to pursue its political goals through economic and political influence.

2.11 Perhaps the most conspicuous recent example of exploiting the political utility of military power is the deployment of SS-20 medium range missiles by the Soviet Union. These missiles are deployed in both the West and the East of the Soviet Union and threaten Western Europe, the Indian Subcontinent, East Asia and Southeast Asia. As seen in the West, the political purpose for deploying these missiles was that the Soviet Union hoped to intimidate the Western allies (principally in Europe and Japan) and set up stresses in the alliance relationships over handling the new Soviet threat. It is reasonable to suppose that ultimately the Soviet Union hoped that the political problems so generated would cause damaging divisions in the alliance relationships and perhaps split NATO. This goal was not successful however. Concern over the continuing SS-20 deployments, together with uncertainty over the credibility of the American nuclear guarantee enforced NATO cohesiveness and led the European NATO governments in 1979 to request the United States to deploy new intermediate-range nuclear (INF) weapons into Europe. As a palliative to those - mainly in Norway, Denmark, Belgium and the Netherlands - who doubted the need for deployment and those, such as former West German Chancellor Helmut Schmidt, who were equivocal, NATO also agreed to implement its decision as part of a 'dual track' policy whereby it tied the

deployment of the new INF missiles to progress in negotiations over limiting the number of intermediate-range nuclear weapons in Europe. Because attempts to negotiate an INF agreement have been unsuccessful to date, the new missiles are currently being deployed in the U.K., FRG, Italy, Belgium and the Netherlands.

Superpower Competition in Europe

2.12 The central focus of the competition between the United States and the Soviet Union is in Europe. Europe contains the greatest concentration of military forces and weapons anywhere in the world. It is the only geographical area in which each side's military forces directly oppose the other across a land border. It is the location of large numbers of nuclear weapons which are fully integrated into the military strategies and force structures of the two alliances. Both the Soviet Union and the United States recognise that defending their interests in Europe is of the highest priority. For this reason, the U.S. has emphasised that the security of Western Europe is a principal interest and that attacks on Western Europe will be regarded as seriously as attacks on the United States itself. This is the position underlying 'extended deterrence' whereby it is recognised that American nuclear weapons could be used in defence of Western Europe.

2.13 The United States views its national security as being 'inextricably linked to the independence of Western Europe'[1] and has continued to contribute to NATO military capabilities, nuclear and non-nuclear, since the end of the Second World War. In the event of war in Europe, U.S. forces, together with those of its NATO allies, would seek to defeat any offensive by Warsaw Pact forces and restrict the conflict to the lowest possible level of violence. To satisfy these objectives, NATO uses a strategy of 'flexible response' to deter the Soviet Union from launching a military attack or gaining political advantage by threatening such an attack. As described in the Federal Republic of Germany's Defence White Paper[2] the strategy embodies three levels of response to Soviet aggression:

a. **Direct Defence** 'to prevent the aggressor - at the level of military conflict chosen by him - from achieving his objective. This may include the use of nuclear weapons. As a result, either the aggression fails or the aggressor is confronted with the threat of escalation'.

b. **Deliberate Escalation** which is 'intended to repulse an attack by persuading the aggressor to take the political decision to cease hostilities, since his prospects of success and the risk he is running are no longer in an acceptable ratio ... the Alliance preserves the options of the politically controlled, selective use of nuclear weapons'.

c. **General Nuclear Response** which is 'directed mainly at the aggressor's strategic potential and means using the Alliance's strategic nuclear weapons'.

2.14 The strategy deliberately leaves open the question of the timing and level of response that can be expected in order to maximise uncertainty and potential risk in the mind of the aggressor. It also includes 'the right to resort to the defensive use of nuclear weapons even if the Soviet Union were to launch a purely conventional attack'[3] and, with its larger forces, threaten to overrun NATO forces.

2.15 Through the strategy of flexible response, NATO attempts to provide an appropriate counter to Soviet military power while, at the same time, meeting the interests of the different members of the alliance. Thus it couples the threat of U.S. strategic weapons to the forward defence of Europe but provides a series of escalatory steps between conventional and strategic nuclear responses so that the United States does not have to fully risk its own survival by threatening to use strategic forces against a low-level threat.

2.16 Approximately one third of allied nuclear weapons in Europe are for use by U.S. forces. The remainder are assigned to other NATO countries under 'dual key' control. In this case the warhead is under American control while the delivery system (aircraft, missile or howitzer) is under the control of the host nation. The 'dual key' system ensures that in war complete consultation takes place between allies before the authorisation to use these weapons is given, although the authorisation for firing must come from the United States national command authority. Such a system of control is complicated and can result in delays and conflicts of interest in time of war. Further, NATO strategy is even more complex because of the existence of independent nationally controlled British and French deterrents (see Chapter 5).

2.17 Soviet nuclear strategy in Europe has not had to accommodate such a range of interests and so is more straightforward. From the 1950s, the Soviet Union built up its conventional and nuclear forces in Europe with the two-fold aim of deterring a NATO attack and preparing to wage a nuclear war should it occur. It seeks to achieve these objectives by developing and maintaining very strong military forces. As Professor Michael Howard stated to the Committee:

> ...the way which the Soviet Union sees best to avoid the danger of war is to be very strong and to ensure that its old enemies, the Germans and the West Europeans, and its new enemies, the Chinese, are kept in awe of Soviet strength and power. I believe that the Soviet Union feels that the only sure way of ensuring permanent peace is by a preponderance of Soviet power, both nuclear and conventional.[4]

2.18 The Soviet Union, however, suffers a disadvantage from the politico-geographic nature of Europe. While the entire Soviet strategic-range forces can, theoretically, target Western Europe, the Soviet Union can be targeted by the Western intermediate-range nuclear forces in Europe as well as by the American strategic forces from the U.S. From the Soviet perception, then, strategic attack can be launched against the Soviet Union by the intermediate-range forces of the U.S., U.K. and France. The U.S. itself is not similarly vulnerable to attack from Soviet intermediate-range forces. As described shortly, both these factors complicate the current negotiations between the superpowers over reducing the number of intermediate-range nuclear forces in Europe.

2.19 While the principal objective of Soviet military power is defence - protection of the Soviet homeland and the maintenance of Soviet dominance over Eastern Europe - Soviet war planning and military force structures emphasise offensive operations and tactics. The Soviet Union has sound historical reasons to do all it can to avoid a general war in Europe, but if such a war did occur, it would probably aim to defeat NATO forces as quickly as possible, overrun NATO countries and use its nuclear weapons to pre-empt NATO attacks. The continued Soviet emphasis on offensive military strategies and capabilities rests uneasily with its constant assurances that it has no intention of attacking the West or of being the first to use nuclear weapons in Europe. Soviet offensive doctrine remains a source of concern and suspicion in Western Europe.

2.20 The existence of large numbers of nuclear weapons in Europe and their integration into the conventional military structures of both sides make it likely that any large-scale conventional military conflict between NATO and Warsaw Pact forces would quickly escalate into nuclear war or that an outbreak of nuclear war elsewhere would ultimately spread to the European theatre. Such a conflict, apart from having catastrophic consequences for Europe itself, could trigger environmental or climatic effects with serious global repercussions (these are described in Chapter 6).

2.21 These factors suggest that to a significant extent, world peace critically rests upon continued political and military stability in Europe. Since the end of the Second World War, the security situation has been characterised by the existence of very large Warsaw Pact forces which have a clear offensive orientation and have been steadily modernised and upgraded. While numerically smaller, NATO forces have been able to offset the Warsaw Pact's advantage in conventional forces through the deployment of superior technology and by the extension of the United States' strategic deterrent. Since the Soviet Union achieved strategic parity with the United States in the mid-1970s, and with the continued deployment of large numbers of Soviet SS-20 intermediate-range ballistic missiles into Europe, there has been growing concern in many quarters that the military balance in Europe is tilting firmly in favour of the Warsaw Pact with serious political and strategic consequences.

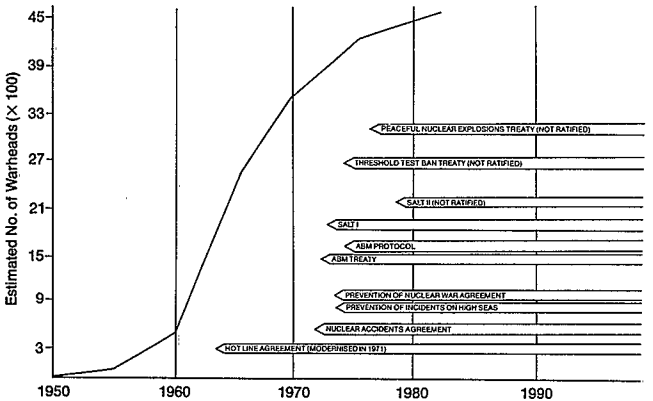
2.22 The United States and many Western European Governments are concerned that these developments are undermining the NATO strategy of 'flexible response' and leaving the West open to coercion or military attack by the Soviet Union and its Warsaw Pact allies. These concerns are based, first, on the view that with strategic parity between the superpowers, the United States nuclear guarantee is no longer credible. Soviet leaders may no longer believe that an American President would expose the United States to destruction by using his strategic forces against the Soviet Union. There is a feeling in Western Europe that in a crisis the United States might abandon its allies rather than risk a Soviet retaliatory strike. This fear led France and the U.K. to develop their own national nuclear forces. More recently this fear is compounded by the concern that the Soviet Union, through its deployment of the SS-20 missiles, is now able to deter NATO from resorting to its forward-based and tactical nuclear weapons in the event of a military conflict. As a result, the Warsaw Pact can now use its conventional military superiority to more likely political or military advantage. A further concern is that the American Poseidon missiles assigned to NATO are no longer adequate for the kind of limited, counterforce exchange scenarios envisaged under flexible response.

2.23 We have already noted that to offset these perceived shortfalls and dangers, NATO introduced the Pershing II intermediate-range ballistic missile and the ground-launched cruise missile into its European armoury. Both weapons are capable of striking military and other targets within Warsaw Pact countries and they help fill the theatre 'escalation gap' using the strategy of flexible response by denying the Soviet Union escalation control and by discouraging Soviet pre-emption in a crisis. Deployment of these systems has attracted considerable non-government opposition in Western Europe, not least because the terminally guided, extremely accurate, Pershing II has a considerable counterforce capability which, combined with its extremely short flight time to strategically important targets in the Soviet Union, could be expected to increase strategic instability. In order to allay Europe's nuclear anxieties, NATO is also building up its conventional forces in Europe and is investigating the use of new technologies for the interdiction or 'deep strike' role in which enemy combat support and rear echelon targets such as airfields, command posts, combat and supply units, and lines of communications would be attacked and destroyed in the early stages of a conventional war. The strategy would seek to neutralise the military potential of the Warsaw Pact forces before it could be brought to bear against NATO forces.[5]

2.24 NATO's tactical nuclear capabilities remain significant (see Chapter 3) and are being modernised to the extent that the current arsenal has a much greater capability than the more numerous but now obsolete systems which existed in the mid-1970s.[6]

2.25 NATO is also attempting to offset Soviet military capabilities through the arms control process by seeking a stable balance at reduced force levels. The principal negotiating forums are the Intermediate-Range Nuclear Forces (INF) talks at Geneva;

Figure 2.1: Bilateral Arms Control Agreements between the United States and the Soviet Union and the growth in the total number of nuclear warheads.



Source: Information based on *SIPRI Yearbook* 1984.

the Conference on Security and Co operation in Europe (CSCE) and its Stockholm Conference on Confidence and Security-Building Measures and Disarmament in Europe (CDE); and the Mutual and Balanced Force Reduction (MBFR) talks in Vienna. As described later on in this Chapter, the INF talks were suspended during 1984 after the Soviet Union walked out in protest against NATO's decision to deploy Pershing II and cruise missiles in Europe. Negotiations on the reduction of intermediate-range nuclear forces have recommenced as part of the overall 'umbrella' talks between the superpowers now taking place in Geneva.

2.26 The basic purposes of the CSCE and the CDE is to formulate steps towards disarmament in Europe and to agree on confidence and security building measures that would reduce the risk of military confrontation. To date, the Conference has largely concentrated on the latter task, with some limited success, but has made no progress towards disarmament. The basic purpose of the MBFR talks is to seek reductions in NATO and Warsaw Pact conventional forces in Central Europe. So far these talks have made little progress.

Bilateral Agreements and Negotiations

The Arms Control Process: Underlying Incentives

2.27 Given the orientations, ambitions and inherent rivalry of the superpowers, it is not strange that little progress has been achieved in arms control between them. When one side or the other has considered that its strategic position could be threatened by the arms control process, progress has not been possible. The Soviet Union has at times agreed to participate in strategic arms control negotiations in order to constrain American arsenal developments. Soviet concern about the developing American anti-ballistic missile capability gave the Soviet Union the incentive to negotiate the ABM Treaty; similarly, Soviet fears about prospects for significant progress in the U.S. SDI research probably put pressure on the Soviet Union to return to Geneva (in March 1985) following a year-long absence.

Bilateral Arms Control Agreements

2.28 Over the years the United States and the Soviet Union have engaged in extensive discussions and negotiations on a range of matters relating to their nuclear and non-nuclear forces. This bilateral process has resulted in the public agreements shown in Figure 2.1. The agreements fall into two broad categories:

a. **Confidence-Building Measures** which aim to minimise the likelihood of accidental nuclear war by maintaining communications between Washington and Moscow and by agreement to notify each other immediately in the event of an incident involving

the possible detonation of a nuclear weapon or the risk of nuclear conflict. This type of agreement includes the Hotline Agreement, the Nuclear Accidents Agreement, the Agreement on the Prevention of Nuclear War and the Agreement on the Prevention of Incidents On or Over the High Seas.

b. **Arms Limitation or Control Measures** which set limits on the number and type of nuclear weapons, delivery systems and defensive measures that may be tested or deployed. These agreements include the 1972 ABM Treaty, the Strategic Arms Limitation Treaties (SALT I and SALT II), the Limited and Threshold Test Ban Treaties and the Treaty on Underground Nuclear Explosions for Peaceful Purposes.

The two superpowers are also subject to a range of multilateral arms control treaties which limit the size and deployment of nuclear weapons. These include the Outer Space Treaty, the Antarctic Treaty, the Sea-Bed Treaty and the Treaty of Tlatelolco. They are discussed in other relevant areas in the Report and are summarised in Appendices 1 and 2.

2.29 The most important bilateral agreements are the ABM Treaty and the two strategic arms limitation treaties, SALT I and SALT II. These agreements constitute the most intense and longest-running attempt to curb the arms race. Together they established broad, and - at the time - mutually acceptable objectives for future bilateral arms control measures, set important constraints on the arms race and formed consultative machinery which has facilitated ongoing dialogue between the superpowers.

The ABM Treaty

2.30 The 1972 ABM Treaty and its companion 1974 Protocol limit the deployment of ABM systems to one site in each country with no more than 100 ABM launchers and interceptor missiles deployed in that site. In addition, each side may deploy limited ABM systems at agreed test sites. It is forbidden to deploy radars for early warning of strategic ballistic missile attack, except along the periphery of the national territory and on condition that they are oriented outwards. The Treaty does allow the deployment of large phased-array radars for tracking objects in outer space or for use as National Technical Means of verification. The parties undertake not to develop, test or deploy ABM systems or components which are based at sea, in space, in the air or in a mobile land-based mode. Also they may not give other missiles an ABM capability and test them in that mode. The use of deliberate concealment measures impeding verification is prohibited.

2.31 A Standing Consultative Commission was established to promote the objectives and implementation of the Treaty, to consider questions of compliance, to provide a means to exchange information, and to consider proposals for further measures to limit strategic arms. The ABM Treaty is of unlimited duration, but subject to a right of withdrawal on six month's notice. The agreement is subject to review every five years. Each side reaffirmed its support for the Treaty at the last review in 1982 although as described shortly, each side has been accused of engaging in actions which are in violation of the Treaty or close to it.

SALT I

2.32 The SALT I Interim Agreement on Offensive Arms 1972 essentially imposed a five-year quantitative freeze on the total number of ICBMs and SLBM launchers (missile silos and submarine tubes) of each of the two superpowers although the parties were free to modernise their forces and to choose the mix of missiles. Verification of the Treaty was to be through National Technical Means and the parties undertook not to use deliberate concealment measures to impede verification. An additional Protocol to the Agreement specified that:

a. The U.S. may have no more than 710 SLBM launchers and no more than 44 modern ballistic submarines, while the Soviet Union may have no more than 950 SLBM launchers and 62 submarines; and

b. older-type submarines may be given replacement launchers, but the deployment of modern SLBMs on any submarines, regardless of type, would be counted against the total level of SLBMs permitted.

2.33 The Interim Agreement was to remain in force for five years unless a subsequent agreement came into force. Both parties agreed to conduct follow-on negotiations with the aim of concluding a further agreement as soon as possible. In September 1977 the U.S. and the Soviet Union formally stated that, although the Interim Agreement was to expire that year, they intended to refrain from any actions that were incompatible with its provisions or with the goal of reaching a new agreement.

2.34 The SALT I Interim Agreement represented the first set of actual limits on strategic nuclear weapons ever achieved. While neither side was fully satisfied with the provisions of the Agreement, both recognised it as an important political achievement and a first step towards achieving more meaningful limits on strategic arms. Significantly, while SALT 1 imposed limits on ballistic missile launchers, it did not limit strategic bombers or their bombs, nor did it limit the production of ballistic missiles nor the option to deploy a number of warheads on each ballistic missile.

SALT II

2.35 SALT II, concluded in 1979, comprises a complex array of documents and understandings including a basic Treaty on the Limitation of Strategic Offensive Arms, a Protocol and an assortment of Joint and Agreed Statements, Common Understandings and Memoranda. In essence, the Treaty established a range of aggregate numerical limits and sub-limits for each side: on the total delivery vehicles (2 400 initially, to be reduced to 2 250 by January 1981); on MIRV launchers including missiles and cruise-missile-carrying bombers (1 320); on MIRVed missiles alone (1,200); and on MIRVed ICBM launchers alone (820). SALT II established limits on numbers of warheads or re-entry vehicles per missile (10 for each ICBM and 14 for each SLBM) and on the number of long-range cruise missiles per heavy bomber (an average of 28). The parties also agreed to several important bans: on the flight testing or deployment of new types of ICBMs, except for one new type of 'light' missile on each side; on heavy mobile ICBMs and heavy SLBMs; on the construction of additional fixed ICBM launchers; and on rapid reload systems. The Soviet Union agreed not to produce, test or deploy its mobile SS-16 ICBM and pledged that it would limit the production of its Backfire bomber to 30 aircraft per year. The Soviet Union further stated that it would not develop the Backfire as an intercontinental bomber.

2.36 It was agreed that National Technical Means of verification would be used to verify compliance and any interference with the means of verification (including telemetric information) was prohibited. The Standing Consultative Commission, established in 1972, was to be used to exchange information and consider questions on compliance.

2.37 The SALT II Treaty was signed by President Carter and Secretary General Brezhnev at Vienna on 18 June 1979 and, subject to ratification, was to remain in force until 31 December 1985. During the ratification process in the U.S. the Treaty was attacked by a number of U.S. critics who questioned the Soviet heavy missile advantage allowed for in the Treaty, the failure to include the Backfire bomber as a strategic weapons system and difficulties in verifying Soviet compliance with the Treaty. The mobilisation of opinion against SALT II together with the Soviet invasion of Afghanistan in December 1980 resulted in the Treaty not being ratified. Despite this, the two superpowers have stated that they would refrain from actions contrary to the SALT II provisions and have generally remained within the numerical limits set by the Treaty (see Table 2.1). Following growing allegations of non-compliance (described shortly) there has been mounting concern that both sides may break out from the SALT II provisions. On 10 June 1985, President Reagan announced that the United States 'will continue to refrain from undercutting the expired SALT I agreement and the unratified SALT II agreement as long as the Soviet Union exercises equal restraint and actively pursues arms reduction agreements at Geneva'.[7]

TABLE 2.1 COMPARISON OF SUPERPOWER STRATEGIC ARSENALS WITH SALT II LIMITS

Category	SALT II Limits (1)	Strengths in 1979 (2)		Present Strengths (3)	
		US	USSR	US	USSR
ICBMs, SLBMs and Heavy Bombers	2250	2283	2504	1883	2547
MIRVed ICBMs and SLBMs and heavy bombers with LRCMs	1320	1049	752	1256	1227
MIRVed ICBM and SLBM launchers	1200	1046	752	1166	1102
MIRVed ICBM launchers	820	550	608	550	818

Notes:
1. The Treaty was signed on 18 June 1979 but has not been ratified by the US Congress. Reductions in missile systems were to begin on 1 January 1981 and were to be completed by 31 December 1981. The Treaty is to continue in force until 31 December 1985.
2. Frank Barnaby 'World arsenals in 1980', Bulletin of the Atomic Scientists, September 1980, p.11.
3. Figures extracted from IISS, The Military Balance 1985-1986, pp.180-81.

Bilateral Negotiations since SALT

2.38 Since the signing of SALT II no further arms control agreements have been concluded between the United States and the Soviet Union. In its first eighteen months in office, the Reagan Administration showed little interest in further arms control. It was also critical of the SALT provisions although it undertook to continue to abide by them as long as the Soviet Union did. President Reagan eventually established a new series of negotiations on strategic nuclear arms entitled START - Strategic Arms Reduction Talks. START replaced the SALT talks and was to be conducted in parallel with new Intermediate-Range Nuclear Force (INF) talks dealing with European theatre weapons. Neither talks made any significant headway and they ended in December 1983 when the Soviet Union walked out of the INF talks and declined to agree on a date for the resumption of START negotiations. No further talks took place until March 1985 when the two sides began a new range of negotiations in Geneva on the questions of strategic arms, intermediate-range nuclear forces and space weapons.

START

2.39 Unlike SALT, which sought to limit the development and deployment of strategic weapon systems, the American goals for START concerned achieving equal ceilings at much lower force levels. The United States' initial position involved a two-phased approach. The first phase would reduce each side's total force of land-based and submarine missiles to 850. Warheads on those missiles would be reduced to 5 000 on each side, with no more than 2 500 on land-based ICBMs. This would cut U.S. missiles by half and Soviet missiles by two thirds (See Table 2.2). The Reagan Administration also insisted that the measures used to verify the START provisions go beyond the National Technical Means - satellites and other intelligence gathering mechanisms employed by both sides - used in SALT. Subject to agreement on these proposals, the United States would be prepared to discuss further restrictions on slow-flying systems such as cruise missiles, and reductions in ballistic missile throw-weight (phase 2 of the negotiations).

Table 2.2 Reductions Required by Phase 1 START Proposals

	United States	Soviet Union
U.S. proposal		
Total Warheads	7128 to 5000 : -2128	6735 to 5000 : -1735
ICBM and SLBM launchers	1564 to 850 : -714	2415 to 850 : -1565
ICBM Warheads	2152 to 2500 : +348	5302 to 2500 : -2802
Soviet counter-proposal		
All delivery vehicles	1940 to 1800 : -140	2650 to 1800 : -850

Note: 1. Bombers not included.

Source: Extracted from SIPRI Yearbook 1983, p.61.

2.40 The original START proposal was modified in October 1983 when President Reagan announced his 'build-down' proposals which included:

a. A provision that linked reductions to modernisation by withdrawing existing nuclear warheads as new warheads of various types were deployed. According to press reports the ratios call for the replacement of two existing by one new (or 2 : 1 build-down) MIRVed ICBMs, a 3 : 2 build-down of SLBM warheads, and a 1 : 1 replacement of single-warhead ICBMs.

b. A provision calling for a guaranteed annual 5 per cent reduction assuming no new deployments.

c. A provision which addressed the build-down and trade-off of bombers and ALCMs, in which the U.S. has an advantage, for Soviet advantages in ICBMs.

2.41 The START proposals reflected the Reagan Administration's earlier concerns with the SALT agreements. As well as seeking to limit and equalise the numbers of delivery vehicles, START tended to emphasise the destructive capacity of strategic weapons, principally through seeking to limit the number of warheads and total megatonnage. The proposals also focused on ballistic missiles, particularly ICBMs, which were seen to be destabilising and were thought to pose a specific and immediate threat to the United States. Partly because of this, the START proposal attracted considerable criticism that it advocated only partial limits rather than overall ceilings and therefore would not prevent either quantitative or qualitative increases to the arsenals of the two superpowers. There was also concern that the proposals had a disproportionate effect on the Soviet Union and so would be unacceptable to them. As the SIPRI Yearbook 1983 noted:

> The selection of warheads as the unit of account has given the U.S. proposal an equitable appearance since both sides would make approximately equal reductions ... However, within the limitations, the Soviet Union is required to make major concessions in numbers of missiles, particularly in land-based systems. It would be forced to reduce 851 more ballistic missile launchers than the United States and would have to reduce 2 802 ICBM warheads, whereas the United States could increase its ICBM warheads by 348. The most decisive impact of the proposal is that the Soviet Union would have to scrap all of its 1 398 land-based missiles with the exception of 250 modern SS-18s or smaller missiles with the equivalent number of warheads.[8]

On this analysis, the U.S. proposal therefore would have required the Soviet Union to restructure the nature and composition of its strategic nuclear forces and to modify substantially its existing

strategic force planning and procurement programs. By contrast, the United States, while being required to reduce its current ICBM arsenal, would be able to pursue its major strategic programs and to continue to modernise and upgrade its land-based and submarine-based forces.

2.42 The Soviet Union welcomed the American willingness to resume talks on strategic arms reductions but was highly critical of the terms of the proposal, rejecting both the United States arguments concerning land-based missiles and stability and the United States effort to dictate Soviet force structure. Moscow countered the initial START proposals with an offer to further reduce the (SALT II) total number of strategic launchers deployed by each side (from 2 250 to 1 800) but with no restrictions on separate strategic weapons systems. It also sought to (1) freeze further development of United States' forward based systems within a certain range of Soviet territory; (2) prohibit all cruise missiles with a range in excess of 370 miles (600 kilometres); (3) ban heavy bombers and aircraft carriers in agreed zones adjoining the territories of the two sides; (4) require prior notification of large-scale exercises of heavy bombers and other aircraft; and (5) allocate safe zones for submarines. The Soviet proposals reflected the view that a situation of rough parity existed between the Soviet Union and the United States, that both sides should be free to deploy whatever mix of forces they like, and that negotiations should proceed along the lines agreed by SALT II.

2.43 Further consideration of the START proposals ended with the Soviet failure to agree to any resumption date for the talks following its November 1983 walkout in response to a British announcement of the arrival of U.S. cruise missiles at Greenham Common.

INF

2.44 In the early 1950s, the United States began to deploy relatively low-yield tactical nuclear weapons into Europe, intended for use against Soviet conventional forces in the event of a Soviet attack on Western Europe. The weapons were to offset the Warsaw Pact's conventional force superiority. They did not have the range to reach the Soviet Union from Western Europe.

2.45 In the mid-1950s and early 1960s, both superpowers began developing ballistic missiles for delivering nuclear weapons over much greater ranges. While the United States concentrated on building-up its inter-continental forces, the Soviet Union gave priority to the development of medium-range systems that could deliver nuclear weapons in and around Europe. The principal aim of these forces was to destroy those forces that most immediately threatened the Soviet Union. The Cuban missile crisis in 1962 led the Soviet Union to move rapidly to develop a strategic capability at least equal to that of the United States. It also continued to expand and upgrade its intermediate-range missile forces in response to the growth of the French, British and Chinese strategic nuclear capabilities.

2.46 By the late 1970s, the NATO countries including the United States increasingly became concerned over the build-up of Soviet intermediate-range forces in Europe, in particular by the deployment of the mobile SS-20 intermediate-range ballistic missile and the Backfire bomber. It was felt that the growing advantage held by the Soviet Union in this area could threaten security by calling into question the credibility of NATO's deterrence strategy (including the extension of the U.S. strategic deterrence to cover Western Europe), particularly since the Soviet Union had attained parity with the United States in strategic nuclear forces.

2.47 This concern led to the so-called 'dual-track' decision in December 1979 in which NATO decided to redress the intermediate nuclear force balance by deploying 108 Pershing II missiles (as replacements for older Pershing Is) and 464 ground-launched cruise missiles (GLCM) into Europe from the end of 1983. In the second 'track', NATO concurrently offered to negotiate with the Soviet Union over limiting intermediate-range forces, initially concentrating on INF missiles and on the understanding that future deployment would depend on what the negotiations achieved.

2.48 The INF talks did not formally begin until November 1981. In the initial round, the United States offered to forego deployment of the Pershing II and GLCM if the Soviet Union would eliminate all its SS-20, SS-4 and SS-5 missiles wherever they were deployed (known as the 'zero option'). The Soviet Union rejected the 'zero option' and responded with two proposals of its own:

a. a renewed call for a moratorium on medium-range nuclear missiles and aircraft in Europe; and

b. an offer to limit the number of Soviet and NATO (including the U.S., United Kingdom and France) medium range missiles and aircraft in or intended for use in Europe.

2.49 The continuing negotiations revealed several areas of disagreement between the two sides, including whether or not the independent forces of France and the United Kingdom should be included in the discussions, the geographical area that should be covered by any agreed treaty and the inclusion of aircraft, particularly forward-based systems (such as the F-111) which had been deferred from SALT I and SALT II.

2.50 While the West modified its initial 'zero option' to allow for some Soviet missiles to remain in Europe as an 'interim' measure, no significant progress was made because of the largely incompatible positions of the two sides. The Soviet Union, arguing that British and French nuclear forces gave the West a significant INF capability in Europe, sought zero American INF deployment while retaining its own INF systems, merely offering in exchange progressively greater concessions in the reductions of Soviet deployments. The NATO allies initially sought to eliminate all Soviet INF missiles but in light of Soviet intransigence, their aim became to ensure American deployment. The initial deployment of GLCM into Europe in

December 1983 led to the Soviet walkout and the end of the INF talks. Both sides are continuing to deploy their INF missiles.

Current Strategic Talks in Geneva

2.51 At a meeting in Geneva on 7 January 1985, U.S. Secretary of State Shultz and Soviet Foreign Minister Gromyko agreed to establish a new set of arms talks encompassing strategic and medium-range nuclear forces and space weapons. The talks began in Geneva on 12 March 1985 and involve a new approach to arms negotiations. Instead of holding separate talks about offensive and defensive weapons, the two sides are discussing both in three categories - INF missiles, strategic weapons and space weapons.

2.52 Since the new negotiations began, there has been a succession of arms reduction proposals presented by the two superpowers. In the opening round of talks, which took place in April-May 1985, the United States again presented its START proposals which called for a reduction in the number and destructive power of offensive strategic arms and included an overall limit of 5 000 warheads and a sublimit of 2 500 warheads on ICBMs. On 27 September 1985, the Soviet Foreign Minister Mr Shevardnadze outlined a Soviet counter-proposal to President Reagan during a meeting in Washington. The Soviet proposal suggested (1) a 50 per cent cut in strategic offensive forces (defined as those superpower nuclear weapons capable of striking the territory of the other superpower); (2) a ceiling of 6 000 'nuclear charges', of which not more than 60 per cent would be on any one leg of the strategic triad; and (3) a requirement for the United States to forego SDI.

2.53 According to the Department of Foreign Affairs October 1985 issue of the Disarmament Newsletter, the United States had a number of reservations about the Soviet offer, including that (1) the Soviet counterforce capability would be substantially strengthened; (2) the Soviet Union would retain major advantages in the numbers of nuclear weapons, nuclear delivery vehicles and ballistic missile throw-weight; (3) the proposal was unclear over the question of modernisation; (4) the proposal presented serious verification problems; and (5) the reductions in offensive arsenals was contingent on the United States stopping all SDI research.

2.54 On 31 October 1985, President Reagan announced that the United States had formulated a counter-counterproposal which was formally presented at Geneva the next day. The major points of the American proposal are listed in Table 2.3. The United States also proposed a 50 per cent reduction in strategic weapons but it rejected the Soviet definition of such systems in favour of the definition used in the SALT negotiations (ICBMs, SLBMs and heavy bombers). The United States also rejected the Soviet demand for a halt to the SDI research program as a precondition for a curb in offensive weapons, and proposed an interim agreement on intermediate-range nuclear forces which would ultimately lead to their total elimination at least as far as the United States and the Soviet Union are concerned. This latter proposal was essentially the 'zero option' that had been proposed in the INF negotiations.

TABLE 2.3: UNITED STATES NUCLEAR ARMS REDUCTION PROPOSAL

STRATEGIC OFFENSIVE FORCES:

1. A limit of 4500 on re-entry vehicles (RVs) on intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs) - about 50 per cent below current levels.

2. A limit of 3000 on RVs carried by ICBMs - about 50 per cent below the current Soviet level.

3. A 50 per cent reduction in the highest overall strategic ballistic missile throw-weight of either side - that is, from the Soviet level of over 12 million pounds (the US has less than 4.4 million pounds).

4. Contingent upon Soviet acceptance of these RV and throw-weight limits, the United States would accept an equal limit of 1500 on the number of long-range air-launched cruise missiles (ALCMs) carried by US and Soviet heavy bombers - about 50 per cent below planned US deployment levels.

5. A limit of 1250-1450 on strategic ballistic missiles (ICBMs and SLBMs) - about 40 to 50 per cent below the current higher Soviet level.

6. In the context of an appropriate agreement on strategic ballistic missiles, the United States could accept a limit of 350 on heavy bombers - roughly a 40 per cent reduction from US SALT-accountable levels.

7. A ban on all new heavy strategic ballistic missiles and the modernization of existing heavy missiles - the most destabilizing weapons.

8. A ban on all mobile ICBMs because of difficulties in verification.

INTERMEDIATE-RANGE NUCLEAR FORCES

1. The United States continues to prefer the total elimination of US and Soviet longer-range, intermediate-range nuclear forces (LRINF). As an interim step, the US suggests a limit on US LRINF missile launcher deployments in Europe of 140 Pershing IIs and ground-launched cruise missiles (GLCMs)- the number that would be deployed on December 31, 1985 - and reductions in the Soviet force of SS-20 missile launchers within range of NATO Europe to 140. Within that launcher limit, the US and USSR could have an equal number of between 420 and 450 warheads in Europe.

2. To achieve equal global US and Soviet LRINF warhead limits, the Soviets to reduce SS-20 launchers in Asia - outside the range of NATO Europe - by the same proportion as the reduction of launchers within range of NATO Europe.

3. Appropriate restraints on short-range intermediate nuclear forces (SRINF).

DEFENSE AND SPACE

1. The United States is committed to the Strategic Defense Initiative (SDI) research program as permitted by, and in compliance with, the 1972 Anti-Ballistic Missile (ABM) Treaty.

2. The United States seeks a Soviet commitment now to jointly explore how a cooperative transition could be accomplished, should new defensive technologies prove possible.

3. The United States proposes that the Soviet Union join in an "open laboratories" arrangement under which both sides would provide information on each other's strategic defense research programs, and provide facilities for visiting associated research organizations and laboratories.

VERIFICATION AND COMPLIANCE

1. The United States continues to stress the critical importance of agreement on effective means of verification so that compliance with the provisions of all agreements resulting from the negotiations can be assessed with confidence.

2. The United States continues to stress the need for the Soviet Union to take the steps necessary to correct current instances of noncompliance with existing arms control agreements.

3. The Soviet Union must alter present practices, such as encryption of telemetry, which impede US verification of compliance.

Source: A Chronology of United States Arms Control and Reduction Initiatives, United States Information Agency, April 1986.

2.55 On 21 November 1985, President Reagan and General Secretary Gorbachev held their first summit meeting and agreed, inter alia:

a. to commit their two countries to early progress at the Geneva nuclear and space talks, and to focus in particular on areas where there is common ground: the 'principle of 50 per cent reductions in the nuclear arms of the U.S. and Soviet Union appropriately applied', and the 'idea of an interim INF agreement';

b. to step up efforts to conclude an effective and verifiable ban on chemical weapons, and to begin discussion on preventing the proliferation of chemical weapons;

c. to facilitate an early and successful completion of the work of the Conference on Disarmament in Europe (CDE) in Stockholm;

d. to emphasise the importance of the multilateral Mutual and Balanced Force Reduction (MBFR) talks in Vienna on reducing the conventional force levels of East and West in Central Europe; and

e. to study, at the level of experts, the question of 'risk reduction centres'.

TABLE 2.4: SOVIET PLAN FOR TOTAL NUCLEAR DISARMAMENT

Stage 1: 1986 - 1993/4

a. Superpowers renounce the development, testing and deployment of space strike weapons (NB. research is not banned)

b. Superpower moratorium on nuclear tests

c. Superpowers reduce by 50% nuclear arms that can reach each other's territory (leaving a maximum of 6000 warheads on remaining delivery vehicles)

d. Superpowers reduce to zero intermediate-range cruise and ballistic missiles in the European zone. US agrees not to transfer strategic or intermediate range weapons to third parties

e. UK and France pledge to not build up their nuclear forces (apparently a quantitative freeze; modernisation not explicitly prohibited).

Stage 2: 1990 - 1995/97

a. Superpowers complete their 50% cut

b. Superpowers reduce remaining intermediate-range weapons to zero

c. Superpowers freeze tactical nuclear systems (range below 1000 km)

d. Other nuclear powers freeze their arsenals (apparently no modernisation and the withdraw of all weapons deployed abroad

e. When the Superpowers have completed the 50% cut:
- all nuclear powers eliminate all tactical nuclear weapons
- all major industrial powers join the prohibition on space strike arms
- all nuclear powers stop nuclear weapon tests
- a ban on the development on non nuclear weapons of mass destruction based on new physical principles.

Stage 3: 1995 - 99

All remaining nuclear weapons eliminated (every nuclear power will have some nuclear weapons left but they will all be strategic weapons).

Chemical Weapons and Conventional Forces

Although not integral to the scheme for nuclear disarmament Gorbachev also urges the early conclusion of agreements on a chemical weapons convention, confidence building measures from the Conference on Disarmament in Europe (CDE) and, at the MBFR talks, US/USSR troop reductions followed by a freeze on troop levels in central Europe.

2.56 On 15 January 1986, General Secretary Gorbachev presented a three-stage plan to eliminate nuclear weapons by the year 2000. The major points of the Gorbachev plan are listed in Table 2.4. The plan envisages that disarmament would take place in three phases. The first stage, lasting five to eight years, is explicitly concerned with U.S. and Soviet nuclear weapons systems. The second stage would bring in other nuclear weapon states. Stage three, beginning no later than 1995, would complete the elimination of nuclear weapons. In announcing his plan, Mr Gorbachev indicated that the Soviet Union would no longer seek compensation in the negotiations for the British and French forces, although he made clear that the Soviet Union was seeking, in the first phase, a freeze on their numbers.

2.57 Responding to the Soviet proposal, President Reagan stated that he was pleased that the Soviet Union agreed in principle to the ultimate goal of totally eliminating nuclear weapons. He also reiterated support for 50 per cent reductions in the nuclear offensive forces of both sides, called for the elimination of all U.S. and Soviet INF missiles by 1990, and urged the Soviet Union to respond to the comprehensive U.S. proposals put forward at Geneva on 1 November 1985. Mr Reagan noted, however, that many of the specific details proposed in subsequent phases of Mr Gorbachev's plan were not appropriate for consideration at this time.[9]

Charges of Treaty Violations

2.58 In recent years, there have been repeated and increasingly strident accusations by both sides of breaches of arms control agreements.[10] In 1983 the United States' Administration submitted to the Congress a report listing seven cases in which the Soviet Union was said to have violated or probably violated its arms control obligations. In the following year a second report was made listing 13 compliance issues. At the same time, the General Advisory Committee to the U.S. Arms Control and Disarmament Agency presented the White House with a report that between 1958 and 1983 the Soviet Union had committed 17 breaches ranging from treaty violations to 'circumventions, or practices incompatible with the essential objects or purposes of agreements'. Further reports on alleged Soviet arms control violations were presented to Congress by President Reagan in February and December 1985.

2.59 While a number of the U.S. allegations might be argued to be either disingenuous or militarily unimportant, others are potentially quite serious. These include:

a. The Soviet Union has encrypted its missile test telemetry (radio signals sent from a missile to ground monitors) in violation of the 1979 SALT II Treaty which requires that the parties do not deny or impede telemetric information required for verification.

b. The Soviet Union's construction of a large phased-array radar near Krasnoyarsk in Central Siberia was said to violate the 1972 ABM Treaty which limits the location (to border areas) and orientation (facing outwards) of such radars in order to prevent the deployment of further territorial anti-ballistic missile defence systems banned by the Treaty.

c. The Soviet Union has tested a second new type of ICBM, the SS-X-25, in violation of SALT II, which limited each party to one 'new type' of ICBM in order to constrain modernisation and proliferation of more capable types. (The U.S. has noted that the SS-X-24 which the Soviet Union had already developed and tested is the only 'new' ICBM allowed by SALT II). Even if the SS-X-25 were not a prohibited new type, it is said to violate the additional SALT II provision not to test an ICBM with a single re-entry vehicle whose weight is less than 50 per cent of the ICBM throw-weight.

d. The Soviet Union may have deployed the SS-16 ICBM which was expressly forbidden by SALT II. The U.S. admits that the evidence for this claim is 'somewhat ambiguous'.

2.60 The Soviet Union has dismissed the U.S. allegations claiming that the Krasnoyarsk radar is to be used for spacetracking, the SS-X-25 is a modernisation of an older Russian ICBM and the SS-16 was never deployed. Moscow admits that it encrypts some telemetric information but claims that its encryption procedures do not impede verification. The Soviet Union made a number of counter allegations including:

a. The United States has been using shelters to cover launchers of Minuteman II ICBMs contrary to the provisions for effective verification contained in the SALT I Treaty.

b. The United States has constructed a large radar installation on Shemya Island (in the Aleutians), using components tested for ABM purposes, it is deploying new systems (specifically the Pave Paws radar) which can be used for ABM defence and, under the President's Strategic Defense Initiative, is contemplating the eventual development and deployment of a full-scale ABM system. All these are said to violate the 1972 ABM Treaty.

c. The deployment of the Pershing II and long-range cruise missiles into Europe (both capable of reaching targets in the Soviet Union) circumvents the provisions of SALT II by posing a new 'strategic' threat to the Soviet Union.

The Soviet Union also claims that the proposed SDI research program is at variance with the provisions of the 1972 ABM Treaty which prohibits the development, testing or deployment of space-based ABM systems or components.

2.61 The United States dismissed the Soviet charges as 'groundless'. The Minuteman shelters were employed during the construction phase as protection against the weather and the Soviet Union was informed of this. The Shemya Island and the Pave Paws radars are to be used for verification and ballistic-missile early-warning respectively and are both located on the periphery of the U.S. and are oriented outwards. The U.S. made it clear to the Soviet Union during the SALT II negotiations that the non-circumvention provisions of the Treaty would not apply to the existing pattern of cooperation with its allies, including the deployment of intermediate-range missiles to counter Russian SS-20s.

2.62 As the SIPRI Yearbook 1984 has noted, the allegations of treaty violations fall roughly into two categories: those relating to the general spirit of the agreements and those dealing with specific provisions. The second kind of allegation has been made by both sides:

> Most of these are vague and conjectural. In some cases, they result from a lack of sufficient precise definitions. For example, the complex language of the ABM Treaty is often equivocal as to what is actually prohibited. The SALT II Treaty, banning encryption of telemetry which would impede verification, fails to indicate what kinds and amounts of information are needed to ensure verification.
>
> In other instances, suspicions may have arisen because the relevant treaties have not entered into force ... had the SALT II Treaty formally entered into force, there most probably would have been fewer problems regarding compliance, because the envisaged regular and obligatory exchange of data on strategic arms would have facilitated both uniform interpretation and verification of the Treaty provisions.[11]

2.63 From the above, it would seem that the Soviet Union and, to a lesser extent, the United States may both have transgressed certain technical provisions or understandings contained within individual treaties. With the exception of the instances outlined and (perhaps) some others, it is reasonably clear that to date both sides have continued to adhere to the agreements. The extent of their adherence has rendered the treaties effective. It would also seem, however, that allegations of treaty violations are being used increasingly in the general propaganda war between the two sides. The great danger is that continued speculation and ill-considered allegations of violations may poison the atmosphere for arms control and undermine existing agreements. They may also detract from genuine compliance concerns which should be able to be raised and discussed calmly within the appropriate consultative framework.

2.64 The debate over treaty violations highlights the importance of adequate verification procedures and formal mechanisms for examining alleged breaches of compliance. It also underlines the fact that arms control agreements are as much acts of confidence (based on mutually agreed interests), as legal or technical documents. Given the technical complexity of arms control agreements, and the difficulties of verification, some uncertainty over compliance is inevitable. Absolute guarantees or demonstrations of compliance are not possible. Given the intense nature of the arms competition, it is likely that there will always be a limited amount of cheating at the margins. Such marginal cheating should not be allowed to detract from the importance of the arms control regime since any gains that are involved are likely to be far less than those provided by negotiated agreements.

CHAPTER TWO
ENDNOTES

1. Report of the Secretary of Defense Caspar W. Weinberger on the FY 1985 Budget, FY 1986 Authorization Request and FY 1985-89 Defense Programs, February 1 1984, p.39.

2. White Paper 1983: The Security of the Federal Republic of Germany, p.146.

3. White Paper 1983, p.146.

4. Evidence, 16 July 1984, pp.181-82.

5. See Per Berg and Gunilla Herolf, 'Deep Strike: new technologies for conventional interdiction', SIPRI Yearbook 1984, Taylor and Francis, London and Philadelphia, 1984, Chapter 8.

6. See William M. Arkin, 'Conventional Buildup - a deliberate delusion', Bulletin of the Atomic Scientists, February 1985, pp.8-9.

7. USIS, A Chronology of United States Arms Control and Reduction Initiatives, April 1986.

8. SIPRI Yearbook 1983, pp.60-61.

9. Department of Foreign Affairs, Disarmament Newsletter, 20 March 1986, p.8.

10. See Jozef Goldblat, 'Charges of treaty violations', Bulletin of the Atomic Scientists, May 1984, pp.33-36; and SIPRI Yearbook 1984, pp.664-652.

11. SIPRI Yearbook 1984, pp.650-51.

APPENDIX 1

MAJOR BILATERAL ARMS CONTROL AGREEMENTS BETWEEN THE SUPERPOWERS

Name of Agreement	Signed	Entered into Force	Provisions
Confidence Building Agreements			
'Hot Line' Agreement	20 June 1963	20 June 1963	telegraph, radio-telegraph and teleprinter communications between the Superpowers, especially useful for emergency communications in times of crisis.
'Hot Line' Modernisation Agreements	30 September 1971	30 September 1971 (Amended 29 April 1975)	Treaty adds satellite communications to earlier communications links between the Parties.
	17 July 1984	17 July 1984	Add facsimile transmission capability.
Nuclear Accidents Agreement	30 September 1971	30 September 1971	each Party to give immediate notification and to take preventive action re any unauthorised or accidental incident involving possible detonation of a nuclear weapon.
Agreement on the Prevention of Incidents On and Over the High Seas (and 1973 Protocol)	25 May 1972 (22 May 1973)	25 May 1972 (22 May 1973)	rules of conduct between the Parties with respect to military ships and aircraft in international waters and airspace. Requires notification of situations of danger and the exchange of factual information re incidents or damage suffered by ships and aircraft involving the other Party.

Name of Agreement	Signed	Entered into Force	Provisions
Prevention of Nuclear War Agreement	22 June 1973	22 June 1973	Treaty enjoins each Party to refrain from the threat or use of force against the other party or its allies in circumstances endangering international peace, and to hold urgent consultations in situations involving risk of nuclear war.
Arms Reduction Agreements			
ABM Anti-Ballistic Missile (ABM) Treaty	26 May 1972	3 October 1972	ABM systems for intercepting ICBMs in flight are limited to the defence of the capital of each Party and one other site housing ICBM. Also limits numbers of launchers, interceptor missiles and ABM radars. Both sides have agreed to limit qualitative improvement of their ABM technology and to prohibit the research, development, testing or deployment of sea-based, air-based, space-based or mobile land-based ABM systems. Systems capable of firing more than one missile at a time are prohibited. MIRVed ABM missiles are also prohibited.
Protocol to ABM Treaty	3 July 1974	25 May 1976	Protocol reduces the two permissible sites for deployment ABM systems to one site for each Party and provides for possible choice of alternative site.

Name of Agreement	Signed	Entered into Force	Provisions
SALT I Interim Agreement	26 May 1972	3 October 1972	Fixes the permissible numbers of ICBM and SLBM launchers for a period of 5 years.
SCC Agreement	21 December 1972	21 December 1972	Establishes a Standing Consultative Commission to promote implementation of the Nuclear Accidents Agreement, the ABM Treaty and the SALT I Interim Agreement.
Vladivostok Accord	24 November 1974		Agreement outlines the elements of proposed further SALT Treaty.
SALT II Treaty	18 June 1979	Not yet ratified	Treaty replaces SALT I 1972 as a comprehensive long-term agreement for strategic weapons reduction. It sets ceilings on ten categories of strategic offensive weapons including: launchers of ICBM, SLBM and ASBM, with sublimits for relevant MIRV. Restrictions also re ALCM, missile launch weight, throw weight, testing and deployment of ballistic missiles and FOBS. Interference with verification by NTM is prohibited. A data base is declared on the numbers of strategic offensive arms of each Party.
Testing Control Agreements			
Threshold Test-Ban Treaty (TTBT)	3 July 1974	not yet ratified	Prohibits underground nuclear weapon tests producing yield in excess of 150 kt and Parties pledge to keep number of underground tests to a minimum. Provides for exchange of data to assist verification by NTM.

Name of Agreement	Signed	Entered into Force	Provisions
Peaceful Nuclear Explosions Treaty (PNET)	28 May 1976	not yet ratified	Treaty limits permissible energy yields of underground nuclear explosions for peaceful purposes to 150kt. It also provides for exchange of information and on-site inspection in certain cases.

APPENDIX 2

MAJOR MULTILATERAL TREATIES WITH NUCLEAR ARMS CONTROL PROVISIONS

Treaty	Entry into Force	Substantive Provisions	Major Parties, Non-Parties (at 1 Jan 1986)		Duration	Termination / Review	Verification	Dispute Settlement
Treaty on the Non-Proliferation of Nuclear Weapons [Non-Proliferation Treaty (NPT)]	5/3/1970	Prohibition on nuclear-weapon States to transfer or assist in acquisition or manufacture of nuclear weapons or other devices. Prohibition on non-nuclear weapon States to manufacture or acquire such devices.	Parties: Australia USSR U.K. U.S.A. plus 128 others	Major Non-Parties: Argentina Brazil Chile China Cuba France India Israel Pakistan S.Arabia S.Africa Spain	At 5 yearly intervals as determined by simple majority of Parties.	Individual repudiation after 3 months notice, due to extraordinary events jeopardising the supreme interests of Party.	For all non-nuclear weapon State Parties mandatory full scope safeguards agreements with the IAFA	For non-nuclear weapon States, in compliance with their agreements with the IAFA and in accordance with the Agency's Statute
Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water ['Partial Test-Ban-Treaty']	10/10/1963	Prohibition of all nuclear explosions in the atmosphere, in outer space or under water. Prohibition of any explosions if radioactive debris would escape beyond the Party's territorial limits.	Australia India USSR U.K. U.S.A. +110	Argentina China Cuba France Korea,N. Pakistan [1] Portugal [1]	No provision	Individual repudiation after 3 months notice, due to extraordinary events jeopardising the supreme interests of Party.	No provision	No provision

Treaty	Entry into Force	Substantive Provisions	Major Parties, Non-Parties (at 1 Jan 1986)		Duration	Termination / Review	Verification	Dispute Settlement
Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Sub-Soil Thereof ['Sea-Bed Treaty']	18/5/1972	Prohibition on deployment of nuclear weapons or related facilities on the bottom of the sea for any purpose.	Australia India USSR U.K. USA +71	Brazil [1] Chile China France Indonesia Israel Korea, N. Korea, S [1] Libya Pakistan Spain	At time and place determined by simple majority	Individual repudiation after 3 months notice, due to extraordinary events jeopardising the supreme interests of Party	Right of observation of, without interference in all relevant activities After consultation between disputants cooperation in further verification procedures by agreement of all interested Parties.	Unresolved serious breach may be reported by aggrieved Party to UN Security Council for action in accordance with Charter.
Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon, and Other Celestial Bodies. ['Outer Space Treaty']	10/10/1967	Prohibition on testing or placement of nuclear weapons in orbit around the earth, installing on celestial bodies, or in outer space in any other manner.	Australia India China U.K. USA USSR France +78	Indonesia Korea, N.	No provision	Individual repudiation after 12 months notice	On reasonable notice by requesting Party all installations and equipment on celestial bodies to be available for inspection provided interference with normal operations is avoided.	No provision

Source: The information in Appendices 1 and 2 is based on Julie Dahlitz, Nuclear Arms Control with Effective International Agreements, McPhee Gribble, Melbourne, 1983, pp.24-30; and SIPRI Yearbook 1986, Chapter 23. Notes: [1] Signed but not ratified.

CHAPTER 3

THE SUPERPOWER ARSENALS AND THE STRATEGIC BALANCE

The Growth of the Superpowers' Nuclear Arsenals[1]

3.1 The present level of armaments and the strategic nuclear doctrines of the United States and the Soviet Union reflect the current state of play in an intense nuclear arms build-up by them which has continued unabated since the end of the Second World War despite some restraints defined in arms control agreements. This build-up is shown in Figures 3.1 to 3.3 which graph the growth of strategic warheads, strategic delivery vehicles and total equivalent megatonnage. Since its beginning, the competition in arms between the United States and the Soviet Union has undergone important phases and changes which have added to the tensions between the two nations and given further impetus to the arms race.

3.2 Between 1945 and the mid-1950s, the United States remained invulnerable to nuclear attack by the Soviet Union, and its nuclear arsenal was markedly superior in most respects. While both sides had exploded a thermonuclear device, the United States had many more warheads and its long-range bombers had the capability to reach Soviet cities. At this time, the major purpose of the United States' nuclear forces was to deter a Soviet conventional attack on Europe. The decade also witnessed the first disarmament proposals, the principal initiatives coming from the United States and aimed at eliminating nuclear weapons. The prospects of successful disarmament were limited however by the state of imbalance between the two sides and the growing poor relations between them which had been heightened by the Korean War and the Soviet invasion of Hungary.

3.3 The second phase, covering the decade from 1957 to the mid-1960s witnessed the end of United States' invulnerability and the substantial escalation of Soviet nuclear capabilities. In 1957, the Soviet Union flight-tested an inter-continental ballistic missile and began deployment of its modern long-range bombers. Not only were American cities now vulnerable, but the ability of the United States to retaliate was in question because overseas bases of its bomber fleet were vulnerable to a first strike. Faced with the possibility of a 'missile gap', the United States gave top priority to the development and production of its own missiles as well as additional bombers. These crash programs and the decision of the Soviet leadership to concentrate on developing shorter-range missiles for use in Europe enabled the United States to retain its superiority in strategic weapons.

3.4 The increasing vulnerability of the United States homeland to a Soviet strike led to three major changes in American strategic policy. First, in order to retain an assured second-strike capability, the United States diversified its strategic forces initiating the 'triad' of land-based ICBMs, submarine-based SLBMs and long-range bombers. In order that a substantial proportion of the triad would survive an initial

Figure 3.1 Total nuclear warheads on intercontinental forces

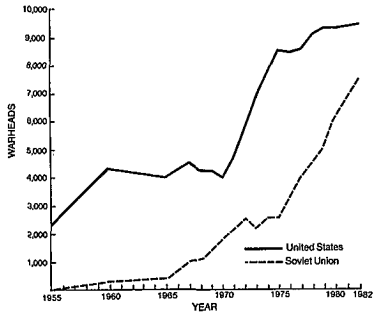


Figure 3.2 Total strategic nuclear delivery vehicles

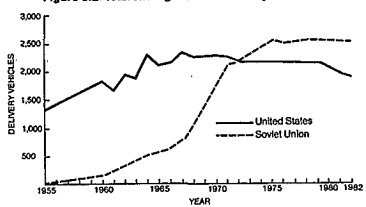
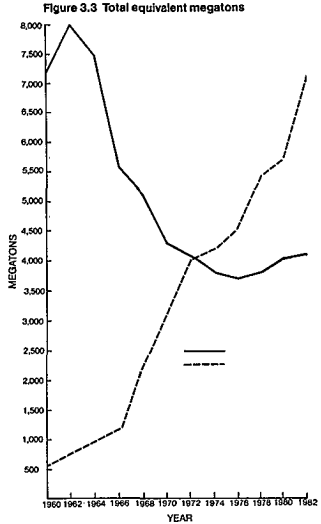


Figure 3.3 Total equivalent megatons



Source: The Harvard Nuclear Study Group, *Living with Nuclear Weapons*, Harvard University Press, Massachusetts, 1983, pp 74-76.

Soviet strike, a large part of the American submarine force was kept at sea, the ICBMs were placed in hardened silos and a number of bombers was kept on alert.

3.5 Second, in 1960 the U.S. Department of Defense drew up a Single Integrated Operations Plan (SIOP) for the conduct of nuclear war by its strategic forces. The initial SIOP and later versions included a range of attack plans against Soviet military and industrial targets but did not include Soviet cities. It was now theoretically possible for the United States to respond to a Russian attack in Europe with a nuclear attack on Soviet military forces, without necessarily starting a mutual exchange of attacks against cities.

3.6 Third, in view of the United States' interest in avoiding nuclear war, together with the inherent problems of the strategy of massive retaliation, America began developing a strategy of 'flexible response':

> Under this strategy, NATO conventional forces in Germany would be strengthened in order to resist a Soviet conventional attack as long as possible. If the Soviet attack was succeeding, low-yield tactical nuclear weapons might be brought into action. If the Soviets pressed ahead, there could, under the amended operations plan, be limited strategic nuclear attacks against Soviet military targets. If the Soviets still continued their advance, the full weight of the U.S. strategic forces might have to be applied. Under 'massive retaliation' strategic weapons would be used quickly; with 'flexible response' such action would only be the last recourse. This new policy was adopted by the U.S. government in the early 1960s and was ratified as official NATO doctrine in 1967.[2]

Growing United States' vulnerability saw increased importance given to the issue of nuclear arms control with the major accomplishment of this period being the Limited Test Ban Treaty 1963 which prohibited nuclear weapons tests everywhere except underground.

3.7 Following the Cuban missile crisis in 1962, the Soviet Union began expanding its strategic missile forces - both land and sea-based - in order to develop a nuclear capability at least equal to that of the United States. It also expanded its defensive capacities, especially air and civil defence. By the early 1970s the Soviet Union had a greater number of strategic nuclear delivery vehicles than the United States and it could deliver a higher megatonnage. During this time, the declared strategic nuclear policy of the United States was modified to 'assured destruction' which would aim to destroy in a single retaliatory strike one-quarter to one-third of the Soviet population and up to three-quarters of Soviet industry. This

would set an upper limit on the strategic forces required and so stabilise the United States' military budget in peacetime. Despite this declaratory policy, throughout the 1960s the American nuclear forces remained targeted primarily on Soviet military forces. The principal change was that while in the early 1960s the Soviet forces were vulnerable to such a strategy, by the end of that decade this was no longer the case.

> ... the growth of Soviet strategic forces had markedly reduced their vulnerability: both sides had strategic forces which could not be substantially damaged by a first strike. The U.S. could no longer minimize damage to American cities by first attacking and destroying a substantial portion of Soviet strategic forces. Now, clearly, the principal use of one side's nuclear forces was to deter the other side from using its nuclear forces. The era of mutual assured destruction (or MAD) had arrived.[3]

3.8 In the early 1970s the United States, despite some initial concern that it would further increase the vulnerability of land-based missile forces and could thus invite a pre-emptive strike, began to replace its single warhead missiles with missiles with several warheads that could be aimed at separate targets (Multiple Independently Targetable Re-entry Vehicles or MIRV). As a result, the United States was able to establish a substantial lead in warheads by capitalising on a technology in which it was significantly ahead.

3.9 This lead was only relatively short-lived however. By 1977, Soviet MIRVing had outpaced that of the United States for land-based missiles and the Soviets had more warheads on their ICBMs than did the United States. Moreover, because of their size, the Soviet missiles could carry much more powerful warheads than could United States' missiles. During this same period, the Soviet Union significantly increased the number of SLBM's on submarines and began to deploy the Backfire bomber. The expanded Soviet arsenal posed considerable problems for American strategists and led to the development of the concepts of counterforce targeting and flexible response which stressed the importance of the U.S. having the capability to respond to Soviet aggression with a variety of 'limited nuclear options', from a small single-weapons strike against advancing Soviet tank forces to more complex strikes against broader ranges of military targets.

3.10 The latter half of the 1970s and the early 1980s witnessed continued developments in Soviet nuclear capabilities which seemed to many Americans to threaten strategic parity. The deployment of these continued, and with improvements in accuracy the Soviets developed a theoretical capacity to destroy American land-based missiles in a first strike. Soviet air defences were improved and the Soviet Union began to deploy a new mobile

intermediate-range missile, the SS-20, which could be used against NATO forces. While the United States improved the offensive capabilities of its ICBM and SLBM forces, its ICBM vulnerability in particular remained a major issue confronting the Ford, Carter and Reagan Administrations. All three Administrations proposed arms control measures which would limit the prospective vulnerability of the United States' land-based missiles. They further initiated the development of the MX missile as well as cruise missiles and the B-1 bomber, the latter two to improve the air element of their strategic triad. In response to the SS-20 threat against Europe, the United States through NATO is deploying 108 Pershing II missiles and 464 ground-launched cruise missiles into Western Europe. These developments, which provide for a greater counterforce capability, in turn increased Soviet concerns over American strategic capabilities and intentions in the longer term.

3.11 In 1980, the Carter Administration confirmed and expanded the earlier concept of 'flexible response' in Presidential Directive (PD) 59. This detailed a nuclear doctrine, known as the 'countervailing strategy', which gave 'greater stress to flexibility in targeting, the ability to change targets during the course of a prolonged nuclear war, and the central importance of secure facilities for command, control, communications and intelligence'.[4]

3.12 As relations between the two superpowers deteriorated, reflecting a complex mixture of internal American politics and Soviet foreign policy expansionism and intransigence, arms control succumbed to political linkages. Three treaties negotiated with the Soviet Union in 1974, 1976 and 1979 - the Threshold Test Ban Treaty, the Peaceful Nuclear Explosions Treaty and SALT II - were not ratified by the United States Senate although they continued to be largely observed by both powers. New negotiations - primarily START and INF - were initiated by the Reagan Administration but these failed to produce agreements and were effectively terminated by the Soviet Union in response to the NATO decision to deploy intermediate range ballistic missiles and cruise missiles into Europe. Since that time, both sides have continued to modernise and upgrade their strategic and intermediate forces and both are embarking on new weapon and research programs which would improve their military capabilities. In March 1985, a new round of arms control talks began in Geneva, embracing strategic and theatre nuclear forces and space weapons. Since these negotiations commenced, there has been a succession of proposals and counter-proposals but no further progress towards negotiating agreed reductions in nuclear armaments (see Chapter 2).

Current Nuclear Forces[5]

3.13 On assuming office in 1981, the Reagan Administration confirmed the view put during the presidential campaign that U.S. military forces existing at the time were insufficient to carry out United States' defence objectives and that U.S. military strength overall had declined relative to that of the Soviet

Union. To offset these perceived deficiencies, the Administration initiated a comprehensive upgrading of U.S. military forces and capabilities[6] in which it:

a. sought to improve the flexibility, strategic mobility, readiness, firepower and combat sustainability of its conventional military forces;

b. undertook a strategic nuclear modernisation program aimed at improving strategic command and control arrangements; modernising its manned strategic bombers; deploying new and improved submarine-launched missiles; improving the accuracy and survivability of its land-based missiles; and improving America's strategic defences by upgrading its surveillance systems and modernising its interceptor forces; and

c. under the Strategic Defense Initiative (SDI) program, in particular, began concentrated research into technologies which might allow for effective defence against ballistic missiles.

3.14 Like the United States, the Soviet Union maintains formidable strategic and intermediate-range nuclear forces, strategic defence forces and ground, air and naval forces. The Soviet nuclear forces are made up of a mixture of inter-continental ballistic missiles, submarine-launched ballistic missiles and manned bombers, with the principal emphasis being given to land forces.

3.15 Over the last decade, the Soviet Union has continued to expand and modernise its forces across the spectrum of strategic, theatre-nuclear and conventional capabilities. Soviet military expenditure has steadily increased over the same period and the Soviet Union has continued to acquire and utilise advanced technologies. It has expanded its international presence and global reach through an increasing number of overseas military facilities, improving its ability to deploy naval and air forces throughout the world, and through continued supply of arms, materiel and advisers.

Strategic Nuclear Forces

3.16 The present size and characteristics of the strategic nuclear forces of the United States and the Soviet Union are shown in Table 3.1.

Land-Based Missiles

3.17 The current U.S. land-based, strategic nuclear force is based on 26 Titan II missiles, which are slowly being phased out, and 1 000 Minuteman missiles, (450 Minuteman II and 550 Minuteman IIIs). Four warhead types are deployed on the land-based missiles, ranging from 170 kilotons to 9 megatons in yield. The Minuteman force is being upgraded and will probably remain

Table 3.1: Strategic nuclear forces of the United States and the Soviet Union

Delivery Vehicle	Deployed Number 7/85	First Year Deployed	Range (km)	Throw-weight (0001b)	CEP (m)	Number of Warheads Per Delivery Vehicle	Total Delivery Capability (No. of Warheads)	Total Delivery Capability (MT)
Land-based (ICBMs)								
Minuteman 11	450	1966	11300	1.6	370	1	442[a]	530
Minuteman 111	250	1970	14800	1.5	280	3	750	128
	300	1980	12900	2.4	220	3	900	306
Titan 11	26	1962	15000	8.3	1300	1	26	234
Sub-Total	1026						2126	1198
Sea-based (SLBMs)								
Poseiden C-3	304	1971	4600	3.3	450	10	3040	152
Trident C-4	312	1980	7400	3.0+	450	8	2496	249
Sub-Total	616						5536	401
Air-based (Long-range strategic bombers)								
B52 G/H	241	1959	10-16000	0.95	45			
ALCM carriers	90					20[b]	1800	732
Non-ALCM carriers	151					8	720[c]	432
Sub-Total	241						2520	1164
TOTAL	1883						10174	2763

Notes: a. Eight Minuteman 11 launchers are communications vehicles

b. ALCM carriers have 12 ALCM, 4SRAM and 4 gravity bombs.

c. IISS shows that only 180 of the 241 B52 aircraft are armed with nuclear weapons.

Source: Extracted from IISS The Military Balance 1985-86, pp.158-165 and 180-181.

Delivery Vehicle	Deployed Number 7/85	First Year Deployed	Range (km)	Throw-weight (0001b)	CEP (m)	Number of Warheads Per Delivery Vehicle	Total Delivery Capability (No. of Warheads)[e]	Total Delivery Capability (MT)
Land-based (ICBMs)								
SS-11	520	1966	9-13000	2-2.5	1100-1400	1[d]	520	520
SS-13	60	1968	10000	1.0	2000	1	60	45
SS-17	150	1975	10000	6.0	450	1-4	600	120
SS-18	308	1975	11000	16	300-450	1-10	3080	1540
SS-19	360	1979	10000	.8	300	1-6	2160	1188
Sub-Total	1398						6420	3413
Sea-based (SLBMs)								
SS-N-5	39	1964	1400	na	2800	1	39	39
SS-N-6	336	1968	2400-3000	1.5	900-1400	1-2	336	200
SS-N-8	292	1972	7800-9100	1.5-8	900-1300	1	292	234
SS-N-17	12	1977	3900	2.5	1500	1	12	12
SS-N-18	224	1978	6500-8000	5	600-1400	1-7	1568	308
SS-NX-20	60	1981	8300	na	na	10	540	108
SS-NX-23	16	1985	na	na	na	na	?	?
Sub-Total	979						2787+	901
Air-based (long-range strategic bombers)								
Tu-95(Bear)	125	1956	12800	0.78	40	4[e]	500	430
Mya-4(Bison)	45	1956	11200	0.87	20	4[e]	180	36
Sub-Total	170						680	466
TOTAL	2547						9987+	4780

d. The mod 3 SS-11 contains 3 MRVs which are usually counted as a single RV.

e. Assumes 1-2 ALCM and 2-3 gravity bombs for Bear and 4 gravity bombs for Bison.

deployed until the end of this century. United States' officials have long argued that this land-based element of their strategic triad is becoming increasingly vulnerable to Soviet ICBM attack. The United States has therefore initiated a modernisation program based on the development of the MX missile system and a small, single-warhead ICBM dubbed 'Midgetman' by the press. Being mobile, the Midgetman will present a moving target of low vulnerability during a Soviet attack. Future deployment modes for the MX missile are still under review; low vulnerability is a leading requirement.

3.18 The MX missile was flight-tested in 1985 and a total of 50 missiles will be deployed into existing Minuteman silos by 1990. The MX will be more accurate than the existing Minuteman III missiles and will carry three times as many warheads. Research on the 'Midgetman' missile is underway and full-scale development is scheduled in FY 1987.

3.19 The Soviet Strategic Rocket Force currently comprises just under 1 400 launchers capable of delivering over 6 000 warheads. By comparison, the U.S. has about 2 100 ICBM warheads. Most of the SS-17s, SS-18s and SS-19s are MIRVed and the most accurate versions of the SS-18 and SS-19 are capable of destroying hard targets. The hardness of the Soviet launchers has been considerably increased to improve missile and launcher survivability. There are contingency plans for reloading and refiring ICBMs from launchers that have already been used to fire the initial missile.

3.20 The Soviet Union is currently deploying two new solid-propellant ICBMs, the SS-X-24 and the SS-X-25 with the latter replacing older SS-11 and SS-13 missiles. The SS-X-24 will carry up to 10 warheads, it will probably be silo-deployed at first but will eventually be deployed in a rail-mobile-mode. The SS-X-25 will carry a single warhead and has apparently been designed for road-mobile deployment similar to that of the SS-20. The SIPRI Yearbook 1986 reports that the Soviet Union has three additional ICBM models or modifications under development where all are expected to be flight-tested in the period 1986-90. These include a new, liquid fuelled, silo-based heavy ICBM to replace the SS-18, a new version of the SS-X-24, and a MIRVed version of the SS-X-25[7].

Submarine-Launched Missiles

3.21 The United States current strategic submarine forces include 19 Poseidon ballistic missile submarines (SSBNs) with 304 Poseidon C-3 missiles; 12 Poseidon SSBNs with 192 Trident I (C-4) missiles; and 5 Trident (Ohio-Class) SSBNs with 120 Trident I (C-4) missiles. A further 3 Ohio-Class Trident submarines are currently being fitted or are undergoing sea trials prior to operational deployment. The Trident SSBN has more and larger missile tubes than the Poseidon, is harder to detect underwater and will have an increased time at sea. A total of 15 Trident SSBNs are to be constructed. The Poseidon submarines are being retired as the Tridents enter service as required by the SALT II Treaty limits.

3.22 A Trident II (D-5) missile is presently under development as a follow-on missile for the entire Trident submarine force. The D-5 will carry a nominal 14 warheads and re-entry vehicles (RVs) per missile compared with 8 for the C-4 (the C-4 can carry 14 warheads but with reduced range) and will have a range of 10 000 km. The D-5s are planned to begin to be deployed in 1989. Their deployment is part of an overall SSBN modernisation program which 'calls for replacing the aging fleet of Poseidon submarines with more capable and survivable Tridents, and for achieving a sea-based capability to destroy hard targets'.[8] [emphasis added]. United States' attack submarines are also about to be equipped with nuclear-armed Tomahawk sea-launched cruise missiles which carry a 200 kiloton warhead and have a range of some 2 000 km.

3.23 The Soviet submarine-launched ballistic missile force accountable under SALT I presently comprises about 980 SLBMs deployed in 62 submarines. The submarines include three Typhoon-class SSBNs which are each capable of carrying 20 MIRVed SS-N-20 SLBMs each with a range of 8 300 kilometres, and a Delta IV Class submarine which is armed with the new SS-NX-23 SLBM. The Soviet Union has built two more Typhoon-class SSBNs with a further three or four under construction. The range and accuracy of Soviet SLBMs have been considerably improved in recent years to the extent that the Soviet Union can now strike the United States from waters contiguous to the Soviet Union. Further developments are likely to continue this trend with the deployment of a replacement for the SS-N-18 and a modified version of the SS-N-20, and the development of a new class of strategic missile-carrying submarine which is expected to enter into service in the early 1990s. The Soviet Union is also developing a sea-launched cruise missile (SLCM) for use with its Navy and SSBN fleet. The new missile, the SS-NX-21, will have an estimated maximum range of 3 000 kilometres and will have a primarily nuclear strike role. Currently the Soviet Union has about 2780 SLBM warheads compared with 5 500 for the U.S.

Long-Range Bombers and Air-launched Cruise Missiles

3.24 Despite large increases in deployment of ICBMs and SLBMs, long-range bombers remain a major factor in the United States strategic calculus. They presently carry around 25 per cent of all strategic nuclear warheads and can deliver over 40 per cent of total megatonnage. Indications are that the manned bomber will retain its key role well into the future. The current bomber force is presently made up of some 241 B-52G/H aircraft. The bomber force carries six types of nuclear bombs and two missiles - the short-range attack missile (SRAM) and the air-launched cruise missile (ALCM). The U.S. is expected to deploy ALCMs on 90 operational B-52Gs and it will begin to modify B-52Hs to carry the missiles. The U.S. has begun the development of a longer-range advanced cruise missile (ACM) which will replace the present ALCMs.

3.25 The U.S. is also reported to be developing a new inter-continental cruise missile with a 6 000 to 8 000 kilometre range.[9] The missile would be supersonic, it would be smaller,

incorporate stealth techniques, and have sensors to evade defences. The same report states the United States has begun to produce a new 1.1 megaton bomb (designated the B-83) which replaces earlier model bombs and:

> ...allows the pilot to release the weapon at supersonic speeds, from as low as 150 feet, activating a parachute-type (drogue) retard and a time-delay fuse. When delivered at low altitudes, the accuracy of this 'laydown' method is equal to or better than that of ICBMs. With its high yield, the B53 will be able to destroy 'hardened Soviet ICBM silo and launch complexes, command, control and communications installations, and nuclear storage sites'.[10]

3.26 In June 1985, the United States deployed the first of its planned 100 B-1B strategic bombers, and has continued work on its Advanced Technology Bomber (ATB), or 'stealth' bomber. The B-1B will be able to deliver an enormous weapons load (up to 30 ALCMs or 38 SRAMs or compact N-bombs) over an unrefuelled range of 7 500 km at a maximum speed of Mach 1.25. It will also be able to fly much faster than the B-52 at lower altitudes and so will have greater penetration capacity. The ATB will draw on various 'stealth' techniques such as use of materials and shapes that absorb or deflect radar waves and the masking of engine exhausts to defeat attack by Soviet heat-seeking devices. The first of a planned 132 ATBs are supposed to enter service around 1992.

3.27 The Soviet Union's long-range bomber fleet comprises some 170 aircraft. Very few of the aircraft are maintained on alert and only 7 per cent of Soviet strategic warheads are carried on bomber aircraft. The Soviet Union has built additional Tu-95(Bear) aircraft to provide a weapons platform for its new AS-15 air-launched cruise missile. The AS-15 is a small, air-launched, subsonic, low altitude cruise missile, similar in design to the U.S. Tomahawk. It has a range of about 3 000 km and was first deployed on Soviet Bear bombers in 1984. A new, swing-wing strategic bomber, the 'Blackjack', similar in design to the US B-1, is currently under development and may be deployed from 1987. The Blackjack will be capable of carrying cruise missiles, bombs or both. It will probably replace the Bison and earlier model Bear Bombers.

Non-Strategic Nuclear Forces

Soviet and Warsaw Pact Forces

3.28 The Soviet and Warsaw Pact theatre and tactical nuclear forces are shown in Table 3.2. They include the SS-20 intermediate-range ballistic missile which is a mobile missile system that carries three warheads. The SS-20 has a greatly improved accuracy and reaction time over the older SS-4 system (CEP for the SS-20 is around 400m) and is more survivable.

Table 3.2: Soviet and Warsaw Pact Non-Strategic Nuclear Forces

Country/ Alliance	Delivery Vehicle	Deployed Number 7/85	First Year	Range (km)	CEP (m)	Nuclear Warhead/Weapon
Land-based (I/MRBM)						
USSR	SS-4	120	1959	2000	2300	1x1MT being withdrawn
	SS-20[1]	423	1977	5000	400	3x150 KT MIRV
Land-based (SRBM/GLCM)						
USSR	SS-1b Scud A	420	1957	150		1xKT range SS-23 replacing
	SS-1c Scud B		1965	300		
	FROG-7	?530	1965	70	400	1x200 KT SS-21 replacing
	SS-12 Scaleboard	? 80	1969	490-900	900	1x200 KT Multi-role SS-22
	SS-21	?220	1978	120	300	1x200 KT
	SS-22	? 45	1979	900	300	1x500 KT
	SS-23	?180	1979/80	500		1xKT range
	SS-C-1b Sepal	?100	1962	450		1xKT range Coast Defence
WTO	Scud B/C	132	1965	160-300		1xKT range. All
	FROG -3/-5/-7	208	1957	40-70	400	1x200KT range. All
Land-based (Artillery)						
USSR	M-1976 152mm	?1500	1981			?2-5KT. Front
	2-S5 152mm	?2100	1978			2-5KT. Army
	S-23 180mm	? 180	1955			2KT. Army. Retiring
	M-55 152mm	?2500	1955			2KT. Div.
	M-1973 152mm	3500+	?1972			Sub-KT-5KT. Div.
	M-1975 203mm	? 200	1979			2-5KT. Front
	M-1975 240mm	n.a.	1979			n.a. Front
WTO	M-55 152mm	(140)				2KT. East Germany, Hungary, Romania
Sea-based (SLCM)						
USSR	SS-N-3 Shaddock	268	1962	450		1x350 KT
	SS-N-7 Siren	88	1968	45		1x200 KT
	SS-N-9	206	1968/9	280		1x200 KT
	SS-N-12 Sandbox	128	1973	1000		1x350 KT
	SS-N-19	88	1980	500		1x500 KT
Sea-based (ASW)						
USSR	SS-N-14 Silex	264	1974	55		KT range
	SS-N-15 torpedo	?396	1982	45		?KT range
	SS-N-16 torpedo	?306	1962	n.a.		?KT range
	SS-NX-22	36	1982	n.a.		1 warhead
	FRAS - 1 rockets	12	1975	n.a.		? 5KT
	Mines	n.a.	n.a.			5-20 KT

Continued/....

Country/ Alliance	Delivery Vehicle	Deployed Number 7/85	First Year	Range (km)	CEP (m)	Nuclear Warhead/Weapon
Air-based (Medium-range bombers and strike aircraft)						
USSR	Tu-16 Badger	400	1955	4800	20	1-2 ALCM, 1 bomb
(2)	Tu-22 Blinder	165	1962	4000	12	1 ALCM, 1 bomb
	Tu-22 Backfire	230	1974	8000	17.5	2 ALCM, 2 bombs
	Su-7 Fitter A	130	1959	1400	5.5	2 bombs
	MIG-21 Fishbed L	135	1970	1100	2	2 bombs
	MIG-27 Flogger D/J	760	1971	1400	7.5	2 bombs
	Su-17 Fitter D/H	1000	1974	1800	11	2 bombs
	Su-24 Fencer	700	1974	4000	8	2 bombs
WTO	Su-7 Fitter A	95	1959	1400	5.5	2 bombs, Czech. Poland
(3)	Su-20 Fitter C	35	1974	1800	9.9	2 bombs. Poland
	MIG-23 Flogger F/H	100	1975	1400	9.9	2 bombs. Bulgaria, Czech, E.Germany
Air-based (ASW)						
USSR	Tu-142 Bear	55	1972	11500		2 bombs
	Il-38 May	50	1970	7200		(?2) bombs
	Be-12 Mail	90	1965	4000		2 bombs
Air-based (ALCM)						
USSR	AS-2 Kipper	90	1961	200		1xKT range
	AS-3 Kangaroo	(100)	1961	650		1x? 800KT
	AS-4 Kitchen up to	830	1962	300-800		1x200 KT
	AS-6 Kingfish up to	820	1977	250		1x350 KT
	AS-15 up to	150	1984	.1800		1x250 KT

Notes:
1. National total, estimated two-thirds of SS-20 within range of Europe
2. All types listed are dual capable, but some in the strike category are notpresently configured for the nuclear role.
3. Nuclear warheads held in Soviet custody. It is uncertain how many Warsaw aircraft are nuclear capable.

Source: Extracted from IISS, The Military Balance 1985-1986, London, 1985, pp.162-165.

Technically, more than one missile can be fired from the same launcher although reloading would take several hours and may not be viable in wartime. Over 400 SS-20s have been deployed so far, two-thirds of those into Europe and the rest into Asia. The SIPRI Yearbook 1986 notes that the overall size of the SS-20 force is expected to grow to over 450 by 1987, and that a new modification to the missile is currently being deployed which will provide for a threefold increase in accuracy. The Soviet Union still maintains some 120 SS-4 intermediate-range ballistic missiles in Europe although these are being phased out.

3.29 The Soviet Union and its allies maintain a force of around 400 obsolescent Tu-16 Badger and 165 Tu-22 Blinder medium-range bombers. Some 230 new Backfire bombers (of which 100 are assigned to naval aviation), approximately 700 Fencer fighter-bombers and over 2 000 other short-range, nuclear-capable fighters and fighter bombers. It has large numbers of nuclear-capable artillery pieces and a range of short-range ballistic missiles including the SS-IC Scud (soon to be replaced by a more accurate and longer-range missile designated the SS-23), SS-12 (being replaced by SS-22) and Frog (being replaced by SS-21).The Soviet Union has an array of short-range air and sea launched missiles with either nuclear or conventional warheads as well as nuclear munitions that can be delivered by tank or artillery.

3.30 The non-strategic nuclear forces of the United States and its Western allies are summarised in Table 3.3. They include the independent nuclear deterrents maintained by Great Britain and France. These are detailed in Chapter 5. The British force operates as part of NATO and comprises four Polaris missile-carrying submarines which are to be replaced in the 1990s with a Trident system. The French force de frappe operates independently of NATO and is made up of a mixture of long and short-range delivery systems. France is to upgrade its nuclear forces over the next decade and is developing an air-launched cruise missile. In addition to these forces, the United States is reported to have assigned 40 of its strategic Poseiden SLBMs for use by the Supreme Allied Commander Europe.[11]

3.31 The United States has large numbers of tactical nuclear weapons.William Arkin and his colleagues estimate that the total number of non-strategic warheads held by U.S. or NATO forces now exceeds 11 000, with nearly 6 000 of these located in Europe.[12] The distribution of these warheads and weapons systems is given in Table 3.4. They can be divided into four principal groups: air-deliverable weapons, land-based missiles, artillery shells and demolition munitions.

a. **Air-deliverable weapons.** Most of the allied non-strategic warheads are delivered by aircraft. Fifteen United States and NATO aircraft types are presently 'certified' to carry nuclear weapons. The tactical nuclear bomb stockpile has been upgraded in recent years to include selectable-yield and lighter weapons. A number of new nuclear weapons for tactical aircraft are in research and development including standoff air-to-surface munitions (TASM).

Table 3.3: Allied non-strategic nuclear and nuclear-capable forces

Country/ Alliance	Delivery Vehicle	Deployed Number 7/85	First Year	Range (km)	CEP (m)	Nuclear Warhead/Weapon
Land-based (I/MRBM)						
USA	Pershing II	48	1983	1800	45	1x5-50 KT
	GLCM	64	1983	2500	n.a.	1x10-50 KT
FRANCE	SSBS S-3	18	1980	3500		1x1MT
Land-based (SRBM)						
USA	Pershing IA	90	1967	160-720	400	1x60/400 KT
	Lance	90	1972	110	150-400	1x1/10/50 KT
NATO	Honest John	26	1960	38	1850	2,20 or 40KT
	Pershing 1A	72	1962	160-720	400	1xKT range
	Lance	55	1976	110	150-400	1x50 KT
FRANCE	PLUTON	44	1974	120	n.a.	1X15/25 KT
Land-based (artillery-dual capable)						
USA	M-110 203mm	1046	1977	20	170	5-10 KT
	M-109 155mm	2200	1963	18-30	n.a.	1x0.1 KT
	M-198 155mm	900	1979	1.6-14	n.a.	1x0.1 KT
NATO	M-110 203 mm	395	1962	16.8	170	5-10 KT
	M-109 155mm	1767	1964	18	n.a.	1x1 KT
	Nike Hercules SAM	443	1962	140		2,20.40KT
Sea-based (SLBM)						
UK	Polaris A-3	64	1967	4600	900	3x200KT
FRANCE	MSBS M-20	64	1977	3000	n.a.	1x1MT
	MSBS M-4	16	1984	4400+	n.a.	6x150KT MIRV
Sea-based (SLCM)						
USA	Tomahawk	96	1983	2500		1x200-250 KT
Sea-based (ASW)						
USA	SUBROC	316	1965	50		1x1-5 KT
	ASROC	1000	1961	11		1x1 KT Dual capable
Sea-based (SAM)						
USA	Terrier	+300	1956	37		1x1 KT
	Nike Hercules		1958	140		2/20/40 KT. Not in front line service
Air-based (Medium-range bombers and strike aircraft - dual capable)						
USA(land)	FB-111A	56	1969	4700	37.5	4SRAM, 2 bombs
	F-4E	440	1962	2200	16	1 bomb
	F-111/E/F	250	1967	4700	25	3 bombs
	F-16	510	1979	3800	12-15	1 bomb
	F-15	383	1975	2700	16	
(carrier)	A-6E	170	1963	3200	15	3 bombs
	A-7E	288	1966	2800	15	3 bombs
	F/A-18	161	1982	1000	17	2 bombs
	S-3	110	1974	?3700	n.a.	1 depth charge
	P-3	258	1961	2500	n.a.	2 depth charges
FRANCE	Mirage IV/111E	52	1964	2400-3200	16-19	1x60KT(IVA);2x15KT
	Super Etendard	36	1980	1500	2	2x15 KT
NATO	F-104	277	1958	2400	4	
	F-4 E/F	167	1967	2200	16	
	F-16	242	1982	3800	12-15	
	Jaguar	45	1974	1600	10	
	Tornado	311	1981	2800	16	

Source: IISS, The Military Balance 1985-86, London 1985, pp.158-161.

Table 3.4. Non-strategic nuclear force warheads (1984)[a]

Weapon (warhead)	United States	Europe US use	Europe NATO use	Deployment Pacific	At sea	Total
GLCM/Pershing II (W-84, W-85)	-	150	-	-	-	150
Bombs (B-28, B43, B-57, B-61)	1 210	1 415	320	135	720	3 800
Depth bombs (B-57)	560	130	60	100	45	895
Pershing IA(W-50)	-	180	100	-	-	280
Lance (W-70)	587	325	370	-	-	1 282
8-inch artillery (W-33, W-79)	500	505	430	65	-	1 500
155mm artillery (W-48)	160	592	140	30	-	922
Honest John (W-31)	-	-	200	-	-	200
Nike Hercules (W-31)	-	110	390	-	-	500
Atomic demolition munitions(W-45, W-54)	220	370	-	20	-	610
Terrier (W-45)	64	-	-	-	36	100
ASROC (W-44)	224	-	-	-	350	574
SUBROC (W-55)	110	-	-	-	175	285
Total	3 635	3 777	2 010	350	1 326	11 098

[a] Authors' estimates as of May 1984.

Source: William H. Arkin, et al, "Resource Paper on the US Nuclear Arsenal", p.10S.

b. Land-based missiles. United States and NATO forces have over 2 200 warheads for four different missiles where the majority of these are deployed in Europe. These weapons include the Pershing 1A and Pershing II intermediate-range ballistic missile, the Lance, Honest John and Nike Hercules short-range missiles, and the new ground-launched cruise missile (GLCM). A total of 108 Pershing II and 464 GLCM are to be deployed to Europe by the end of 1988. The Pershing II is terminally guided and is more accurate than the SS-20. It does not depend on presurveyed or physically planned launch positions. Unlike the SS-20 it carries only one warhead (50+ KT). The exact range of the Pershing II is classified. The Soviet Union claims that the real range is close to 2 500 km which would enable it to strike targets around Moscow. The GLCM has a maximum range of 2 500 km and needs to be launched from pre-surveyed, but not physically planned launch positions. The GLCM is more mobile than the Pershing II and so is less vulnerable to a pre-emptive strike.

c. Artillery Shells. The allied arsenal includes both conventional and enhanced radiation warheads (the so-called 'neutron bomb') with nearly 1 700 shells deployed in Europe. The shells have yields between 0.1 and 12 kilotons.

d. Demolition munitions. U.S. forces have two types of demolition munitions or mines, one a medium-yield device and a smaller weapon for use by commandos or saboteurs.

3.32 United States' naval forces also carry a range of non-strategic nuclear weapons including bombs and missiles for anti-shipping, anti-submarine, anti-air and air-to-ground strikes. The U.S. Navy has one type of nuclear surface-to-air missile (SAM), the Terrier, of which there are 100 warheads. The next generation, long-range nuclear SAM is the Standard 2 which will carry a fission warhead which is to be deployed in the early 1990s. Nuclear-armed, land-attack versions of the Tomahawk sea-launched cruise missile are also being deployed onto recommissioned battleships and submarines and will eventually be deployed on a wide variety of surface ships.

Warhead Development and Nuclear Testing

3.33 Both sides have continued to develop and test new warheads. Since 1945, the superpowers have conducted over 1 360 nuclear tests between them (See Table 3.5). Nuclear testing plays an important role in the design, development and modification of nuclear warheads. According to the U.N. Comprehensive Study on Nuclear Weapons, United States tests during the late 1970s were conducted to improve yield-to-weight ratios , reduce warhead costs, enhance warhead safety and control against unauthorised use, and develop new warheads.[13]

Table 3.5: Estimated nuclear explosions
6 August 1945 - 31 December 1985

I. Estimated nuclear explosions 6 August 1963 - 31 December 1985

a = atmospheric
u = underground

Year	USA		USSR		UK[a]		France		China		India		
	a	u	a	u	a	u	a	u	a	u	a	u	Total
6 Aug - 31 Dec 1963	0	18	0	0	0	0	0	1					19
1964	0	29	0	6	0	1	0	3	1	0			40
1965	0	29	0	9	0	1	0	4	1	0			44
1966	0	40	0	15	0	0	5	1	3	0			64
1967	0	29	0	15	0	0	3	0	2	0			49
1968	0	39[a]	0	13	0	0	5	0	1	0			58
1969	0	29	0	15	0	0	0	0	1	1			46
1970	0	33	0	12	0	0	8	0	1	0			54
1971	0	15	0	19	0	0	5	0	1	0			40
1972	0	15	0	22	0	0	3	0	2	0			42
1973	0	14	0	14	0	0	5	0	1	0			34
1974	0	12	0	19	0	1	7	0	1	0	0	1	41
1975	0	17	0	15	0	0	0	2	0	1	0	0	35
1976	0	15	0	17	0	1	0	3	3	1	0	0	40
1977	0	12	0	18	0	0	0	6	1	0	0	0	37
1978	0	16	0	27	0	2	0	7	2	1	0	0	55
1979	0	15	0	29	0	1	0	9	0	0	0	0	54
1980	0	14	0	21	0	3	0	11	1	0	0	0	50
1981	0	16	0	21	0	1	0	11	0	0	0	0	49
1982	0	18[b]	0	31	0	1	0	5	0	0	0	0	55
1983	0	17	0	27	0	1	0	7	0	1	0	0	53
1984	0	17	0	27	0	2	0	7	0	2	0	0	55
1985	0	15	0	7	0	1	0	8	0	0	0	0	31[c]
Total	0	474	0	399	0	16	41	85	22	7	0	1	1045

a Five devices used simultaneously in the same test are counted here as one explosion.
b Two devises used simultaneously in the same test are counted here as one explosion.
c To data for 1985 are preliminary.

II. Estimated nuclear explosions 16 July 1945-31 December 1985

USA[a]	USSR	UK[a]	France	China	India	Total
805	562	39	134	29	1	1570

a All British tests from 1962 have been conducted jointly with the United States at the Nevada Test Site. Therefore, the figure for US tests is actually higher than indicated here.

Source: SIPRI Yearbook 1986, p.129

3.34 The most outstanding feature in warhead development has been the reduction of size and weight of warheads in relation to yield. Nuclear warheads are available for virtually all types of tactical and strategic weapons and for most military roles. These weapons range from portable land-mines weighing 70 kg (with a yield equivalent to about 10 tons of TNT) to huge strategic bombs weighing in excess of 3 tons and with multi-megaton yields.

3.35 There is continuing emphasis on developing warheads with different yields (including so-called 'mini-nukes' which have an explosive power equivalent to only a few tons of TNT) and with different radiation characteristics. The most notable example of this latter development is the neutron (or 'enhanced radiation') bomb in which the zone of danger due to high energy neutrons significantly exceeds that due to blast. Neutron bombs therefore provide an effective counter to large-scale armoured forces which are quite resistant to blast and heat but offer little protection against neutron radiation. The United States is producing enhanced radiation warheads for its Lance ground-to-ground missiles and 8-inch artillery shells, and a warhead is being developed for 155 mm artillery projectiles. The Soviet Union has developed and tested a neutron bomb but does not seem to have deployed it.[14]

Strategic Defence Systems

3.36 Both the United States and the Soviet Union maintain significant strategic defence systems based on a wide range of capabilities including surveillance and early warning systems, anti-missile defence systems, air defence systems and anti-satellite systems. In the face of continuing improvements in strategic delivery systems, both sides are actively seeking to upgrade their strategic defence capabilities across the board. The most significant development in this area is the United States Strategic Defense Initiative (SDI) research program which is investigating the feasibility of technologies that could be used for defence against ballistic missiles.

Surveillance and Early Warning

3.37 The Soviet Union maintains an extensive early warning system for both ballistic missile and air defence. Its operational ballistic missile early-warning system includes a launch detection satellite network, over-the-horizon radars and a series of phased-array radars located primarily on the periphery of the Soviet Union. Its early-warning air surveillance system comprises an extensive network of ground-based radars linked operationally with those of their Warsaw Pact Allies. The long-range systems provide the Soviet Union with 30 minutes warning of an ICBM strike launched from the United States. The warning times for both SLBMs and IRBMs located in Europe are much less (approximately seven minutes in the case of Pershing II). The air defence radar systems provide almost complete coverage at medium and high altitudes over the Soviet Union but, at present, only limited coverage against low-altitude targets such as cruise missiles. The Soviet Union has a strong research and development

program to produce advanced early warning and air surveillance radars. In addition, the Soviet Union is deploying air surveillance data systems that link radar outputs to ground-controlled intercept sites and SAM command posts.

3.38 The United States maintains extensive early warning, surveillance and target acquisition systems designed to detect and track incoming ICBMs, SLBMs, aircraft and cruise missiles. The defence systems are under the command of the U.S. Space Command which is located with the North American Aerospace Defense Command (NORAD). They utilise both satellites and radar systems with stations located in the United States, Canada and overseas (including Australia).

Ballistic Missile Defence (BMD)

3.39 The United States and the Soviet Union have both worked on ballistic missile defences since the early 1950s and each has deployed limited ABM systems. Partly in recognition of the technical and economic difficulties involved in fielding effective defences against a major ballistic missile attack, and partly because of the primacy of offensive capabilities in their strategic doctrines, the two states signed the Anti-Ballistic Missile Treaty in 1972 which imposed severe constraints on the development, testing and deployment of ABM systems (See Chapter 2).

3.40 Since then, only the Soviet Union has maintained an operational ABM system although both the Soviet Union and the United States have continued to conduct research into BMD. The Soviet Union has upgraded its current ABM system, developed a new air defence missile system, (the SA-X-12), which could have some BMD application, and continued research and development on advanced weapons technologies - such as laser and neutral partical beams - which also have application to ABM defence. These developments have led the United States to claim that:

> The Soviets are developing a rapidly deployable ABM system to protect important target areas in the USSR. They have been testing all types of ABM missiles and radars needed for widespread ABM defenses beyond the 100 launcher limit of the 1972 ABM Treaty. Within the next ten years, the Soviets could deploy such a system at sites that could be built in months instead of years.[15]

3.41 Under its Sentinel ABM programme, the United States originally placed an ABM system around the ICBM field in North Dakota, but withdrew it in 1975. The United States does not have any operational ABM systems but it has continued to conduct BMD research under two programmes known as the Advanced Technology Program (ATP), which is concerned with the development of non-nuclear warheads and target acquisition technologies, and the Systems Technology Program (STP) which seeks to integrate the systems developed under the ATP and other programmes into a

workable BMD system. The SIPRI Yearbook 1984 reported that funding for these R & D programs for fiscal years 1982 and 1983 was just over $462 million and $519 million respectively.[16] The United States has also conducted considerable research on high-energy lasers and directed energy weapons which could be used in BMD. United States' BMD activities were given renewed impetus by President Reagan in March 1983 when he announced the Administration's Strategic Defense Initiative (SDI) research program which expanded and refocused the earlier BMD efforts into a single, integrated program for investigating the feasibility of effective ballistic missile defences. Whilst the SDI program is discussed in detail in Chapter 12, the Committee feels it appropriate that a short summary of the program be incorporated here.

The Strategic Defense Initiative (SDI)

3.42 The Strategic Defense Initiative is a comprehensive research program that has been 'established to explore and demonstrate key technologies associated with concepts for defense against ballistic missiles'.[17] SDI does not involve the development or deployment of ballistic missile defences, rather it 'seeks to provide the technical knowledge required to support a decision on whether to develop and later deploy advanced defensive systems'.[18] In the event that the research yields positive results, the United States:

> ...will consult with our allies about the potential next steps. We would then consult and negotiate, as appropriate, with the Soviet Union, pursuant to the terms of the ABM Treaty ... on how deterrence might be strengthened through the phased introduction of defensive systems into the force structures of both sides. This commitment does not mean that we would give the Soviets a veto over the outcome anymore than the Soviets have a veto over our current strategic and intermediate-range programs. Our commitment in this regard reflects our recognition that, if our research yields appropriate results, we should seek to move forward in a stable way.[19]

3.43 While the SDI program involves basic research, the research is organised towards developing a layered defensive system which would intercept and destroy ballistic missiles in all phases of their flight paths. The key to success is the first layer which would attempt to destroy Soviet missiles within minutes of launching. Boost-phase interception is critical because (1) the number of targets is much smaller than in later phases of the trajectory; (2) the booster rocket flame offers a strong infra-red signal that facilitates target identification and tracking; and (3) the booster rocket is more vulnerable than the re-entry vehicles it releases in the post-boost phase. Failure to significantly thin-out an attack in the booster phase would present major problems to subsequent defences and could result in them being overwhelmed.

3.44 The SDI Office has identified a number of key functions and technologies associated with each layer of a potential ballistic missile defensive sytem and has grouped its research efforts into five program elements as follows:[20]

a. Surveillance, acquisition, tracking and kill assessment. This program involves research into sensing of information for initiation of the defence engagement and battle management and assessment of the status of forces during an engagement. Relevant technologies include radar and optical sensors, signal and data processing and laser imaging.

b. Directed energy weapons. This program provides for the 'development and demonstration' of technologies required for boost and post-boost intercepts. The technologies include space-based lasers, ground-based lasers, particle beam weapons and nuclear-driven energy concepts.

c. Kinetic Energy weapons. These would seek to make use of the very high velocity of a small mass to render a ballistic missile or its warhead ineffective. The technologies include hypervelocity launchers (ground, air and space-based).

d. Systems concept and battle management. This program is concerned with the command and control of ballistic missile defences and largely involves computer and communications technologies.

e. Survivability and lethality. This program examines the requisite technologies and concepts for enhancing system survivability against Soviet attack.

3.45 United States' official estimates are that the SDI will cost about $US 26 billion over the period 1985 to 1989 which represents just under 2 per cent of the total U.S. defence budget and nearly 15 per cent of the defence research budget for this period. Of this, $1.2 billion is to be spent on SDI during fiscal year 1985.

3.46 The SDI program and its underlying assumptions have triggered extensive debate over its technical feasibility, its implications for the existing arms control regime and its impact on deterrence and the maintenance of strategic stability. These issues are discussed in detail in Chapter 12 of the Report.

Anti-Satellite Systems

3.47 The Soviet Union has been testing anti-satellite devices since the late 1960s and, according to Soviet Military Power-1985, has had the capability since 1971 to attack satellites in near-earth orbits with a ground-based interceptor.

> Using a radar sensor and a pellet-type warhead, the interceptor can attack a target in various orbits during its first two revolutions ... The interceptor can reach targets orbiting at more than 5 000 kilometres, but it probably is intended for high priority satellites at lower altitudes.[21]

The potential impact of the present Soviet ASAT capability is reduced, however, by the fact that most of the important U.S. satellites, such as those used for communications and early warning, are in geosynchronous orbit - around 36 000km above the Earth - far beyond the demonstrated range of the Soviet ASAT.[22] The Soviet capability is further limited because it can only be launched from a small number of locations. Furthermore, because it is liquid-fueled, the number of ASATs that can be launched in any given time is highly constrained. Finally, the testing of Soviet ASATs has not been entirely successful. In testimony before the U.S. Senate Foreign Relations Committee in July 1979, the then Air Force Chief of Staff stated that:

> I think our general opinion is that we give it a very questionable operational capability for a few launches. In other words, it is a threat that we are worried about, but they have not had a test program that would cause us to believe it is a very credible threat.[23]

The Soviet Union is also continuing research into directed energy weapons, which could be used in an anti-satellite role, including high energy lasers, radio-pulse sources and particle beams.

3.48 For its part, the United States had operational ASAT systems deployed between 1963 and 1975 - one based on the Army's Nike missiles and the other using the Air Force's Thor missile. The U.S. is planning to begin operational testing of a new anti-satellite system soon. SIPRI reports that the new system:

> consists of a two-stage solid propellant missile carrying a non-nuclear warhead called the miniature homing vehicle (MHV) designed to damage the enemy satellite. Such missiles will be launched from F-15 aircraft flying at an altitude of 20 km.[24]

The first flight test of the air-launched MHV was on January 21 1984, and the system was successfully tested against a disused American scientific satellite on 14 September 1985. It is expected to become operational in 1987. Present procurement plans call for two squadrons of ASAT-equipped F-15s with a stockpile of 112 MHVs. SIPRI reports that the 1986 cost estimate of the U.S. ASAT program is $4 billion. This is said to include

$1 400 million for development, $2 640 million for procurement, and $40 million for military construction.[25] The implications of the developments in anti-satellite weapons for the strategic balance and for arms control are discussed in Chapter 13.

Air Defence

3.49 At present, the Soviet Union has deployed some 1 200 aircraft and nearly 10 000 surface-to-air missile (SAM) launchers for strategic defence. It could use a further 2 000 interceptors and 1 800 tactical SAMs which are contained within its tactical and theatre forces. The United States Government claims that Soviet air defences are in the initial stages of a major overhaul aimed at fielding an integrated air defense system much more capable of low altitude operations.[26]

3.50 The United States maintains an extensive satellite-based early warning system which is augmented by air and ground radar systems (which are being improved) and interceptor forces utilising F-15 and F-16 aircraft. At present there are no surface-to-air missiles for U.S. continental air defence.

Civil Defence

3.51 Over the past two decades, the Soviet Union has devoted considerable time and resources to civil or passive defence measures. These measures include hardening of military command posts, establishment of survivable communications for key military commanders and civilian managers, planning for the transition of the entire state and economy to a wartime posture and the protection of the general population through evacuation procedures and extensive sheltering in or near urban areas. From the Soviet perspective, passive defence represents an essential component of its overall military posture and war planning, and aims to ensure the survival and wartime continuity of the Soviet leadership, military command and control, industrial production, and the essential workforce.[27]

3.52 While civil defence for natural disasters has long been an important consideration in the United States, civil defence for nuclear war has only recently attracted government action.[28] One objective of the U.S. civil defence program, as defined in Presidential Directive 41 revised in March 1982 is to provide for survival of a 'substantial portion of the U.S. population in the event of nuclear attack preceded by strategic warning, and for continuity of government should deterrence and escalation control fail'.[29]

The Strategic Balance

3.53 An issue of central concern to the superpowers and their allies is the strategic balance. Are the forces of the two sides roughly equivalent or does one side have a significant advantage? Can such advantages be exploited for military, political or diplomatic purposes? Could they lead to military conflict?

3.54 There seems to be wide agreement that the maintenance of general parity between the strategic nuclear forces of the two superpowers is essential for maintaining stable deterrence and peace between them. Such a view is held by the Australian Government and is accepted by the United States and the Soviet Union. As a former Department of Defence analyst, Mr R.H. Mathams, submitted to the Committee:

> The maintenance of 'essential equivalence', with regard to nuclear forces, is vital to both superpowers. Both have used arms limitations negotiations to this end and both have a substantial capacity to develop and produce additional nuclear weapons to restore 'equivalence' if either considers that it has been unduly disturbed.[30]

There is also the view that actions by either superpower should not upset the strategic balance. As the Department of Foreign Affairs argued in its submission:

> To maintain security arms control and disarmament measures need to be balanced. Especially in cases where mutually hostile and suspicious countries confront each other, the security of all concerned is dependent on the preservation of a delicate, perhaps even precarious, stability which is likely to be upset by unilateral measures of disarmament or measures which favour one side against the other. This is a question both of military balance and of the political confidence which flows from such balance.[31]

3.55 By the early 1970s, rough strategic parity existed between the United States and the Soviet Union. This widespread belief was recognised in the SALT I and SALT II agreements which put a freeze on the most significant strategic assets held by each side. Since that time, the continuing modernisation of Soviet strategic forces has raised the concern for many Americans that parity no longer exists and deterrence is being threatened at a number of levels. The principal area of concern is the continued modernisation and deployment of Soviet ICBMs which are now, in theory, sufficiently numerous, accurate and powerful to destroy most of America's ICBM force in a first strike. Other areas of concern include the continued improvements to the Soviet air and anti-ballistic missile defence systems, the deployment of the mobile and highly accurate SS-20 missiles into Europe and Asia and the development of a new generation of short-range tactical ballistic missiles - the SS-21, SS-22 and SS-X-23 - which pose an increasing threat to NATO's sea areas and conventional forces.

3.56 These developments led Secretary of Defense Caspar Weinberger in 1985 to report to Congress that:

> The build-up in Soviet strategic nuclear forces and the improvement in Soviet strategic defense systems threatened the credibility of our deterrent posture, which rests on the assumption that our ability to retaliate will cause the Soviets to perceive that the costs of aggression would be far higher than any possible benefit. Likewise, the growing imbalance in non-strategic nuclear capabilities could potentially have led the Soviets to conclude that we would be deterred from fulfilling our commitment to defend NATO against attack.[32]

He further stated that:

> It is against this background, which it is imperative for the American people to understand, that we must form and negotiate our arms reduction proposals. This is why we must secure agreement on reductions to equal levels that are fully verifiable. This is also why it is so misleading and dangerous to urge that we must have an agreement no matter what it provides, or to argue that the United States is being stubborn in insisting on equality.[33]

These kinds of concerns have resulted in the United States modernising its own military forces, pursuing arms control proposals that would limit the perceived vulnerability of U.S. land-based missiles and deploying intermediate-range Pershing II and cruise missiles into Europe. They also provide a major rationale for President Reagan's Strategic Defence Initiative which could eventually lead to the deployment of an anti-ballistic missile defence.

3.57 Critics of these U.S. policies argue that American concern over its increasing strategic vulnerability are overstated. They contend that the strategic forces of the two sides are roughly equivalent and that recent U.S. initiatives, particularly SDI, are part of a concerted attempt to regain a position of superiority before seriously conducting arms control negotiations with the Soviet Union. They further contend that many of the United States' weapons and research initiatives will destabilise rather than stabilise the strategic balance.

3.58 There is also a view that the preoccupation with strategic parity and maintaining a balance at all levels in the strategic equation is inimical to any long term progress towards disarmament: if neither side is prepared to make concessions (out of fear that they may be exploited by its opponents), the arms race continues, albeit within a framework constrained by considerations of mutual interest. The corollary argument is that

in order to help reverse the arms race, it is necessary for one side to make a conciliatory gesture in the form of one or a series of unilateral steps which would signal that it is prepared to take the risk of making a move which might make it more vulnerable but which may, on the other hand, invite a response. Several witnesses cited President Kennedy's initiatives in 1963 towards achieving the Partial Test Ban Treaty, claiming that such moves could control the present continuing build-up of arms.

Assessing the Military Balance

3.59 The nuclear capabilities of the United States and the Soviet Union can be compared using a wide variety of measures and means. The most common approach is to compare the basic characteristics of the forces themselves. This includes such measures as the number of delivery vehicles, the number of re-entry vehicles or warheads, delivery throw-weights or payloads, and the total explosive yield of each side's arsenal (or its equivalent megatonnage). As the International Institute for Strategic Studies (IISS) noted in its publication The Military Balance 1985-1986, it is important to note that no single measurement can give a full representation of the nuclear balance:

> One measure may be useful for some purposes but not for others, and there is considerable debate among analysts as to which measures should be given greatest weight in assessing the overall balance. Moreover, many of these measures are often either themselves subject to considerable uncertainties (e.g. weapon yield), or else very sensitive to predicted performance (deliverable warheads) or to other assumptions which are also highly uncertain (e.g. effectiveness against particular classes of targets).[34]

3.60 Furthermore, such static measures do not provide any indication of how the respective strategic nuclear forces would compare during conflict nor do they indicate advantages that may accrue from industrial and economic capacity, technological know-how or geo-strategic position. Both sides therefore simulate nuclear exchanges to examine the effectiveness of dynamic measures such as readiness, reliability, command and control, and accuracy. The SIPRI Yearbook 1983 notes that in this overall context, 'the U.S. Joint Chiefs of Staff place particular importance on four numbers: total weapons, total equivalent megatonnage, weapons capable of destroying military targets, and weapons capable of destroying military targets quickly'.[35]

3.61 The assessment of the strategic balance is complicated further by a number of other factors. First, the composition and characteristics of the nuclear forces of the two superpowers

differ widely, reflecting the divergent historical, technological and geo-strategic factors that have influenced their development. These factors have led the Soviet Union to place greater emphasis on its land-based ICBM and IRBM forces whereas the United States has tended to concentrate on developing its sea and air forces.

3.62 As Mathams argued before the Committee,[36] the basic 'asymmetries' in the nuclear forces of the two superpowers make comparison and analysis of respective force capabilities very difficult. They also fuel concern by each side that its opponent may be able to exploit a perceived advantage to gain either a military or political advantage. Often the appearance of inferiority - whatever its actual significance - can have serious political consequences. Thus each side has a high incentive to achieve not only the reality but also the appearance of equal capability.

3.63 A related problem stems from the different approaches of each side to considering the strategic balance. These differences are discussed by Raymond Garthoff in his recent monograph, Perspectives on the Strategic Balance, where he concluded that:

> A broad strategic balance or equilibrium is stressed by the Soviet side, with its approach centred on the political significance of military power. The tendency in the United States is to view the strategic balance much more in analytical terms, focusing on possible uses of military power in particular options under various geopolitical scenarios, and it is therefore much more prone to see marginal advantages in a 'delicate balance of terror', as it was termed as early as two decades ago.[37]

Thus the Soviet Union would tend to see that strategic parity between it and the United States would continue as long as each had broadly similar overall capabilities including the capability to deal the other a devastating retaliatory strike in the event that it was struck first. As long as these conditions continue to exist, there could be fairly wide discrepancies in the actual or perceived strategic balance without upsetting it. The United States, on the other hand, seems to require a more exact matching of capabilities (or counter-capabilities), and is concerned by specific differences or 'windows of vulnerability'.

3.64 Another problem confronting strategic nuclear comparisons is deciding which weapons systems should be included. Delivery vehicles are usually divided into three categories: strategic or inter-continental systems with ranges normally in excess of 5 000 km; intermediate-range or theatre systems (typically 1 000 to 5 000 km) and medium and short-range or tactical systems (less than 1 000 km). In practice there is considerable overlap of weapons or delivery systems between these groupings. Furthermore, a particular weapon system may be given a

use which would normally be met by another category weapon. For example, the United States allocated a number of its strategic submarine-launched ballistic missiles for NATO use in Europe and the Soviet Union has in the past at least targeted Western Europe with a portion of its strategic ICBM force. In addition, medium-range systems can have a theatre or strategic application by virtue of where they are deployed. Thus Soviet medium-range missiles in Eastern Europe could target considerable areas of Western Europe, NATO missiles could target Moscow, and the United States could utilise its naval assets to deploy aircraft or, more significantly, cruise missiles against Soviet territory. The distinction between different weapon categories is blurred further by the existence of the independent deterrent forces of China, France and the United Kingdom, and by mobility factors. Thus Soviet SS-20 missiles targeted against China could be switched to target NATO forces, and nuclear-armed aircraft based in the United States can rapidly be deployed to Europe. Finally aircraft are difficult to classify since they are able to perform either conventional or nuclear roles and their ranges vary according to their mission and payload.

3.65 The problem of classification is compounded by new types of nuclear and non-nuclear weapons which are making static comparisons both more complicated and less important. It is becoming increasingly difficult to compartmentalise weapons into distinctive classes. Both the United States and the Soviet Union are deploying new types of weapons, for example the cruise missile, which can be used in a variety of roles with a wide range of munitions. As these kinds of weapons proliferate, it will be increasingly less feasible - for the purposes of arms control or analysis more generally - to talk and think in terms of a 'strategic nuclear balance', a 'theatre nuclear balance' and so on. On the other hand, as weapons systems grow more diverse and complex, the significance of individual weapons or delivery systems is diminishing. The factors that are becoming more important in assessing the strategic balance are those that relate to force effectiveness including target acquisition, command control and communications, redundancy, reliability and survivability. Such capabilities are more difficult to measure and, as Richard Burt has argued:

> ...it may become necessary to distinguish between two separate military balances; a symbolic balance based on static hardware counts and an operational balance reflecting the real capabilities of the two sides to engage in sustained nuclear conflict. Given trends in both nations' forces and doctrine, it seems almost certain that the latter balance - a much more elusive balance to measure - will acquire greater political significance in the years ahead.[38]

3.66 Despite these problems and different perspectives, the Committee considers that assessments of the military balance, and the impact of new weapons or arms control proposals on that

balance are important, partly for their political consequences but also as a means of determining what significant arms reductions can be pursued with the least risk in order to maintain stability at the lowest possible level of arms. Stable deterrence and avoidance of nuclear conflict depends largely on the maintenance of a strategic military balance between the nuclear forces of the two superpowers. Any change which significantly alters this balance - in real or perceived terms - or which prevents either side from retaliating in kind to a massive first strike should be avoided.

3.67 At the same time, it is important to recognise the uncertainties involved in any evaluation of a military balance - nuclear or conventional - and to understand that such calculations are to a large extent dependent on the assumptions used.

The Strategic Nuclear Balance

3.68 The International Institute for Strategic Studies (IISS) has provided a comparison of the present strategic nuclear forces of the United States and the Soviet Union in terms of the number of delivery vehicles and deliverable warheads available to either side and the destructive power of each arsenal (See Tables 3.6 and 3.7). The destructive power is represented by 'equivalent megatonnage' (EMT), which provides a measure of effectiveness against area targets such as cities. It could also be represented by 'counter-military potential' (CMP), which takes into account the accuracy of the weapon and so provides an indication of the hard-target-kill capacity of the weapons systems. The Institute noted that both 'equivalent megatonnage' and 'counter-military potential' contain high degrees of uncertainty due to difficulties in determining the exact explosive yield and accuracy of all the different weapons systems although the uncertainties associated with EMT were said to be significantly less than those for CMP. Moreover, even if EMT and CMP could be precisely determined and then aggregated for entire strategic forces, they would not be wholly effective instruments for measuring the balance of these forces since the forces are targeted against a mix of area and point targets.

3.69 Subject to the qualifications and uncertainties described above, the Tables show that the Soviet Union's ICBM force has a decided advantage over that of the United States, whereas American airpower is much greater than its Russian equivalent. Rough equivalence exists between the two sides' submarine forces; the Soviet Union has more launchers but only half as many warheads; it can deliver a slightly greater equivalent megatonnage but probably with less accuracy. Overall, both superpowers have approximately equal numbers of strategic nuclear warheads but the Soviet Union currently has 733 more delivery vehicles than the United States. The estimates of total EMT suggest a Soviet advantage of approximately 2.4:1 in ICBM and SLBM, and of roughly 1.6:1 when bomber-delivered weapons are included.

Table 3.6 Comparison of the Strategic Nuclear Forces of the United States and the Soviet Union

United States				Soviet Union			
Delivery System	Number Deployed	Warheads per Launcher	Total Warheads	Delivery System	Number Deployed	Warheads per Launcher	Total Warheads
ICBM				ICBM			
Minuteman II	442[*]	1	442	SS-11	520	1[a]	520[a]
Minuteman III	550	3	1650	SS-13	60	1	60
Titan II	26	1	26	SS-17mod1		(1)	
				mod2		(1 or 4)	
				mod3	150	4	600[b]
				SS-18mod1		(1)	
				mod2		(8)	
				mod3		(1)	
				mod4	308	10	3080[b]
				SS-19mod2		(1)	
				mod3	360	6	2160[b]
Sub-Total(ICBM)	1018		2118	Sub-Total	1398		6420
SLBM							
Poseidan C-3	304	10[c]	3040	SS-N-5	39	1	39
Trident C-4	312	8[c]	2496	SS-N-6 1		(1)	
				2		(1)	
				3	336	(1)	336[d]
				SS-N-8 1		(1)	
				2	292	1	292
				SS-N-17	12	1	12
				SS-N-18 1		(3)	
				2		(1)	
				3	224	7	1568
				SS-N-20	60	9	540
				SS-N-23	16	?	?
Sub-Total(SLBM)	616		5536	Sub-Total	979		2787+
Sub-Total (ICBM & SLBM)			7654	Sub-Total (ICBM & SLBM)			9207+
Aircraft				Aircraft			
B52G	90	20[g]	1800	Tu-95(Bear)	125	4[h]	500
B52H	90	8[g]	720	Mya-4(Bison)	45	4[h]	180
TOTAL			10 174				9987+

* 8 other launchers are comms vehicles.
a There are three Mods: Mod 1 and Mod 2 have a single 1-MT RV; the three MRV on Mod 3 are counted as one RV.
b SS-17, Mods 1 and 2, SS-18 Mods 1,2 and 3, and SS-19 Mod 2 may no longer be in service.
c May carry up to 14 RV.
d Very few Mod 1 believed in service; 2 MRV (counted as one RV).
e Assumes Mod 3 has replaced Mods 1 and 2.
f Due to approximation, these are not precise totals of the figures in the column.
g Assumes 12 ALCM, 4SRAM, 4 gravity bombs for B-52G; 4 SRAM, 4 bombs for B-52H. These are operational, not maximum, loadings. SRAM counted as deliverable warhead.
h Tu-95: 1-2 AS-3/-4 ALCM, 2-3 bombs; Mya-4: 4 bombs.

Source: International Institute for Strategic Studies, The Military Balance 1985-86.

Table 3.7: Comparison of Estimated Equivalent Megatonnage

United States				Soviet Union			
System	Total warheads [N]	Yield[MT] per warhead [Y]	Total EMT [N x Y 2/3]	System	Total warheads [N]	Yield[MT] per warhead [Y]	Total EMT [N x Y2/3]
ICBM				ICBM			
Minuteman II	442	1.20	489	SS-11 Mods 1/2/3	520	1.00	520
Minuteman III	750[a]	0.17	230	SS-13	60	0.75	50
	900[a]	0.34	438	SS-17 Mod 2	800	0.20	205
Titan	26	9.00	112	Mod 3			
				SS-18 Mod 4	3 060	(0.5)	1 940[b]
				SS-18 Mod 3	2 160	(0.55)	1 450[c]
SLBM				SLBM			
Poseidon	3 040	0.05	413	SS-N-5	39	1.00	39
Trident C-4	2 488	0.10	538	SS-N-8 Mod 1		(1.00)	
				Mod 2	336	(1.00)	200
				Mod 3		(0.50)	
				SS-N-8 Mod 1	292	(1.00)	252[d]
				Mod 2		(0.80)	
				SS-NX-17	12	1.00	12
				SS-N-18Mod 2	1152	(0.45)	470[e]
				Mod 3		(0.20)	
				SS-N-20	540	(0.20)	185
				SS-N-23	16	no data	-
Sub-total [ICBM and SLBM]:			2 230	Sub-total [ICBM and SLBM]:			5 323[f]
Aircraft				Aircraft			
B-52G(90)[g]	1 080	0.25	429	Tu-95[h] Bear-B,-C			
	360	0.20	123	-G,-H	500	0.88	452
	360	1.00	360	Mya-4[h] Bison	180	0.2	82
B-52H(90)[g]	360	0.20	123				
	360	1.00	360				
TOTAL:			1 395	TOTAL:			514
GRAND TOTAL:			3 625	GRAND TOTAL:			5 837[f]

[*] Assumes 250 msls carry 3 x 0.17-MT, 300 carry 3 x 0.34-MT MIRV.
b Assumes all msls now carry 10 x 0.5-MT MIRV.
c Assumes all msls now carry 6 x 0.55-MT MIRV.
d Assumes all are Mod 2 msls, carrying 0.8-MT single RV.
e Assumes 104 msls carry 3 x 0.45-MT, 120 carry 7 x 0.2-MT MIRV.
f Due to approximation, these are not precise totals of the of the figures in the column.
g B-52G: 12 ALCM at 200 KT, 4 SRAM at 200 KT, 4 bombs at 1Mt; B-52H: 4 SRAM at 200 KT, 4 bombs at 1 MT.
h Tu-95: 1-2 AS-3/-4 ALCM, 2-3 bombs; Mya-4: 4 bombs.

Source: IISS, The Military Balance 1985 - 1986, London, 1985, p 181

3.70 The Tables also show that the United States has a much more balanced strategic force than the Soviet Union which has the bulk of its strategic power concentrated on its land forces. As well, the strategic forces of the United States are technologically more advanced (they tend to be more accurate and therefore require smaller explosive yield per warhead) than their Soviet counterparts, although this difference is becoming less marked. These latter factors would tend to offset Soviet numerical superiority particularly under operational conditions.

3.71 The Committee considers that the Tables indicate that the strategic nuclear forces of the two superpowers are 'essentially equivalent'. In addition, both sides at present retain the capability to deliver its adversary a devastating retaliatory blow in the event that the other strikes first. This view has been generally supported by Australian Government Officers and other expert witnesses who appeared before the Committee. A former senior intelligence analyst with the Australian Department of Defence, Mr R.H. Mathams, stated for example that at present:

> ... the operational capabilities of the two forces are, in sum, 'essentially equivalent'; or, at least, there is a sufficient perception of operational equivalence by both superpowers to ensure substantial deterrence against actions that might lead to the use of nuclear weapons.[39]

A similar view was expressed by Australia's Ambassador for Disarmament, Mr Richard Butler, who concluded that:

> ... I do not deny that there are quantitative differences [between the superpower arsenals] nor do I deny the asymmetries that are very significant, but ... I personally do not believe there is an imbalance and more specifically I believe that mutual deterrence continues to prevail.[40]

3.72 A number of witnesses also suggested that there are changes in prospect which, if continued, could 'destabilise' the present balance and lead to conflict. These changes embrace the development of new weapons systems and capabilities and ways in which such weapons should be used. They are described in later chapters.

The Nuclear Balance In Europe

3.73 Table 3.8 compares the nuclear and nuclear-capable forces of NATO and the Warsaw Pact countries which are deployed in Europe. Such comparisons are limited by difficulties in separating theatre weapons from strategic ones, by multiple roles of some weapons systems and by uncertainties over the number of weapons systems deployed in Europe by the Warsaw Pact.

Table 3.8: NATO/Warsaw Pact Potential Nuclear Weapons Systems in Europe

2. NATO/WARSAW PACT POTENTIAL NUCLEAR WEAPON SYSTEMS, EUROPE

NATO			WARSAW PACT		
Category and type	Countries deploying	Launcher total 7/85[a]	Launcher total 7/85	Countries deploying	Type
LAND-BASED					
ICBM			[b]	USSR	SS-11/-17/-19
IRBM					
SSBS S-3	France	18	120	USSR	SS-4
			261[c]	USSR	SS-20
GLCM					
BGM-109A *Tomahawk*	USA	64			
MRBM					
Pershing II	USA	54			
SRBM					
Pershing IA	USA	54	(450)	USSR	SS-21/*FROG*
Pershing IA	FRG	72	(516)	USSR	SS-23/*Scud* A/B
Lance	USA	36	90	USSR	SS-12/-22
Lance	Allies[d]	55	208	Allies	*FROG*-3/-5/-7
Pluton	*France*	44	132	*Allies*	*Scud* B/C
Artillery[e]					
M-110	USA	500			M-1976, 2 S-5, S-23, M-55/D-20,
M-110	Allies	357	(3,500)	USSR	M-1973/C2-53, M-1975 how,
M-109	USA	500			M-1975 mor
M-109	Allies	1,187	140	Allies	M-1955, D-20 152mm gun/how
SAM (dual-capable)					
M1M-14B *Nike Hercules*	Allies[f]	443			
SEA-BASED					
SLBM					
UGM-73A *Poseidon* C-3	USA	40[g]	24	USSR	SS-N-5
Polaris A-3	Britain	64			
MSBS M-20	France	64			
M-4	*France*	*16*			
SLCM					
BGM-109A *Tomahawk*	USA		130[d]	USSR	SS-N-3[d]
(TLAM/N nuc mod to be installed in *Los Angeles*			48[d]	USSR	SS-N-7[d]
SSN (12); *Iowa* BBG (8); *Virginia*, *Ticonderoga*,			140[d]	USSR	SS-N-9[d]
Long Beach, California, CGN/CG (16); *Burke*,			80[d]	USSR	SS-N-12[d]
Spruance DDG.)			48[d]	USSR	S-N-19[d]
AIR					
Land-based strike					
F-104	Allies[f]	258	360	USSR (Air Force)	Tu-95, Mya-4, Tu-16, Tu-22, Tu-22M
F-4E	USA	96			
F-4E/F	Allies[f]	173	165	USSR (Navy)	Tu-16, Tu-22, Tu-22M
F-111E/F	USA	150			
F-16	USA	144	1,190	USSR (Frontal)	Su-7, MiG-21, MiG-27, Su-17
F-16	Allies[f]	242			Su-24
Mirage IVA	France	22	95	Allies[f]	Su-7
Mirage IIIE	France	30	35	Poland	Su-20
Jaguar	France[f]	45	100	Allies[f]	MiG-23
Tornado	Allies[f]	311			
Carrier-based strike					
A-7/F-18	USA	48[g]			
Super Etendard	France	36			
ASW					
S-3A	USA	20[g]	(110)	USSR	Tu-142, Il-38, Be-12
P-3	US	(12)			
P-3	Allies[f]	20			
Nimrod	Britain	28			
Atlantic	Allies[f]	55			

[a] Listings for US assume unreinforced deployments except in the case of *Poseidon* SLBM, 40 of which are assumed to be assigned to Supreme Allied Commander Europe from US central systems.
[b] A proportion of the launchers deployed (shown in Table 1) is assigned to peripheral targets.
[c] For detail, see Table 1.
[d] USSR types and totals based on estimated naval deployments and equipments.
[e] Figures assume 2 US carriers in European area.
[f] Incl 45 in range in Central Asia.

Source: IISS, The Military Balance 1985-1986, pp.165-166.

3.74 The figures for 1985 show that with the continued deployment of Soviet SS-20 missiles, the Warsaw Pact enjoys a considerable advantage in land-based missile systems (1 777 launchers or 2 299 warheads compared with 396). The advantage is partly offset by NATO's stronger sea-based missile systems (868 deliverable warheads compares with 470). This latter advantage is based on the assumption that 40 United States Poseiden SLBMS are assigned to the Supreme Allied Commander Europe from U.S. central systems. A similar difference operates between land and carrier-based nuclear-capable strike aircraft. IISS notes, however, that nuclear capability does not necessarily imply a primary nuclear role, and, in the case of NATO at least, the nuclear role for aircraft has progressively diminished. Moreover, many Warsaw Pact aircraft, especially those operated by Eastern European forces, are likely to be used in an interceptor role rather than ground attack and so would not carry offensive nuclear weapons.

The Conventional Balance of Forces in Europe

3.75 The lastest IISS estimate of the East-West Conventional balance in Europe is given in Table 3.9. The balance is presented in terms of a range of static indicators comprising manpower, divisional organisation and their equivalents, ground force equipment, naval units, naval and maritime aircraft and land attack aircraft. The totals are given for NATO in Central and Northern Europe (taken together) and Southern Europe, for United States forces in Europe and for NATO as a whole. These totals are compared with equivalent Soviet and non-Soviet holdings both in absolute numbers and as a proportion of NATO strengths in each category.

3.76 In addition to the general factors described at the beginning of this section, the comparison of conventional forces involves a number of uncertainties and unknowns that could have an important bearing on the assessment of the overall balance. First, depending on the particular contingency, not all of the manpower shown in Table 3.9 may be available for deployment into Europe. Some of the U.S. strategic reserves based in America and earmarked for Europe, for example, also form the nucleus of their Rapid Deployment Forces and so may be needed elsewhere in a major crisis.

3.77 Secondly, the mobilisation and deployment rates of the two forces differ. Both Western European and Warsaw Pact countries can quickly mobilise and deploy extra forces, although some refresher training may be required. United States and British reinforcements would need to be transported to Europe by sea and air which could be slow and vulnerable to attack. Furthermore, the successful deployment of British and American reserves critically depends on the ability of NATO front-line forces to delay an initial enemy advance and deploy its own reserve forces. The Soviet Union would also have a number of problems in respect to force mobilisation and deployment. Not all Soviet forces are maintained at full strength (so-called Category 2 and Category 3 division are only manned at 50 per cent and 10 per cent levels) and would need to be expanded either prior to or at the commencement of hostilities. Furthermore, the long lines

Table 3.9: Conventional Force Comparisons: NATO and Warsaw Pact

	NATO				Ratios of	Warsaw Pact				
	Europe				NATO:Pact		Soviet		Non-Soviet	
	North[a]	South[b]	US	Total	Totals	Total	North[c]	South[d]	North[e]	South[e]
Manpower (000)										
Total uniformed manpower[f]	1,629	1,290	2,152	5,071	1:1.27	6,440	5,300		696	444
Reserves (all services)	2,200	2,312	2,332	6,844	1:1.09	7,484	5,400		1,181	903
Total ground forces	1,006	994	979	2,979	1.06:1	2,809	1,995		475	339
Total ground force reserves[f]	1,738	1,800	1,143	4,681*	1:1.13	5,280	3,500		995	785
Total ground forces deployed in Europe	877	994	217	2,068	1:1.29	2,685	1,173	698*	475	339
Divisions[g]										
Divs deployed in Europe, manned in peacetime	Tk[h]	12½	2	2½	16½	1:1.60	26½	14	2	8	2½
	Mech	5½	3	2½	10½	1:4.13	44	20	6	12	6
	Other	2½	1½	1½	5½	1:1.35	7½	3½	1½	2	1
Divs for reinforcement, manned or on mobilisation of reserves[i]	Tk	6½	2½	4½	14	1:2.21	31	17	8	4	2
	Mech	14	17½	8½	40	1:1.68	67	18	29	5	15
	Other	13	17½	15½	46	-	-	-	-	-	-
Total divs, war mobilised[j]	Tk	19	4½	7	30½	1:1.88	57½	31	10	12	4½
	Mech	19½	20½	11	50½	1:2.19	111	38	35	17	21
	Other	15½	19½	16½	51½	6.74:1	7½	3½	1½	2	1
Ground Force Equipment										
Main battle tanks		8,799	6,534	5,000	20,333	1:2.59	52,600	24,200	13,800	10,200	4,400
Arty, MRL		4,235	4,509	670	9,414	1:3.24	30,500*	14,800	8,900	3,540	3,275*
SSM launchers		165	32	168	365	1:4.30	1,570	660	370	196	146
ATK guns		364	-	-	364	1:4.63	1,684*	456*	468	420	340*
ATGW launchers (crew-served, AFV-, hel-mounted)		1,292	134*	800*	2,226*	1:2.79	6,218*	2,660*	2,350*	688*	320
AA guns		3,776	1,778	100	5,654	1.25:1	4,506[k]	1,100	780	1,576*	1,050
SAM launchers (crew-served, ground forces only)[l]		527	173	180	880	1:6.60	5,808[k]	2,800*	1,730*	760*	518*
Naval Units										
Submarines: cruise missile attack		-	-	-	-	-	41*	39	2	-	-
		87	48	53	188	1.38:1	136*	103	28*	3	2
Carriers		5	3	7	15	5.00:1	3	1	2	-	-
Cruisers		-	3	11	14	1:1.79	25	16	9	-	-
Destroyers		59	34	39	132	2.49:1	53*	31	21*	1	-
Frigates		98	40	47	185	3.49:1	53*	31*	15	2	5
Corvettes/large patrol craft		68	52	-	120	1:1.04	125*	47*	30	33	15
FAC(G/T/P)		101	55	6	162	1:2.36	383*	110*	100	96	77
MCM[f]		185	77	3	265	1:1.11	293*	165*	65	50	13
Amphibious[m]		34	109	27	170	1.75:1	97	38	21	38	-
Naval and Maritime Aircraft										
Bombers		36	-	-	36	1:5.14	185	85	100	-	-
Attack		110	20	336	466	3.61:1	129*	30	65*	34	-
Fighters		44	8	168	220	5.50:1	40*	40*	-	-	-
ASW		21	6	70	97	1:1.44	140	140	-	-	-
MR/ECM		160	49*	77	286	1.80:1	159*	99	50*	10	-
Asw hel		215	126	136	477	4.30:1	111	60	40	8	3
Land Attack Fighter Aircraft[n]											
Bombers		151	-	-	151	-	-	-	-	-	-
FGA		1,194	745	378	2,317	1:1.23	2,851*	1,915	325*	441	170
Fighters		94	216	144	454	1:2.44	1,110*	625*	265*	150	70*
Interceptors		351	-	96	447	1:3.97	1,775*	790*	265*	825	395
Reconnaissance[o]		195	93	69	357	1:1.18	423	167	80	110	66
Armed hel		(in Army)		330*		(data incomplete)	721*	495*	80*	102	44

* Estimated figures.

[a] Comprises Norway, Denmark, W. Germany, Luxembourg, Netherlands and Belgium, and includes forces actually deployed from Britain, Canada, US (Second Fleet), France (Army; Navy: Atlantic-deployed elms incl Naval air).

[b] Comprises Turkey, Greece, Italy, Portugal, France (Navy), US Sixth Fleet and forces deployed in Southern Europe.

[c] Comprises Poland, E. Germany and Czechoslovakia, and includes Soviet forces in these countries and in the Leningrad, Baltic, Byelorussian and Carpathian MD.

[d] Comprises Hungary, Romania and Bulgaria, and includes Soviet forces in Hungary and in the Odessa, Kiev, North Caucasus and Trans-Caucasus MD.

[e] "Uniformed manpower" refers to main forces only and excludes para-military forces.

[f] "Reserves": Many countries have Reserve obligations into middle age; where not otherwise stated in the country entry, a five-year post-conscript period has arbitrarily been selected in calculating the numbers. After five years, health and training standards begin to decline. In Pact countries a large proportion of these older reservists are probably assigned to "shadow" formations and units with stored obsolete equipment, potentially doubling the mobilisable forces from those shown but necessarily at very low standards of efficiency. This table, however, shows equipment totals for listed Category 1, 2 and 3 divisions only.

[g] Divisions are not a standard formation between Armies: 3 brigades or regiments are considered to be a divisional equivalent.

[h] "Tk" includes tank and armoured divs; "Mech" includes mechanized, motorised and motor rifle; "Other" includes airborne, air portable, mountain, amphibious, light infantry and naval infantry.

[i] Mobilisation and reserve reinforcement systems vary considerably. A distinction between the two categories of immediate reinforcement and "when mobilised" must of necessity be judgmental, especially for NATO. This year's entry combines them, in contrast to previous years. See country entries for detail.

[j] Figures in part are unit organisations. Ratio between guns and SAM may vary.

[k] Field forces only; Soviet Air Force and APVO equipment is considered primarily to be for airfield defence and not for use by field formations.

[l] Excludes support craft and inshore boats.

[m] Excludes LCV, LCVP, LCA, small craft.

[n] OCU aircraft are included in these totals.

[o] Includes EW/ECM aircraft.

Source: IISS, The Military Balance 1985-1986, pp.186-187.

of communication in Eastern Europe are vulnerable to interdiction by NATO air forces which could attack them before they are ready for deployment. This is the basis of the 'deep-strike' strategies being investigated by NATO (see Chapter 2).

3.78 Third, the Warsaw Pact has been able to standardise its weapons systems and tactical doctrine whereas NATO employs a range of doctrines and weapons with consequent duplication of supply systems and inter-operability problems. On the other hand it is clear that NATO is making concentrated efforts to apply modern technology to warfare. This is perhaps most noticeable in the case of armoured warfare where NATO planners have sought to make full use of the latest developments in armour, shell and gun laying equipment to produce vehicles which are qualitatively superior to anything the Pact currently possesses. Whether such technological superiority would offset the Warsaw Pact's numerical advantage is impossible to answer without the test of combat.

3.79 In its assessment of the conventional balance in Europe, the Institute acknowledged that the presence of these kinds of unknown and unknowable factors makes it difficult to draw firm conclusions on whether NATO could be defeated in war or whether the Warsaw Pact enjoys an advantage sufficient to risk an attack. This notwithstanding, the Institute concluded that there is 'sufficient danger in the trend to require remedies in the Western Alliance', and that:

> The numerical balance although generally in favour of the Warsaw Pact (particularly in equipment) appears to have stabilised over the past year. At the same time, however, the West has largely lost the technological edge in conventional equipment which allowed NATO to believe that quality could substitute for numbers.[41]

The Institute qualified this assessment, however, with the further observation that:

> ... the conventional overall balance is still such as to make general military aggression a highly risky undertaking for either side. Though possession of the initiative in war will always permit an aggressor to achieve a local advantage in numbers sufficient to allow him to believe that he might achieve limited tactical successes in some areas, there would still appear to be insufficient overall strength on either side to guarantee victory. The consequences for an attacker would still be quite unpredictable, and the risks, particularly of nuclear escalation, incalculable.[42]

CHAPTER THREE
ENDNOTES

1. This discussion of the history of the arms race is largely derived from The Harvard Nuclear Study Group, Living with Nuclear Weapons, Harvard University Press, Cambridge, Massachusetts, 1983, Chapter 4.

2. Living with Nuclear Weapons, p.85.

3. Living with Nuclear Weapons, p.89.

4. Living with Nuclear Weapons, p.95.

5. Information contained in this section has been extracted from the Stockholm International Peace Research Institute, World Armaments and Disarmament, SIPRI Yearbook 1986, Oxford University Press, Oxford, 1986; The International Institute for Strategic Studies, The Military Balance 1985-1986, London, 1986; Soviet Military Power (Fourth Edition), US Government Printing Office, April 1985; and Thomas B. Cochran, William M. Arkin and Milton M. Hoenig, Nuclear Weapons Databook: Volume 1, U.S. Nuclear Forces and Capabilities, Ballinger, Cambridge, Massachusetts, 1984.

6. See Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1985 Budget, FY 1986 Authorization Request and FY 1985-89 Defense Programs, U.S. Government Printing Office, February 1, 1984, pp. 43-59.

7. SIPRI Yearbook 1986, pp.50-51.

8. Report of the Secretary of Defense, p.187.

9. William M. Arkin, Thomas B. Cochran and Milton M. Hoenig, 'Resource Paper on the U.S. Nuclear Arsenal', Bulletin of the Atomic Scientists, August/September 1984, p.8s.

10. Resource Paper on the U.S. Nuclear Arsenal, p.8s.

11. The Military Balance 1984-1985, p.137.

12. Resource Paper on the U.S. Nuclear Arsenal, p.10s.

13. United Nations Centre for Disarmament, Comprehensive Study on Nuclear Weapons, New York, 1981, pp.33-4.

14. Comprehensive Study on Nuclear Weapons, p.32.

15. Soviet Military Power 1985, p.48.

16. SIPRI Yearbook 1984, p.358.

17. U.S. Department of Defense, Report to the Congress on the Strategic Defense Initiative, 1985, p.3.

18. Report to the Congress on the Strategic Defense Initiative, p.7.

19. United States Information Service, Fact Sheet on the Strategic Defence Initiative, 10 June 1985, p.5.

20. Report to the Congress on the Strategic Defense Initiative, Section VI.

21. Soviet Military Power 1985, p.55.

22. See, for example, The Fallacy of Star Wars, Chapter 10 and the 'Space Weapons' supplement contained in Bulletin of the Atomic Scientists, May 1984.

23. The Fallacy of Star Wars, p.208.

24. SIPRI Yearbook 1982, p.300.

25. SIPRI Yearbook 1986, p.133.

26. Soviet Military Power 1985, p.48.

27. See for example Captain John F. Troxell, 'Soviet Civil Defense and the American Response', Military Review, January 1983, pp.36-46.

28. See 'Soviet Civil Defense and the American Response' and 'Programs for Surviving Nuclear War: A Critique', Bulletin of the Atomic Scientists, June/July 1983, supplement.

29. 'Programs for Surviving Nuclear War', p.8s.

30. R.H. Mathams, Submission, p.S650.

31. Department of Foreign Affairs, Submission, p.55

32. Report of the Secretary of Defense, p.23.

33. Report of the Security of Defense, p.23.

34. The Military Balance 1985-1986, p.178.

35. SIPRI Yearbook 1983, pp.47-48.

36. R.H. Mathams, Submission, p.S649.

37. Raymond L. Garthoff, Perspectives on the Strategic Balance, The Brookings Institution, Washington, D.C. 1983, p.34.

38. Richard Burt, 'Reassessing the Strategic Balance', International Security, Summer 1980, p.39.

39. R.H. Mathams, Submission, p.S650.

40. Evidence, 7 June 1984, p.92.

41. The Military Balance 1985-1986, p.185.

42. The Military Balance 1985-1986, p.185.

CHAPTER 4

DETERRENCE AND THE STRATEGIC NUCLEAR DOCTRINE OF THE SUPERPOWERS

Introduction

4.1 Weapons and armed forces are not developed or maintained for their own sake. They form part of a country's overall strategy - encompassing political, diplomatic, economic, social and security considerations - for meeting its national objectives. The readiness to use military forces for this purpose is defined by a nation's strategic doctrine. Both the United States and the Soviet Union have plans and policies for the effective use - or skillful non-use - of their nuclear and non-nuclear forces under a range of possible contingencies or circumstances. Any assessment of the risks and consequences of nuclear war must take these plans into account.

4.2 The examination of strategic doctrine is not an easy matter. It is a highly complex subject and is compounded by a propensity for jargon, the dictates of official secrets acts, and, in the case of the Soviet Union in particular, the absence of detailed information. It is complicated further by the fact that the development of nuclear weapons and their continued acquisition by the superpowers pose fundamental problems for politicians and strategists alike by calling into question many existing political and military institutions and traditions. These issues have led to a continued, and to date unresolved, debate in the United States over the most appropriate strategic doctrine for the nuclear age. Some argue for the continuation of existing concepts and practices, others say that current policies are increasing the risks of nuclear war and so should be replaced.

4.3 The same debate is taking place in Australia, albeit in a more muted form, and was reflected in the submissions to this inquiry. The issue is important because of Australia's close relationship with the United States - based on a range of common ideals and interests - and its continued support for U.S. strategic doctrines and policies. If we assess the present approach can be improved, then Australia would urge its review. This Chapter describes the evolution, current status and characteristics of the strategic nuclear doctrines of the two superpowers, and discusses some of the major criticisms of their current policies.

The Basic Problems Posed by the Existence of Nuclear Weapons

4.4 The advent of weapons of mass destruction has brought with it the problem of deciding whether and how these new forces should be used. On the one hand, the leaders of both superpowers are faced with the certain knowledge that nuclear weapons are capable of destruction beyond human comprehension. The consequences of using even a single nuclear weapon are difficult to imagine and there is growing scientific speculation (described in Chapter 6) that the explosion of a small fraction of today's

nuclear arsenals could have severe world-wide climatic and ecological repercussions through the so-called 'nuclear winter' effect. These potential consequences raise serious questions about what kind of political or strategic goal could justify the use of nuclear weapons. On the other hand, both superpowers are confronted by the fact that nuclear weapons do exist, they are in the hands of adversary states and they provide the potential for enormous military or political influence. Both sides will not rely entirely on the good sense of its opponent not to use nuclear weapons and so each continues to expand and improve its nuclear forces and plans for their employment, to prevent nuclear war from occurring and to satisfy certain goals in the event of military conflict.

4.5 The central problem of how best to utilise weapons that we hope will never be detonated is compounded by the fact that both superpowers have large and secure nuclear forces, that nuclear weapons can be delivered virtually anywhere in the world in a matter of minutes and that, at present, there is no real defence against them. These developments have radically altered the nature of strategic warfare and the use of force in the pursuit of national interests. In the past, nations could use military force to either defend themselves against aggression or conquer and destroy adversaries. There were clear winners and losers. Now the 'losers' can equally easily destroy the winners. The forces that inflict damage on an adversary can no longer protect the state. Attacking and destroying an adversary's military forces will not prevent the destruction of its own homeland; each side can protect its cities only with the cooperation of its adversary. In short, nuclear war between nuclear armed states is no longer 'the continuation of politics by other means' but only suicide.

4.6 Planning for the employment of nuclear weapons is also complicated by the fact that no-one has first-hand experience of bilateral nuclear war. Effective conventional military doctrines draw on the experience of history where we are able to examine large numbers of instances of political and military conflict. There is no operational history of thermonuclear war to study or draw lessons from. All our knowledge is derived from the study of hypothetical contingencies. We can only speculate, for example, on the number and types of nuclear weapons that are sufficient to satisfy national objectives, or what is required to influence an adversary in a particular way, or what course a nuclear war might take. The lack of evidence about the effect of alternative nuclear strategies means that strategic planning in the nuclear age is a theoretical or deductive exercise. Under such circumstances, care must be taken that strategic doctrines and their underlying assumptions do not entail unrealistic conflict scenarios or that they do not impose conditions or expectations on their military forces which are unattainable.

4.7 The West has sought to accommodate the dilemmas and problems posed by nuclear weapons through the notion of nuclear deterrence. Deterrence aims to convince the potential adversary

that he has nothing to gain by using force or threatening to use it, and that he runs the risk of having to accept serious setbacks in the event of a conflict. Deterrence is not a new phenomenon. Nations have, in the past, used strong defences or military forces to deter potential adversaries from aggressive or coercive acts. The cornerstone of nuclear deterrence, however, is the primacy of offensive forces which are used to 'defend' the national interest. Defensive capabilities, at least against ballistic missile attack, have remained very limited although both the United States and the Soviet Union are continuing to conduct research into various defensive technologies. These include ballistic missile defences, air defence and anti-submarine warfare.

4.8. While there is general agreement on the need for a strategy of nuclear deterrence, there have been, and still are, considerable differences of opinion over the detailed application of this strategy. In particular, differences arise about the kind of military forces required and their appropriate operational doctrines and preparedness. Colin Gray has identified in his book Nuclear Strategy and Strategic Planning the three principal schools of thought that have dominated the debate over deterrence in the West.[1] They are:

a. 'Societal Punishment'. Sometimes known as 'basic deterrence', under this approach the Soviet Union 'is deterred by the prospect of suffering societal punishment on a massive scale' in the event it attacks the United States or its interests. Gray notes that there are several variants to this approach differing largely in terms of the size of the retaliatory forces although the 'difference between massive damage and more massive damage is not of interest from the perspective of deterrence or of likely physical and social effects'.

b. The 'Countervailing Strategy' or 'extended deterrence'. In this view, 'the Soviet Union is deterred when confronted by threats that both focus on the highest of official values and have some credibility about them with respect to likelihood of action. The United States deters by threatening to thwart Soviet strategy - deny victory to the Soviet Union - by striking at the war-waging structure and instruments of the Soviet State. Credibility is lent to the prospect of execution by targeting plans that are designed to preclude, or minimize, unwanted collateral damage'. The countervailing strategy utilises, and is sometimes described in terms of, counterforce weapons and capabilities. These are weapons systems that are capable of destroying military targets such as missile silos, nuclear stockpiles or command and communications centres.

c. The 'Prevailing Strategy'. Under this approach, the Soviet Union 'is deterred when the United States is able both to impose military - and hence political - defeat on Soviet arms and to secure the achievement of Western political purposes at a military, economic, and social cost commensurate with the stakes of the conflict'. Gray notes that the prevailing strategy involves more than simply denying victory to the enemy. 'To prevail in stressful circumstances the United States must be able to defend itself against nuclear attack. In this perspective, credibility for deterrent effect flows from ... Soviet belief, or strong suspicion, that the United States could fight and win the military conflict and hold down its societal damage to a tolerable level'. The prevailing theory of deterrence retains the concept of basic deterrence but extends it to cover a range of lower-level contingencies.

4.9 These three schools of nuclear-policy thinking represent different ways of accommodating the nuclear problems described above. Each view has its strengths and weaknesses and each has always been represented to some degree in the United States nuclear policy of the day. While there are problems in separating America's real (or operational) nuclear strategy from its publicly declared strategic position,[2] it is clear that the emphasis of U.S. and NATO nuclear strategy has changed over time from societal punishment or 'basic deterrence' through the countervailing strategy and towards, but not yet encompassing, the ability to 'prevail'. Thus while the principal goal of U.S. nuclear strategy over the last forty years has been to deter nuclear war, the way this objective is to be achieved has changed as new doctrines and technologies have evolved. The principal concern of some commentators is that this trend has introduced new problems which may threaten to undermine deterrence. Some argue that the 'countervailing' strategy increases the possibility of nuclear war.

4.10 For its part, the Soviet Union has tended far more than the United States to treat elements of its nuclear arsenal in much the same way as conventional weapons. From the beginning, the Soviet Union integrated its nuclear weapons into its traditional military operational structures. Further, in so far as can be ascertained from unclassified sources, it has always employed doctrines for tactical nuclear use that are similar or the same as doctrines for conventional conflict. This should not to be taken to suggest, however, that the Soviet Union does not understand the concept of deterrence and does not employ it. It is true that it does not use the term 'deterrence' in its pronouncements on nuclear weapons matters (perhaps because the term is identified with American strategic doctrine). Nevertheless, the Soviet military posture seems to be calculated to prevent aggression against the Soviet Union. In addition, the Soviet Union has demonstrated a willingness to comply with principles of strategic nuclear deterrence as they

are understood in the West. The Soviet Union has signed the ABM Treaty which enshrines the logic of deterrence through mutual vulnerability. Thus, while it has devoted considerable resources to civil defence and has deployed significant active defences against nuclear attack, the Soviet Union appears to recognise that it remains vulnerable to nuclear attack in like manner to the United States.

4.11 Over recent years, there has been a convergence of American and Soviet strategic doctrine and associated military capabilities. While accepting the premise of mutual vulnerability at the strategic level, both nations now emphasise counterforce weapons and capabilities and both have deployed tactical and intermediate-range nuclear forces. Despite this increasing convergence, there remain significant differences between the two sides, however, which have important consequences for future stability.

Soviet Nuclear Policies and Doctrine

4.12 It is very difficult to establish an accurate picture of Soviet nuclear policies or strategy. Soviet nuclear policies are not publicly available in coherent form and so they need to be deduced from a range of disparate sources including Soviet military writings, current force dispositions, speeches and official releases. Despite these difficulties, Western scholars have been able to identify certain common themes and trends that characterise the Soviet Union's strategic posture and its nuclear objectives and policies.[3]

4.13 There is broad agreement, for example, that Soviet force structures and military doctrines are significantly influenced by geographic and historical factors. The most important of these is the Soviet Union's position as a large continental nation separated from powerful neighbours by long and relatively accessible borders. This geo-strategic vulnerability coupled with memories of a devastating German invasion in 1941 has led the Soviet Union to seek to maintain a buffer zone of acquired territories and allies along its borders in order to protect its heartland from intrusion. They have also impelled it to maintain very strong regional forces which have significant strategic importance since its European and Chinese neighbours now possess nuclear delivery systems that are capable of attacking the Soviet homeland or its forces in wartime.

4.14 In addition to its regional forces, the Soviet Union maintains inter-continental-range nuclear forces that are capable of striking targets in the United States. The need for such a capability became critical in the 1960s when the United States began to deploy large numbers of inter-continental weapons that could not be effectively offset by Soviet defences

or regional forces. The principal purposes of the Soviet Union's inter-continental forces are:

> ... to directly offset the strategic forces of the United States as a means of defending the Soviet homeland, supporting its global interest, and underpinning its aspirations for achieving regional predominance, both politically and militarily.[4]

4.15 The same factors have also been important in determining how these forces would be used. Traditionally, Soviet military forces and military thinking have been dominated by land force concepts which are still reflected in the modern Soviet approach to the use of its regional and long-range nuclear forces and weapons systems. At the regional level, Soviet operational planning is based on the simultaneous employment of nuclear and non-nuclear forces with emphasis on decisive action and territorial occupation. As noted in Chapter 2, if war should break out in Europe, the Soviet Union's principal objectives would be to use all of the forces at its disposal to quickly destroy its adversaries' military forces and war-making capacity as well as to seize and hold vital contiguous territory.

4.16 Although the principal objective of the Soviet Union's inter-continental forces is to deter the use of American strategic nuclear forces, should deterrence fail, Soviet strategy would aim to destroy U.S. strategic assets and its supporting economic and industrial base. As Berman and Baker have stated, in the event of an all-out war:

> ...Soviet military writings suggest the American threat would be countered by deep nuclear strikes at military and non-military targets that would so devastate the United States that it could no longer influence the course of the war. Success in this mission would greatly improve the Soviet Union's chances of achieving its regional objectives and assuring the survival of its homeland.[5]

4.17 There are two major consequences of the continuing currency of early Soviet strategic thinking. The first relates to the necessity to defend the Soviet Union and Soviet communism. In pursuit of this defence, the Soviet Union has conscientiously pursued civil defence, the hardening of command and control facilities, air defence and anti-ballistic missile (ABM) defences. In seeking to defend the Soviet homeland and revolution, the Soviet leadership has consistently devoted significant resources to the survivability of its military forces and industrial capacity in order to sustain long, drawn-out military campaigns. In continuing with these programs the Soviet Union has conveyed the impression that it would attempt to avoid the 'assured destruction' of a nuclear war with the U.S. Although the Soviet Union abides by most of the provisions of the ABM Treaty (which is the major guarantee of 'assured destruction') it has demonstrated that it is pursuing many options that may

prevent the destruction of the Soviet Union in a nuclear war. The current Soviet strategic defence program complies with this long-standing strategic goal.

4.18 The second major effect of the continuation of early Soviet strategic thinking is the persisting Soviet belief that war is a viable option. In the nuclear era the maintenance of this view entails the feasibility of nuclear war. In Soviet military literature there is an increasing number of references to techniques for conducting war, both non-nuclear and nuclear, at the tactical, operational and strategic levels. While these references do not reveal that the Soviet Union wants to go to war, they clearly indicate a Soviet assessment that they have the capability to wage war effectively, even with nuclear weapons, and achieve political goals:

> This does not mean that nuclear war...has ceased to be an instrument of politics, as is claimed by the overwhelming majority of representatives of pacifist, anti-war movements in the bourgeois world. This is a subjective judgement. It expresses merely protest against nuclear war.[6]

In fact nuclear war has been conceived to be an adjunct to other forms of the global struggle in Soviet strategic thinking:

> Nuclear war...should not be thought of as a gigantic technical enterprise alone - as a launching of an enormous number of missiles with nuclear warheads to destroy the vital objectives and manpower of the enemy, or as operations by the armed forces alone. Nuclear war is a complex and many-sided process, which in addition to the operation of the armed forces will involve economic, diplomatic and ideological forms of struggle. They will all serve the political aims of the war and be guided by them.[7]

Indeed, some Soviet sources indicate that the Soviet Union considers its nuclear arsenal to be the principal element of the Soviet forces for this purpose:

> [Results depend]... on the presence and distribution of nuclear weapons among the various branches of the armed forces and the combat arms, on the power of the available nuclear warheads and the capabilities of their carriers, and the effectiveness of the systems for air defense and the control of troops.[8]

4.19 The Soviet Union conceives of superpower war in broad terms. First, the Soviet Union considers that such conflict is ultimately a political and ideological struggle. Second, the Soviet Union considers that global nuclear war with the U.S. would involve most major countries and almost all areas of the world; it would be far more extensive than the strategic nuclear

exchange envisioned by American strategic thinkers. This wider conception of potential conflict with its superpower adversary is also reflected in the Soviet understanding of what would constitute strategic conflict. For the U.S., 'strategic' conflict would mainly entail inter-continental-range attacks on the territories of the superpowers. For the Soviet Union, however, any attack is strategic if it results in damage to the Soviet homeland, and any Western forces capable of such attacks are 'strategic' forces. Accordingly, Europe is a central part of Soviet strategic calculations.

4.20 One important consequence of this view is that the notion that some kind of strategic parity prevails between the superpowers is interpreted by the Soviets in terms of their formula 'equality and equal security'. This concept implies that any fair balance of American and Soviet forces would provide the Soviet Union with a numerical advantage. The Soviets argue that this advantage would compensate for Soviet disadvantages caused by British and French nuclear forces. Also, strategic systems are defined by the Soviet Union to include American systems assigned to NATO capable of striking targets in the Soviet Union. For the U.S., these systems are irrelevant to calculations about the U.S.-Soviet Union central balance because they are committed to defending NATO, and because they are designed to offset Warsaw Pact superiority on the ground.

4.21 Significantly, it is clear from the Soviet view of 'equal security' that the Soviet Union will not be satisfied with any superpower military balance that does not entail a numerical Soviet superiority in strategic weapons. This is consistent with the appeal that the concept of superiority has long held for Soviet strategic thinkers:

> First and foremost, account should be taken of the fact that the established correlation of forces determines the actual capabilities of the sides to exert influence on one another at a given moment with a determined degree of probability of success. In the process the advantage in principle accrues to that side which significantly surpasses the other in strength in the aggregate or in individual and the more essential components of combat might. Superiority accelerates the process of the physical and moral defeat of the enemy, makes it possible to operate more daringly and decisively, and to impose one's will on the enemy and to attack him more successfully. It promotes the development of flexibility in the selection of scales, forms and methods of conducting combat operations, expands the scope of methods for coordinating the delivery of nuclear, fire and air attacks with the maneuver of troops, and increases the effectiveness of using space, time, and other

> factors which influence the course of military operations. Conversely, an obvious shortage of forces substantially limits capabilities for organizing the repulsing of the enemy.[9]

For Soviet strategists, nuclear superiority has the virtue of ensuring the enemy's defeat:

> Today's weapons make it possible to achieve strategic objectives very quickly. The very first nuclear attack on the enemy may inflict such immense casualties and produce such vast destruction that his economic, moral-political and military capabilities will collapse making it impossible for him to continue the struggle, and presenting him with the fact of defeat.[10]

The Soviet interest in neutralising the American SDI program through arms control negotiations is perhaps stimulated by the consideration that even a partially successful American SDI would prevent the Soviet Union from achieving any kind of strategic superiority, or conversely, that it may place the United States in a position of unchallenged superiority.

4.22 Another implication of the Soviet interest in superiority is that the Soviet Union would look for a quick victory in any military conflict. Since World War II Soviet strategic planning and force development has called for the ability to break through an enemy's defence by the massing of forces. Soviet planners consider that this requires a high speed attack, permitting breakthroughs and redispersion by deep operations against the enemy's rear:

> Under conditions where nuclear rocket weapons are used... that side which manages during the first days of the war to penetrate more deeply into enemy territory naturally acquires the capability for more effectively using the results of its nuclear attacks and disrupting the mobilization of the enemy. This is especially important with respect to European theaters of operations with their relatively small operative depth.[11]

4.23 Two centrally important Soviet strategic concepts remain to be mentioned. They are the necessity to target the opponent's war-fighting (counterforce) capacity and the imperative to be the first to strike. During the modern period of Soviet strategic planning, counterforce targeting has assumed a central role in achieving the defeat of any enemy. Emphasis is placed on the:

> ...redistribution of previously planned nuclear strikes of rocket troops and aircraft for the purpose of the decisive defeat of an opposing grouping of enemy troops, mainly a nuclear

> grouping, as well as the rapid transfer of forces and material for the purpose of creating the most favorable grouping of them for prompt and complete exploitation of the results of the use of weapons of mass destruction and completion of the defeat of the enemy.
>
> The chief content of strategic maneuver is the redirection of nuclear strikes and nuclear groupings for the fast and complete destruction of large enemy groupings and the achievement of strategic results.[12]

For Soviet planners, counterforce targeting necessarily includes the removal of the enemy's means of defence:

> Changes in the sequence of destruction of objectives are also not excluded. Thus, a strike by medium-range missiles can be inflicted first against such objectives as large military-industrial and administrative centres. However, as a means which is closer to enemy objectives, they can be used above all for a strike order from the very beginning to deprive the state subjected to attack of the capability of defense. Other variants are also quite probable.[13]

4.24 It is also clear that for Soviet strategic planners, successful counterforce strikes depend on the element of surprise. This in turn makes it crucially important in Soviet calculations to be the first to strike:

> Mass nuclear missile strikes at the armed forces of the opponent and at his key economic and political objectives can determine the victory of one side and the defeat of the other at the very beginning of the war. Therefore, a correct estimate of the elements of the supremacy over the opponent and the ability to use them before the opponent does, are the key to victory in such a war.[14]

4.25 The policy of pre-emption is potentially unstable in a crisis and is probably purposely so since it serves to protect the Soviet Union from political as well as military threats that might threaten the power structure of the Soviet regime. The Soviet pre-emption doctrine is worrying for the West because were the Soviet Union involved in an intense crisis, there could be a danger that real or imagined threats would be perceived as requiring a pre-emptive response. The fear of a Soviet pre-emptive strike against United States and NATO forces is allayed by the fact that the Soviet Union must understand that Soviet pre-emption could trigger a global nuclear war, and the

destruction of the Soviet Union. It seems reasonable to assume that the Soviet Union would launch a massive pre-emptive nuclear attack only if it was absolutely convinced that a nuclear attack was about to be launched against it.

4.26 While maintaining similar forces and capabilities the Soviet approach to strategic doctrine contrasts in many ways with that of the United States and other Western nuclear powers. Western concepts rely on persuading the enemy that the cost of his actions - in terms of prospective economic, military and political losses - would far outweigh his gains. The Western concept attempts to dissuade the enemy from initiating nuclear war. If war should break out, the United States and its allies would continue to seek survival by means of deterrence by attempting to end the war through threats to escalate the conflict to increasingly higher levels of destruction. Thus the West has incorporated a number of discrete steps in the 'escalation ladder' in order to facilitate escalation control and intra-war bargaining and thereby accommodate the possibility of limiting nuclear war to something short of an all-out exchange.

4.27 Like the United States, the Soviet Union seeks to avoid nuclear war by deterring its potential adversaries. This is done, however, by the more traditional means of demonstrating a very significant capacity to wage nuclear war and to be able to prevail militarily should such a conflict erupt. The Soviet Union tends to be sceptical about the possibility of limiting a nuclear war or even desirability of promoting this concept and as a consequence does not give public credence to Western notions of 'escalation control' or 'intra-war bargaining'. In addition, as noted by a recent United Nations study, Soviet doctrine does not differentiate to the same degree as the West between conventional and nuclear weapons usage:

> A widely held view is that Soviet military strategists are generally inclined to recommend an early use of nuclear weapons ... The impression is formed that it is not the threshold between conventional and nuclear weapons which is important, but the threshold of war in general.[15]

Continuing developments in the Soviet nuclear arsenal, together with the Soviet leadership's recent public emphasis on the dangers of mutual annihilation in the event of a global nuclear war between the two superpowers, has led to some speculation that it may be adopting an official position which is closer to the Western view of deterrence although the evidence for this remains scant.[16]

The Evolution of United States' Strategic Nuclear Doctrine

4.28 In the 1950s, the United States' strategic nuclear capability was essentially based on the doctrine of 'massive retaliation'. Under this doctrine, should the Soviet Union invade Europe, the United States would simply drop all of its bombs as quickly as possible on targets inside the Soviet Union,

destroying as many key factories and military facilities as it could. The strategic doctrine reflected America's nuclear superiority at that time and was intended to underscore the preventive nature of the nuclear threat. By the early 1960s, the Soviet Union had begun to develop its own nuclear arsenal and could use inter-continental ballistic missiles to deliver nuclear warheads directly against the United States. It became clear that the doctrine of massive retaliation was unduly restrictive and it lost most of its credibility as a deterrent posture against Soviet conventional attack as generalised war would effectively amount to mutual suicide.

4.29 These developments, together with the introduction of tactical nuclear weapons and the emergence of the concept of limited war, led to the adoption by the United States in the early 1960s of the doctrine of 'graduated deterrence' or, later, 'flexible response' whereby Soviet aggression would be met at its own level and defeated or stalemated at that level. Under this new strategy, greater stress was placed on strengthening the conventional forces of the NATO alliance, the idea being that the strategic forces of each side would act as a shield between which its conventional forces could, if need be, carry on a limited conventional or nuclear war. Strengthening conventional forces would provide scope for providing a 'stopping mechanism' or 'pause' before the introduction of strategic nuclear weapons and so raise the nuclear threshold. The policy also linked the conventional defence forces of NATO with U.S. strategic forces in order to deter the Soviet Union from exploiting its significant advantage in conventional forces in Europe. The doctrine also initially envisaged the development of some form of nuclear counterforce capability aimed at limiting the Soviet Union's ability to launch a second strike and hopefully enable the conflict to be resolved before it escalated to an all-out exchange. The prominence of this 'no-cities' aspect of flexible or controlled response was short-lived however, in view of the existing technical difficulties associated with its implementation and McNamara's growing concern over the impact of counterforce on the arms race. McNamara realised that because a counterforce strategy involved attacking an enemy's military forces, it proscribed no logical limit to the number of weapons required. As the Soviet Union continued to expand its forces, so the United States would need to do likewise.

4.30 The doctrine of flexible response gave the United States' command authority more options and the potential for greater control over its military response in the event of conflict with the Soviet Union and so enabled deterrence and bargaining to occur after the outbreak of hostilities, not just before it. It also gave clear expression to counterforce or war fighting doctrines which had always been an important consideration in American nuclear strategic planning but, as mentioned, was limited by political and technological factors. As the technology became available to locate and destroy military targets such as hardened ballistic missile silos, counterforce strategies became more prominent in the declared nuclear doctrine of the United States.

4.31 The 1960s also saw the development of the concept of 'assured destruction'. Secretary of Defense, Robert McNamara,

argued that the United States could deter any Soviet government from launching a military attack on the United States or its interests by maintaining a strategic nuclear force capable of surviving an initial attack and then inflicting 'unacceptable' damage on the aggressor. McNamara's definition of 'unacceptable' damage amounted to the capacity to kill one quarter of the Soviet population and destroy half of its industry where such assured destruction was considered to require 1 200 equivalent megatons spread between the three arms of the United States' strategic triad. As both superpowers possessed sufficient forces to assure destruction of their opponent, the overall strategy became known as 'mutual assured destruction' or MAD.

4.32 The concept of 'mutual assured destruction' remained central to United States' strategic nuclear policy through the 1960s and 1970s. A principal advantage of the MAD doctrine was that the strategy could be implemented by a finite number of strategic nuclear weapons and so it provided some scope for halting the arms race. If implemented however, MAD would still result in the deaths of millions (and by the 1970s hundreds of millions) of civilians in both countries. It also provided little flexibility for the national command authorities and left no room for error. Once deterrence failed, the United States' President had only two choices: surrender or engage in a full countervalue retaliation which would in turn imperil American cities once the war escalated to such levels. While MAD remained the declared policy of the United States, counterforce or damage limiting concepts continued as a major factor shaping the size and targeting plans of United States' strategic forces. The United States' strategic war plans contained in the Single Integrated Operating Plans (SIOP) published since 1961, for example, showed that the majority of U.S. strategic targets were Soviet military forces and installations. MAD as a strategic doctrine entailed the ultimate sanction although a range of others were also available.

4.33 Counterforce was given new impetus initially as part of the Nixon Administration's attempts to define strategic 'sufficiency' but more forcefully under Defense Secretary James Schlesinger who, in 1974, undertook to publicly commit the United States to a revised nuclear strategy. Schlesinger argued that the United States needed to be able to consider a wider range of 'options' short of all-out nuclear war in response to potential actions by the Soviet Union. As Ron Huisken (then of the Australian National University) has described,[17] under the revised strategy United States' strategic forces were expected:

- to forestall direct attacks on the United States;
- to deter nuclear attacks on U.S. allies;
- to have a deterrent effect against massive non-nuclear assaults, although the primary responsibility here rested with U.S. and allied theater forces; and
- to inhibit coercion of the United States and its allies by nuclear powers.

In order to perform these deterrent functions, Schlesinger outlined four requirements U.S. strategic forces should satisfy. These comprised:

> . an essential equivalence with the Soviet Union in the basic factors that determine force effectiveness;
>
> . ...a highly survivable force that can be withheld at all times and targeted against the economic base of an opponent so as to deter coercive or desperation attacks on the economic and population targets of the United States and its allies;
>
> . ...a force that, in response to Soviet actions, could implement a variety of limited preplanned options and react rapidly to retargeting orders so as to deter any range of further attacks that a potential enemy might contemplate. This force should have some ability to destroy hard targets, even though we would prefer to see both sides avoid major counterforce capabilities. We do not propose, however, to concede to the Soviets a unilateral advantage in this realm; and
>
> . ...a range and magnitude of capabilities such that everyone - friend, foe and domestic audiences alike - will perceive that we are the equal of our strongest competitors.[18]

Schlesinger played down the counterforce aspects of his revised doctrine, arguing that the new strategy would provide the United States with greater flexibility to deal with a range of threats that could now be posed by the Soviet Union. In Schlesinger's view, such a capability would be more credible to the Soviet leadership than assured destruction and would improve the United States' ability to deter Soviet aggression. The strategy would also counter Soviet attempts to develop its own counterforce capacity and, more importantly, it was seen to improve the chances of a negotiated settlement being reached before population centres were struck.

4.34 To a large extent, the Schlesinger doctrine was made possible by the coincidental development of new and associated support technologies which permitted counterforce and target damage - limiting strategies to be actually carried out. Primary among these was the capability for Multiple Independently-Targetable Reentry Vehicles (MIRV) which, together with missile accuracies of the order of hundreds rather than thousands of feet, made all missile sites vulnerable to missile attack. Improvements in accuracy have given military leaders more confidence that they can select and destroy well protected targets at long range with 'surgical' precision. Other important developments which enhance the potential counterforce role include: the new stealth technologies which may allow both aircraft and missiles to approach their targets undetected; anti-satellite weapons which can threaten early warning systems;

and more sophisticated command, control, communications and intelligence (C^3I) systems which are capable of coordinating the employment of the full range of counterforce systems.

4.35 The Schlesinger doctrine has been accepted and extended by successive administrations. In spite of some initial qualms over the feasibility of limited strategic nuclear war, the Carter Administration, through its Presidential Decision Memorandum 59 (PD-59), made it clear that the United States could and would respond effectively to Soviet aggression at any level of conflict and that U.S. forces would be able to endure repeated exchanges over an extended period of time. PD-59 also gave greater priority to political and psychological considerations in the determination of U.S. strategic targeting options. These changes were seen to be more effective in overcoming any perceived advantages the Soviet Union might obtain from its numerical superiority of ICBM forces. As one author put it:

> PD-59 is based on the view that the most effective way to deter Soviet nuclear aggression is by maintaining escalation dominance, and by targeting those things which their leadership values most. The countervailing strategy would put in jeopardy the Politburo's political and military control, their conventional and military forces, Soviet defense industries, and the lives of Soviet leaders ... Proponents of the 'countervailing' strategy believe that Soviet leaders would be most deterred by the fear of defeat of their war machine, their loss of control at home, and by the threat of U.S. 'decapitation' strikes against Andropov, Gromyko, Ustinov, and their Politburo colleagues in their bunkers.[19]

4.36 The nuclear policy goals of the Reagan Administration were summarised by the Harvard Nuclear Study Group in its book Living-with-Nuclear-Weapons as follows:[20]

a. Deter nuclear attack by the Soviet Union on the United States (basic deterrence). This essentially involves the ability to retaliate in kind to an initial nuclear attack (or 'first strike') by the Soviet Union.

b. Help deter a nuclear or conventional attack on U.S. allies ('extended deterrence'). The United States has a number of commitments, by formal treaty and by common interest, to protect allied nations or other countries whose security is vital to it, including NATO Europe and American allies in East Asia and Australia.

c. Minimise the incentives for either side to strike first in an international crisis ('crisis stability'). As well as deterring a premeditated attack by the Soviet Union, the United States wants to minimise the risk of a Soviet pre-emptive nuclear strike.

d. If deterrence fails, help defeat nuclear or conventional attacks on the United States or its allies and minimise damage to them ('war-fighting', 'damage limitation', 'escalation control').

Although the United States does not want to fight a nuclear war, it maintains nuclear war-fighting forces, in the event that war does occur, in order to limit the destruction of itself and its allies.

e. If deterrence fails, help terminate conventional or nuclear war in a manner least damaging to American and allied security ('war termination'). This involves attempting to terminate military hostilities between the superpowers as quickly as possible, before the conflict escalates into total nuclear war.

f. Support U.S. foreign policy in peacetime and prevent nuclear coercion of the U.S. and its allies ('diplomatic support', 'counter-deterrence'). This is largely to offset Soviet moves to use its strategic nuclear arsenal to coerce or influence the allies of the United States. An important element of this policy goal is the need to maintain a rough strategic parity between the two superpowers. Failure to maintain parity 'would be incompatible with the overall role of the U.S. in the world at large, would produce uncertainty, alarm, and possibly defection on the part of U.S. allies, and would encourage Soviet expansion and adventurism'.[21]

g. Provide support for U.S. policies in arms control negotiations. Nuclear weapons decisions can complicate efforts to achieve arms control, they can undermine existing arms control agreements by making verification more difficult, or they can be used as 'bargaining chips' to offset perceived advantages held by one side or the other.

4.37 Like its immediate predecessors, the Reagan Administration is planning to develop sufficient capabilities to deter a wide spectrum of threats through the deployment and counter threat of U.S. strategic nuclear programs, as well as maintain a global military balance. In his Financial Year FY-1985 Annual Report to the Congress, Defense Secretary Caspar Weinberger stated that the United States continues 'to seek nuclear and conventional capabilities sufficient to convince any potential aggressor that the costs of aggression would exceed any potential gains that he might achieve'.[22]

4.38 Current U.S. nuclear policy also contemplates American actions should deterrence fail:

> ... while we work to preserve deterrence, we must also think about and plan against possible failures of deterrence. If deterrence should fail, we cannot predict the nature of a Soviet nuclear strike nor ensure with any certainty that what might begin as a limited Soviet attack would remain confined to that level. We must plan for flexibility in our forces and in our options for response, so that we might terminate the conflict on terms favourable to the forces of freedom, and reestablish deterrence at the lowest possible level of violence, thus avoiding further destruction.[23]

While acknowledging that 'nuclear war cannot be won, and must never be fought', the Administration nevertheless argues that:

> credible deterrence, either nuclear or conventional, requires that we have the ability, in case deterrence fails, to halt any attack and restore the peace on terms favourable to us and our allies. And we must accomplish that while trying to limit the scope, duration, and intensity of a conflict. Obviously, U.S. forces are not available to defend everywhere against any threat at all times. Should deterrence fail, general strategic priorities, specific circumstances, and forces available at the time would govern force employment.[24]

4.39 The current U.S. operational plans for conducting a nuclear war with the Soviet Union are contained in a secret Pentagon planning document, termed Defense Guidance, which recently was allegedly leaked to the American media. Leslie Gelb of The New York Times reported that under the general heading of 'Wartime Strategy' the document read: 'Should deterrence fail and strategic nuclear war with the U.S.S.R. occur, the United States must prevail and be able to force the Soviet Union to seek earliest termination of hostilities on terms favourable to the United States'. Gelb stated that among the requirements for doing this were the following:

> Deployment plans that assure United States' strategic nuclear forces can render ineffective the total Soviet military and political power structure through attacks on political/military leadership and associated control facilities, nuclear and conventional military forces, and industry critical to military power. These plans should also provide for limiting damage to the United States and its allies to the maximum extent possible.

> Forces that will maintain, throughout a protracted conflict period and afterward, the capability to inflict very high levels of damage against the industrial/economic base of the Soviet Union and her allies, so that they have a strong incentive to seek conflict termination short of an all-out attack on our cities and economic assets.
>
> United States strategic nuclear forces and supporting C^3I - command, control, communications and intelligence - capable of supporting controlled nuclear counterattacks over a protracted period while maintaining a reserve of nuclear forces sufficient for trans- and post attack on our cities and economic assets.[25]

Gelb claimed that the basic notions of 'developing the capability to strike military targets, being able to control and fight a prolonged battle, and having the power to prevail' indicate that the Reagan Administration appears to have extended the notion of counterforce to cover nuclear conflict. It seeks to deter the Soviet Union by demonstrating the capacity to destroy Soviet arms and to secure Western political purposes at a military, economic and social cost commensurate with the stakes of the conflict; in short, by convincing the Soviet Union that the United States could fight and win a military conflict and hold down its own societal damage to a tolerable level.

4.40 The Reagan Administration is also concerned that the current system of deterrence is under threat from developments in Soviet strategic offensive and defensive capabilities and forces. As part of a major research programme into the feasibility of ballistic missile defences (the Strategic Defense Initiative) it is investigating the prospects of moving from a system of deterrence based on offensive weapons to one that utilises defensive systems that could offset the Soviet ballistic missile thrust. The concept of defensive deterrence and the SDI program are examined shortly.

4.41 American attempts to come to terms with the basic strategic dilemmas of the nuclear age have largely involved assessments of the relative merits of deterrence by punishment or denial. As Desmond Ball pointed out to the Committee, the exercise has predominantly been a political one in which succeeding administrations tried to get a title for their strategic approach that made it in some way distinctive from that of previous administrations. While the 'declared' nuclear policy has generally moved in cycles, with emphasis sometimes on counter-city targeting, massive retaliation and assured destruction on the one hand, and sometimes on counterforce or damage limitation on the other, U.S. operational policy has continued to emphasise counterforce notions. According to Ball:

> The fact of the matter has been that right since the late 1940s, since 1949, American nuclear targeting plans have contained a wide range of target sets: the Soviet nuclear forces beginning when they first started building their capability up from 1949; Soviet conventional military capabilities, their naval bases, their army camps, their tank concentrations; Soviet command and control; their political leadership as well as their underground command centres in the missile fields and elsewhere; and the Soviet economic industrial base; right throughout these periods it has been called massive retaliation, or mutual assured destruction. At the time when mutual assured destruction was at its highest, the American strategic war plans gave most emphasis to attacking Soviet strategic nuclear capabilities. In fact there would have been less than 100 weapons targeted against the Soviet urban industrial base at the time when all the declaratory language was talking about assured destruction. So, what has been talked about, both officially and in the literature in more recent years about American policy becoming one of counterforce, being one of threatening, limited use of nuclear weapons - hopefully with an ability to control that limited use so that it does not escalate to an all-out urban industrial exchange - does not really reflect much which is new. There has always been a wide range of target sets of which the nuclear counterforce element has always been the pre-eminent element within American targeting policy.[26]

4.42 While the 'declared' nuclear policy has moved in cycles, the emphasis on assured retaliation and counterforce targeting has tended to decline over time. The present Administration's nuclear policies reflect a time when declared and operational policies are in tune. While the goal of United States' nuclear policy remains deterrence, both its declared and operational strategies are generally those of counterforce: blocking and readiness to destroy Soviet military power, and denying the Soviet Union a military advantage from any aggression they might contemplate. There remains considerable debate within the United States whether counterforce or 'countervailing' strategies are more or less stable than the doctrine of mutually assured destruction. Both approaches seek to answer the central dilemma of how best to use weapons of mass destruction to protect or advance the interests of the state without actual recourse to their use. Both have their own problems and contradictions which have generated pressures to find alternative means of ensuring national security in the nuclear age.

Assured Destruction or Deterrence by Punishment

4.43 Deterrence by punishment, or 'basic' deterrence, is where a nation maintains sufficient strategic nuclear capabilities to be able to hold at risk under all circumstances of attack a large number of an adversary's urban areas and other economic or political targets believed essential to recovery from war. Thus in the event of a Soviet attack on American forces in the United States or Europe, the United States would use its strategic nuclear forces to destroy Soviet cities, and under more

recent versions of U.S. strategic thought, the Soviet political infrastructure (so-called 'decapitation' strikes). Seeing this possibility, the Soviet Union would be deterred from attacking in the first place, the costs of such an action far outweighing any potential benefits gained. Basic deterrence requires retaliatory forces that are capable of surviving the worst conceivable enemy attack and still cause massive destruction in the attacker's own country. This condition is known as 'assured destruction'. When both superpowers have such a capability, as has been the case since the 1960s, we have a situation known as 'mutual assured destruction', or MAD.

4.44 The strategy of assured destruction is currently seen in its clearest form in the nuclear policies of the United Kingdom and France. Both these nations deploy offensive missile forces with the primary purpose of destroying Moscow and other Soviet cities in the event of a Soviet attack upon Britain or France. For this purpose, British and French weapons do not need to be numerically comparable with Soviet forces. They need only to be mobile and well hidden so that they can survive a Soviet attack long enough to be fired.

4.45 The theory of assured destruction is simple and logical. It requires the maintenance of a force of offensive nuclear weapons capable of satisfying three basic conditions: the force must be powerful enough to destroy Soviet urban society, innaccurate enough not to threaten Soviet strategic weapons, and invulnerable enough to survive a Soviet surprise attack. The primary advantages of the concept is that it provides for crisis stability, meaning that even if the United States and the Soviet Union become involved in an intense crisis, neither side has any incentive to attempt a disarming first strike. Also, it does not necessarily entail an arms race. The strategic deterrent required to ensure 'assured destruction' is both definable - destruction of major cities or urban industrial centres - and relatively small. In the early 1960s, United States' strategic analysts calculated that assured destruction of the Soviet Union could be achieved with only 1 200 equivalent megatons or as little as 400 warheads. This is very small compared with today's strategic holdings of over 11 000 warheads or more than 9 000 equivalent megatons.

4.46 A further advantage of the concept of assured destruction is that it has been tested in the real world. United States' weapon deployments have been guided for forty years in theory, and to a large extent in practice, by the requirements of assured destruction. During this time the world has witnessed a number of severe international crises and regional wars; but none of the wars has escalated into World War III and nuclear weapons have remained unused since 1945. While there is no way of measuring how much the doctrine of assured destruction has contributed to the continuing nuclear peace, it is reasonable to surmise that it has played a significant role.

4.47 Despite these advantages, deterrence by punishment presents a number of practical and moral problems, particularly since the Soviet Union has achieved strategic parity with the United States and itself can destroy the United States in the event of a nuclear conflict. Perhaps the major problem for

deterrence by punishment stems from the fact that, in order to be effective, deterrent threats must be credible. In an age of mutual assured destruction, it is doubtful whether the threat alone to inflict societal punishment would constitute a credible option - particularly against low-level aggression - since it would effectively amount to national suicide. Neither American nor Soviet leaders are likely to risk possible annihilation by using strategic nuclear weapons against each other's cities in a low-level conflict. A crucial example of this dilemma concerns the defence of Europe. If all-out war means the destruction of the United States, would American leaders rather see Western Europe conquered - bad as that outcome would be - than attack the Soviet Union with strategic nuclear weapons and have it retaliate?

4.48 As a result, stability in the military balance at the strategic level may engender greater instability at lower levels of conflict where both sides may be prepared to use limited violence because the other's threat to respond by all-out retaliation cannot be very credible. This is the so-called 'stability-instability' paradox, which provdes a trade-off between the perceived risk of total conflict and the possibilities for adventurism. It can be argued that the 'stability-instability' paradox makes MAD inherently unstable since it leads to the development of strategies short of massive retaliation which in turn may increase the possibility of nuclear conflict. Nevertheless, the continuing uncertainty associated with the use of nuclear weapons will tend to make both sides operate very cautiously, particularly in times of crises. National leaders and policy-makers have to be careful not to allow crises to assume a military dimension. Bernard Brodie has remarked as follows:

> It is a curious paradox of our time that one of the foremost factors making deterrence really work and work well is the lurking fear that in some massive confrontation crisis it might fail. Under these circumstances one does not tempt fate.[27]

On the other hand, the problem of making intrinsically incredible weapons look credible can lead to irrational behaviour especially at lower levels of conflict. States are forced to use tactics that seek to convince their adversary that mutual disaster will result if the latter does not make concessions. Thus in a crisis, a state may decide to stand firm, or it may attack in the belief that war is inevitable.

4.49 Basic deterrence is also seen by many to be morally repugnant. Under the MAD strategy, the leaders of both sides threaten, and prepare to commit the mass murder of the civilian population of another country, or if nuclear winter occurs, whole continents, in order to deter aggression by an adversary. Such a policy does not rest easy with Western liberal ideals of decency and justice. Moreover, the MAD doctrine does not provide much flexibility to the national leadership in the event deterrence fails. While MAD constitutes a powerful deterrent, there is always a finite chance that conflict could break out, in which case there should be scope to avoid total devastation.

While ever nuclear war remains a possibility, governments owe it to present and future generations to make prudent defence preparations to limit damage to the greatest extent possible in the event that deterrence fails.

4.50 At the policy level, the MAD doctrine also provides little scope for terminating a nuclear conflict, or even to take advantage of the tremendous political power offered by the possession of nuclear weapons. As Colin Gray has argued:

> ... the United States and its allies do, and must, ask of nuclear weapons considerably more than that they function simply as a counterdeterrent, inhibiting Soviet nuclear initiatives. As a matter of geostrategic necessity and elementary prudence, US policy-makers envisage the possibility of actual nuclear employment for the purpose of restoring deterrence ... it is difficult even to conceive of a military capability functioning as a deterrent if it is bereft of a theory of controlled execution in support of political purpose.[28]

Gray considers that 'nuclear strategy and its force-postural expression must be relevant to the support of vital U.S. national interests' at all phases of international political life including the superpower competition in peacetime, times of crisis, war and for war termination and postwar competition.

4.51 Basic deterrence is also susceptible to technological change. A credible deterrent requires an invulnerable retaliatory striking force that can inflict 'unacceptable' damage upon an attacker even after absorbing an initial nuclear attack aimed at destroying the deterrent. In addition, the retaliatory force must be able to penetrate or overcome active and passive defences that would be deployed by each side to reduce damage in the event of nuclear war. Both sides must continue to strive to maintain invulnerable deterrent forces by examining new technologies and seeking to either use or counteract them and so contribute to a spiralling arms race.

4.52 Finally, the concept of deterrence through mutual destruction has not been endorsed by the Soviet Union. As described earlier, the primary mission of Soviet strategic rocket forces is to destroy United States' military assets in time of war. Unacceptable damage to the U.S. population may be a consequence of their use but it is not their main purpose. Soviet strategic doctrine also emphasises strategic defences which for some time has raised concern in the minds of American planners over the continued efficacy of assured destruction as a deterrence posture. For this reason it was superseded in the late 1960s in the U.S. and was reinforced by significant 'countervailing' elements.

4.53 The basic contradictions and dilemmas of the MAD doctrine led successive American administrations to seek an alternative approach which would better solve the 'stability - instability' paradox and provide U.S. decision-makers with

flexible and realistic foreign and defence policy options to maintain and advance U.S. interests in the event that deterrence failed. The principal direction taken has been toward a counterforce or countervailing strategy in which nuclear weapons are treated like any other weapon to be employed rationally to advance American military and political interests. Counterforce has always been a component of United States' nuclear strategy but in the past has been limited by technical constraints. As nuclear weapons have become more accurate, more controllable and more diversified, counterforce has assumed an increasing prominence in United States' nuclear thinking. On the surface, the counterforce or countervailing strategy answers, or overcomes, many of the dilemmas posed by basic deterrence. On closer examination, however, it reveals its own set of problems and contradictions.

Deterrence by Denial: Counterforce

4.54 The counterforce or countervailing strategy seeks to make deterrence credible by minimising the gap between what the United States threatens to do and what it actually would do should deterrence fail. Its basic aim is to deny the Soviet Union an advantage from any military adventure, or threatened military adventure it may contemplate. It is achieved by developing and maintaining a military structure - and a range of appropriate targeting options - capable of matching a variety of Soviet challenges with a variety of appropriate responses. The United States would demonstrate that it would be able to use sufficient military force to prevent the Soviet Union from achieving its goals, wherever, and at whatever level of violence the Soviets chose to initiate. The Russians would be deterred because they would not gain anything from a war; they would not conquer any territory, they would stand to lose more military resources than their adversaries, and, if war became total, they would recover more slowly than the West and so could not expect to dominate what was left of the post-war world.

4.55 According to Colin Gray, the key features of the present U.S. 'countervailing' strategy are:[29]

a. emphasis on denial of victory. The fundamental requirement is to ensure that the Soviet Union should 'anticipate defeat in the event of war';

b. the Soviet Union would see victory as impossible 'if the essential military, paramilitary, and police assets of the state are damaged to the point where they cannot perform their functions and/or if the political control functions of the Soviet state cannot operate at a minimum essential level';

c. a continued role for deterrence by punishment where 'the United States plans to punish the Soviet state and its executive instruments rather than its captive, or acquiescent, society';

d. an increasing trend 'to focus almost exclusively on Soviet targets of direct or at least very plausible relevance to the waging of the war'. Hence the claim by many critics of the present strategy that it is a 'war-fighting' one; and

e. the inclusion of the requirement that the United States 'should be able to prevail in war, whether the war be short or long'. Here Gray suggests that the U.S. Government has not chosen a protracted war strategy, rather, 'it has simply observed that the quality of crisis, and intrawar deterrence should be enhanced usefully if the Soviet leadership is convinced the United States has the means to protract a conflict'. It is based on the important assumption that the Soviet Union particularly fears a protracted conflict since the stresses of war could foment revolution and undermine Soviet hegemony.

4.56 The countervailing strategy is designed to fulfil military tasks at a level far exceeding the requirements of 'mutual assured destruction'. The emphasis in American strategic doctrine has shifted beyond the survivability necessary to assure that it can launch a single, pre-planned retaliatory strike to the flexibility and endurance required to match a variety of Soviet challenges and be able to fight a war that may extend over some period of time and involve a series of nuclear exchanges. In a speech delivered at the Naval War College on 20 August 1980, former U.S. Secretary of Defense Harold Brown stated that:

> ... deterrence remains, as it has been historically, our fundamental strategic objective. But deterrence must restrain a far wider range of threats than just massive attacks on U.S. cities. We seek to deter any adversary from any course of action that could lead to general nuclear war. Our strategic forces must also deter nuclear attacks on smaller sets of targets in the U.S. or on U.S. military forces, and be a wall against nuclear coercion of, or attack on, our friends and allies. And strategic forces, in conjunction with theater nuclear forces, must contribute to deterrence of conventional aggression as well.[30]

4.57 The countervailing strategy emphasises both counterforce concepts and capabilities as well as the notion of 'escalation dominance'. Counterforce involves the ability to attack and destroy military targets where the principal capabilities required to meet this capability have been described by SIPRI as follows:

> Minimal requirements are weapons which are reliable, accurate and survivable; command, control and communications networks which are efficient, accurate and redundant; anti-submarine weapons capable of neutralizing missile submarines; and defensive systems to protect military installations. Protection of cities and civilian populations may be desirable, but if it is genuinely believed that the mutual self-interest and rationality of the adversaries can be counted on to preserve a 'no-cities' understanding (either tacit or explicit), then this protection can be less extensive and primarily passive (e.g. fall-out shelters but no massive evacuations of area-defence anti-ballistic missile systems).[31]

Escalation dominance means that the United States would seek to limit the escalation of a conflict between the two superpowers by demonstrating to the Soviet Union that it would be denied victory at whatever level of violence it contemplated. This involves initially matching Soviet behaviour - using conventional forces against Soviet conventional forces, employing tactical nuclear weapons in response to Soviet usage, and so on - and then ensuring that the Soviet Union would not gain any advantage by escalating, or threatening to escalate, the conflict beyond this level.

4.58 Despite its emphasis on targeting military facilities, the strategy is not a war-fighting strategy any more than deterrence by punishment is a war-fighting strategy (unless deterrence fails). As Robert Jervis, author of the book The Illogic of American Nuclear Strategy, has argued:

> The primary aim of the countervailing strategy is deterrence. It is a war-fighting strategy in the sense of developing plans for how a variety of wars might be fought, but the objective is to show the Soviets that they cannot gain from a clash of arms and thereby restrain them.[32]

Moreover, the countervailing theory does not preclude deterrence by punishment which remains an important element of U.S. strategic nuclear policy. However, as the capability to fight becomes more flexible, versatile and controllable, the basic deterrent function - to deny an all-out Soviet attack against the United States - becomes more and more incidental to the objectives directly associated with the countervailing model.

4.59 The countervailing strategy with its associated counterforce weapons and capabilities appears to be sound and prudent. It overcomes the credibility problem inherent in deterrence by punishment, provides scope for escalation control, war termination or damage limitation in the event that deterrence fails and is said to be closer to the Soviet view of military power so is likely to be more effective. More careful scrutiny of the strategy and its underlying assumptions, however, reveal a number of new problems which may serve to restrict both the achievement of stable deterrence and the prospects for arms control.

4.60 Some of these problems have been described by Robert Jervis in his book.[33] Jervis argues that while the countervailing strategy has been developed to overcome the basic concern that MAD lacks credibility, it continues to utilise MAD's underlying philosophy of threatening to destroy what the Soviet government values most; in this case Communist control of the state. Apart from the difficulty of exercising such an option, Jervis suggests that targeting the political and military leadership of the Soviet Union also lacks credibility since such an attack would probably lead the Soviet Union to respond in full. Faced with this prospect the United States would be deterred from attacking these targets. Hence it is not an 'implementable' threat; at best it could be carried out as a last resort, in retaliation for Soviet destruction of the United States. Jervis concludes that:

> In criticizing the effectiveness of deterrence by punishment and yet basing part of its plans on a form of this deterrence, current U.S. doctrine is incoherent. The strategy tries to move toward deterrence by denial, but cannot completely fail to recognise that the threat of punishment is inescapably central to superpower relations.[34]

4.61 The same logic also raises the question whether 'escalation dominance' is possible while a situation of mutual assured destruction continues to exist at the strategic level.

> ... if the ability to deny the Soviets their objectives is taken in the ... sense of being able to prevent all Russian gains and protect American values, this end cannot be achieved without Soviet cooperation. Lacking an effective defense, the United States cannot prevent the Russians from destroying American society, as would be implied by a coherent doctrine of deterrence by denial. Furthermore, even if the United States were able to deny the Soviets any direct military advantages from making certain moves ... it would not prevent them from coercing the West unless the West were willing to run the risk of all-out war. The Soviets could advance even if the United States could match them at every level of violence if they convinced the Americans that fighting, even at low levels, was too costly and dangerous to be tolerated.[35]

Given the risks of Soviet escalation and the costs this would impose on the United States, Jervis considers that it is likely that the United States would be self-deterred from any limited use of nuclear weapons since such use could ultimately amount to suicide by installments. In his view the credibility of the American threat to retaliate with limited use of nuclear weapons, or to limit a nuclear conflict to something well short

of an all-out exchange and on terms which clearly favour the United States, is fundamentally undermined by the vulnerability of American cities.

4.62 There are ways out of this dilemma. One is to deploy effective defences which would eliminate the vulnerability of U.S. cities to a Soviet strategic strike and thereby be able to threaten the Soviet Union with the 'ultimate' sanction. Another is to improve intra-war bargaining and war termination capabilities; in short, to convert the Soviet Union to the American view of deterrence. The United States is currently pursuing both these options, the first as part of its Strategic Defense Initiative Program and the second by way of strategic modernisation. Each approach entails significant costs and risks with no guarantee that the basic problems imposed by nuclear weapons will be overcome. The issue of strategic defences is discussed in detail elsewhere. The remainder of this Chapter examines some of the problems associated with improving the countervailing theory.

4.63 A fundamental problem with deterrence generally and its countervailing form in particular is that it is based on an artificial model of U.S.-Soviet behaviour which assumes that the Soviet Union will always act rationally and abide by the logic of deterrence. These assumptions must always be problematical especially since the publicly stated Soviet doctrine does not recognise the concept of deterrence or of limited nuclear war. Instead Soviet military writings continue to assert that in any nuclear engagement, whether global or theatre, Soviet nuclear forces will strike simultaneously at the strategic capabilities, political-military command infrastructure and major urban-industrial centres of its adversaries. Despite some speculation to the contrary by Western analysts, Soviet writings reveal no trace of interest in the notions of intra-war bargaining, graduated escalation or crisis management which figure predominantly in current Western theories of counterforce. Even if the Soviet Union did agree to abide by the rules there is no guarantee that it would have the same understanding of them as the United States or that either side would continue to act calmly and rationally once a nuclear conflict began.

4.64 A second problem with the countervailing doctrine is that it can be construed by an adversary as threatening since the weapons and support systems needed to carry out a flexible counterforce strategy are indistinguishable from those needed for a disarming first strike. Thus, an adversary can never be sure that its opponent is not really developing the capacity to destroy in single strike the whole of its strategic deterrent. The uncertainty generated, particularly during a crisis, can in turn lead to the adoption of automated or 'launch-on-warning' postures which can increase the chances of an inadvertent or accidental conflict. Moreover, the possession of these kinds of capabilities by both sides increases the incentive to strike first since the aggressor would suffer much less damage than would be the case if he tried to ride out an initial attack.

4.65 This is further exacerbated by the fact that both the United States and the Soviet Union have MIRVed their missile forces. They now have large numbers of accurate, independently

targetable warheads deployed on relatively few delivery systems. For example, the U.S. Polaris-Poseidon submarine carries around 160 nuclear warheads, and the Trident may carry as many as 250 or more. But it takes only one weapon to destroy a submarine, and if a number of submarines happen to be in port when war begins, an attacker could destroy many hundreds of warheads with a single shot.

4.66 A measure of the incentive to strike first is the ratio of independently targetable warheads on one side divided by the number of military significant targets - elements of the retaliatory strike force - on the other. At present, the United States has around 11 200 strategic warheads carried on some 1 870 delivery systems. The Soviet Union deploys just over 9 000 warheads on some 2 500 delivery systems. Thus each side has over four times the number of weapons necessary to destroy its adversary's strategic deterrent. SIPRI has argued that the ratio is important because is reveals:

> ... a growing disparity between the potential losses which will be suffered by the party which strikes first and the one which strikes second. The stability of any crisis decreases as this ratio increases, because the incentive for a first strike, or at least a launch-on-warning posture, in increased. The contradiction is clear: the more the capability for flexibility is increased by increasing the variety of and reliability of possible attacks, the less amenable the psychological atmosphere will be to calm, rational restraint required to exercise the flexibility judiciously.[36]

The significance of the disparity between the number of targetable warheads and military significant targets should not be overstressed however. A disarming first strike is an enormously complicated undertaking whose success depends on much more than a simple ratio of warheads to targets. Each superpower, for example, maintains a considerable capability to retaliate after an initial nuclear attack by its adversary.

4.67 The picture is different in important ways for the Soviet strategic force, but the conclusion is much the same. The Soviet ICBM force would be vulnerable to a first strike if the U.S. possessed sufficient numbers of counterforce capable warheads. Currently the U.S. does not have the numbers of such warheads to render the Soviet ICBM force highly vulnerable. In addition, the Soviet Union deploys about 1 000 SLBMs on board submarines that are very difficult to detect. Further, the Soviet Union also has a significant strategic bomber force. SIPRI's 'ratio', then, is not at present a cause of concern.

4.68 A third area of concern is that the countervailing theory of deterrence contains the explicit assumption that limited nuclear war is possible. Indeed part of the rationale for its development was to provide a means of avoiding the

intolerable choice imposed by the MAD doctrine in the event of Soviet aggression: surrender or mutual suicide. The capacity to provide a limited and controlled response to an initial Soviet strike is considered to reduce the chances of escalation and would provide an additional bonus of limiting the number of civilian casualties. This view is based on the assumption that nuclear war between the superpowers could be limited to something well short of an all-out exchange. Such an assumption may be highly dubious, however, especially in view of the Soviet Union's doctrine of massive pre-emption and the inherent difficulties of controlling a nuclear war. Successful intra-war bargaining and escalation control depend on the survival and continued operation of the strategic C^3 systems of both sides. Despite massive expenditure by the United States and the Soviet Union on their C^3 infrastructure they are more vulnerable and have less endurance than the strategic forces they are intended to support. Desmond Ball raised this issue when he stated:

> Many C^3 systems, such as radar sites, VLF antennae and satellite sensor systems are necessarily relatively 'soft'; some C^3 elements, such as the National Command Authorities, cannot be proliferated; major command posts, satellite ground stations and communication modes are generally fixed; and radar sites and communication stations are extremely difficult to camouflage because of their electronic emissions. C^3 systems are generally more vulnerable to the blast effects of nuclear weapons than are the strategic forces, and have various peculiar vulnerabilities as well - susceptibility to electromagnetic pulse, electronic jamming, etc.[37]

Ball considered that the vulnerabilities of such critical elements of the strategic C^3 architecture, 'impose quite debilitating physical constraints on the situation in which escalation might be controlled' and on 'the time period over which control might be maintained' suggesting that it is unlikely to last 'beyond either a few days or a few hours of detonation'.

4.69 A limited nuclear war could trigger a 'nuclear winter' effect (described in detail in Chapter 6) in which smoke and dust caused by the explosions are carried into the atmosphere and block out the sun for a protracted period of time. This in turn could cause widespread climatic and ecological disruption throughout the northern and possibly the southern hemispheres. The severity of the impact would depend on a number of factors including the size of the attack and the nature and composition of the targets, but under the appropriate conditions it could constitute a disaster for the attacking as well as the targeted nation even if the latter did not retaliate.

4.70 Even given that a nuclear war could be limited, civilian casualties would still be very high because large numbers of strategic weapons and support systems are located near major

population centres. Desmond Ball has estimated that the U.S. and Soviet fatalities arising from a major counterforce attack against each other's military forces would, depending on the circumstances of the attack, range from two to nearly thirty million in each country, with the most likely figure lying half way between the two. Ball concluded that:

> Given casualties of this magnitude, and the particular Soviet difficulty of distinguishing a comprehensive counterforce attack from a more general military cum urban-industrial attack, the notion of limiting a nuclear exchange to supposedly surgical counterforce operation appears rather incredible.[38]

Moreover, because much of the Soviet political and military leadership is located in or near major urban areas, attacks on these would be tantamount to counter-city attacks. Apart from the obvious difficulty in targeting the national leadership - which reduces the credibility of such a posture - this approach may serve to precipitate a Soviet pre-emptive strike. It is also counter to the essential rationale of limited and controlled nuclear conflict which requires that the adversary's leadership is able to continue to operate and control its forces once a war has begun.

4.71 This raises the more general issue of whether the objectives of the countervailing strategy can realistically be met, since taken literally they would require forces and capabilities well in excess of current levels. Desmond Ball has stated that the current U.S. Single Integrated Operational Plan (SIOP), which describes U.S. operational plans and targeting options to be followed in the event of war, lists some 40 000 potential target installations. In addition to this a successful countervailing strategy depends on a range of support and infrastructural functions and capabilities such as an advanced attack assessment capability, accurate and immediate intelligence on the status and disposition of Soviet forces, and an enduring command, control and communications system. It is clear that U.S. forces do not provide precision to these capabilities at present, and it must be doubtful whether it ever will, given that the strategic C^3 systems will remain vulnerable to all the threats to which nuclear forces themselves could be subject, as well as secondary effects such as electromagnetic pulse (EMP), jamming and deception. Furthermore, because C^3 systems are crucial to the counterforce strategy, they are likely to be targeted by the Soviet Union at the beginning of a conflict.

Overview: Problems and Future Options

4.72 Since the discovery of nuclear power, the United States and the Soviet Union have continued to expand their nuclear arsenals partly to underwrite their superpower status and partly to prevent their major rival from gaining either a military or political advantage in world affairs. The steady

accumulation of nuclear weapons has brought with it the problem of deciding whether and how these new forces should be used. The leaders of both sides are faced with the realisation that, on the one hand, nuclear weapons provide the potential for enormous military or political influence but, on the other hand, a military conflict between the two states could result in their mutual destruction.

4.73 The basic approach taken by the superpowers to the problems posed by the existence of nuclear weapons differed, at least initially. In the Soviet Union, nuclear weapons were integrated into the military structures and operational concepts that existed at the time. The Soviet leadership was aware of the enormous damage that could be inflicted by nuclear weapons and sought to limit this damage in the event of war by building up its defences against attack by U.S. aircraft and other weapons, and by developing the capacity to end any military conflict quickly. This latter approach stemmed from the historical experiences of the Soviet Union and tended to emphasise counterforce weapons and capabilities, which could be used to attack and destroy an adversary's military assets, thereby limiting his ability to conduct a prolonged military campaign. It also gave preference to the doctrine of pre-emption in which the adversary's assets would be attacked before he could use them. This 'conventional' approach to nuclear war-fighting has continued to characterise Soviet strategic nuclear policy, although in recent years there have been increasing signs that the Soviet leadership realises and accepts that nuclear war of any kind is no longer a feasible military option.

4.74 Unlike the Soviet Union, the United States' political leadership has held the view that there are no effective defences against nuclear attack - especially attack by ballistic missiles - and so nuclear war would result in the destruction of the two nations. Rather than seek to limit the damage that would occur in the event of a military conflict, the United States sought to prevent such a conflict from occurring in the first place by utilising the concept of deterrence. Deterrence aims to convince the potential adversary that he has nothing to gain by using force or threatening to use it against another state.

4.75 Initially, <u>nuclear</u> deterrence was achieved by threatening to destroy Soviet society in the event that it attacked U.S. interests with either nuclear or conventional forces. In recent years, however, U.S. strategic nuclear policy, both in theory and in form, has moved to a more complex position. Continued technological advances, together with the desire to escape from the moral and policy dilemmas of the MAD doctrine, has led the U.S. towards a policy of deterrence by denial where Soviet aggression is thought to be most credibly deterred by meeting the threat at the level posed.

4.76 While deterrence has remained the central objective of America's national security posture, the policies designed to achieve this objective have changed significantly. Official language now extends the meaning of deterrence from assured destruction to preparing to engage in a nuclear war and being able to deny the Soviet Union victory at the level of aggression

it chooses to initiate. To some extent, U.S. nuclear policy has become 'conventionalised', that is, nuclear force is being increasingly described in terms of, and may be expected to be used in much the same way as, military force prior to 1945. It has also become more closely aligned with current Soviet strategic doctrine although there are some significant differences between the two. Despite these differences, many of the criticisms of the countervailing strategy apply in equal force to the present Soviet doctrine.

4.77 It has been argued that the evolving 'countervailing' theory of deterrence may well be more suitable to the strategic and technical environment of the 1980s than the earlier theory of deterrence by punishment which underlay the MAD doctrine. But it has not overcome the basic fact that both the United States and the Soviet Union remain at all times, before and during a war, vulnerable to a devastating attack against their cities. The national security of both the United States' and the Soviet Union ultimately remains dependent on the action of their major adversary. Further, there must be serious doubts whether the deployment of intermediate-range nuclear weapons into Europe provides United States' decision-makers with a range of plausible options below the strategic level. From the point of view of the Soviet Union, there is little difference if an attack on its territory were from U.S.-based ICBMS or European-based IRBMS. The damage incurred would be much the same and the Soviet Union would probably respond to both attacks in the same way. Thus intermediate-range nuclear weapons such as the Pershing II, and to a lesser extent the GLCM, carry the high risk of escalation in the event of military conflict in Europe.

4.78 It can be argued that the continued mutual hostage relationship that operates between the superpowers makes each side extremely cautious in their dealings with the other. While the use of military force is likely to put the aggressor's own country at risk he will be deterred from carrying out such an action. The problem with this is that one of the consequences of the move towards developing more credible options under the countervailing theory of deterrence is that it obscures the logic and strength of basic deterrence. An important advantage of assured destruction is that it separates nuclear weapons from other political and military activities and so serves to reinforce the fact that nuclear weapons should never be used. The development of 'war-fighting' doctrines together with the countinued miniaturisation of nuclear weapons and their integration into conventional force structures, may be contributing to an increasing perception that nuclear wars may be able to be fought and endured in much the same manner as conventional armed conflicts: limited, controlled, prolonged and with a 'winner'and a 'loser'. Such a belief erodes the fear of a nuclear holocaust and may induce some leader at some time in the future to think that he could risk starting a nuclear war because he would either be able to stop short of a complete catastrophe or reduce the risks or costs of such a conflict below 'acceptable' levels. The United States has recognised this problem for some time. President Reagan has stated that nuclear war is not regarded as a viable policy option often pointing out that 'nuclear war cannot be won and must never be fought'.

4.79 In addition to making the possible use of some nuclear weapons more feasible the countervailing theory is also introducing a number of other problems and dilemmas which are at least as troublesome - some would argue more so - than those posed by the concept of assured destruction. It is far more complex to manage than a system based on assured destruction, and directly contributes to the arms race since it prescribes no logical limit to the number of weapons or capabilities needed to deter the Soviet Union. As long as both sides keep building weapons there will be a need for more and more weapons with which to destroy them. Continued technological improvements and an expansion in military capabilities enforces the 'asymmetries' in the respective strategic arsenals and makes the achievement of a strategic balance more difficult to achieve. More importantly, as both sides increase the roles and capabilities of their nuclear forces, worst-case planning by both superpowers is likely to dictate that existing policies and rules governing the use and deployment of nuclear forces be reviewed. Under these conditions, policies such as launch-on-warning or first strike - which presently are not taken seriously by either side - may begin to be countenanced.

4.80 The countervailing strategy may provide greater flexibility and be more credible than assured destruction but it by no means guarantees stability in a crisis. Many of the new counterforce weapons pose a direct threat to the opposing side's retaliatory or second-strike forces. Each superpower is vigorously developing and deploying new weapons systems that it will view as highly threatening when the opponent also acquires them.The increasing integration of nuclear and non-nuclear forces and the deployment of tactical nuclear weapons into Europe is increasing the potential paths to nuclear conflict and lowering the nuclear threshold. The current imbalance between numbers of nuclear warheads and delivery systems is increasing the incentive for pre-emption in times of tension. The Soviet doctrine of massive counterforce response, together with NATO doctrine of first use of tactical nuclear weapons in a local conflict, ensures that any use of nuclear weapons - whether accidental or contrived - may quickly escalate to an all-out exchange.

4.81 The doctrines of counterforce and deterrence by denial are firmly entrenched on both sides and will continue to be developed which will ensure the continuation of the trends and problems described above. Both superpowers are proceeding to expand their counterforce and war-fighting capabilities through strategic modernisation programs which will continue into the 1990s. However, partly in recognition of the problems posed by the system of deterrence, the Reagan Administration is also examining, under its Strategic Defense Initiative, the feasibility of establishing a new deterrent concept based on defensive rather than offensive technologies and weapon systems. Such a transition, if it is feasible, would occur in parallel with the continued modernisation of U.S. offensive strategic forces and would be unlikely to be implemented before the end of this century.

4.82 The problems of the countervailing doctrine and its Soviet equivalent are sufficient to warrant serious consideration of whether the current system of deterrence provides a suitable solution over the longer term. Is there an alternative nuclear or non-nuclear strategy which could form a safer restraint for superpower competition and a better basis for world security in the future? If an alternative exists, a question of equal importance is how it should be implemented. When considering a range of possible alternatives, it is useful to divide them into two categories:

a. those involving the continuation of existing concepts and policies at expanded, current or reduced levels of nuclear weapons; and

b. those involving a radical transformation of either existing doctrine and arsenals either as a result of disarmament, or the introduction of large-scale defences against nuclear attack or a combination of both.

These are discussed in detail in Chapter 20.

CHAPTER THREE
ENDNOTES

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2. According to Desmond Ball [Pacific Defense Reporter, May 1981, p.7.] declaratory policy 'is that set of public pronouncements made by the President, the Secretary of Defense or sometimes other senior Administration officials regarding the requirements of deterrence targeting policy, and strategic doctrine'. Operational or action policy, on the other hand, 'comprises the actual war-fighting strategy that the United States would adopt in a nuclear exchange; the designation of the forces to be used and the targets to be hit... and the rate at which the exchange is to proceed. It is the policy laid down in various [classified] presidential memoranda spelt out in the Nuclear Weapons Employment Policy (NUWEP) issued by the Secretry of Defense, and given effect in the Single Integrated Operational Plan (SIOP).

3. See, for example, United Nations Centre for Disarmament, Comprehensive Study on Nuclear Weapons, United Nations, New York, 1981, pp.103-105; Lawrence Freedman, The Evolution of Nuclear Strategy, MacMillan, London, 1981; and Robert P. Berman and John C. Baker, Soviet Strategic Forces: Requirements and Responses, The Brookings Institution, Washington D.C., 1982, Chapter 2.

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CHAPTER 5

THE SPREAD OF NUCLEAR WEAPONS (HORIZONTAL PROLIFERATION)

Introduction

5.1 Concurrent with the expansion of the nuclear arsenals of the superpowers, there has been a gradual, but much less rapid, spread of nuclear weapons to other states. There are now five recognised nuclear weapon states - United States, Soviet Union, Great Britain, France and the People's Republic of China - and a sixth nation, India, detonated what it called a 'peaceful nuclear explosion' in May 1974. There is also a significant number of countries suspected of either possessing nuclear weapons or being very close to possessing them. These so-called 'threshold states' include Israel, South Africa, Pakistan, Brazil, Argentina and Iraq.

5.2 In this Chapter, horizontal proliferation is defined as the growth in the number of countries that have nuclear weapons or explosive devices or the capability to manufacture such a device. As more nations acquire the means, materials and motivation to build nuclear weapons, there is an increased risk that nuclear war could break out between nuclear states in the same region. If the superpowers were drawn into such a conflict, it could lead to general nuclear war. Horizontal proliferation therefore is an important item on the arms control agenda.

5.3 To date, horizontal proliferation has been reasonably controlled. Excluding India, there are still only the five original nuclear weapons states. There is now in place an extensive non-proliferation regime, embracing international and bilateral agreements and safeguards. The Nuclear Non-Proliferation Treaty (NPT) is widely credited as the most successful international arms control agreement, although this may be arguable in view of the significant number of states which are not signatories to the NPT and the continued growth in the number of 'threshold states'. Moreover there is no room for complacency. The non-proliferation regime is under increasing pressure which could undermine its effectiveness and ultimately lead to a flood rather than a trickle of entrants into weapons-producing status. The principal pressure stems from the increase in the number of threshold states and their nuclear capabilities. The failure of the superpowers to achieve significant reductions in their nuclear arsenals could also reduce the level of insecurity felt by non-nuclear states. While the prospect for controlling further horizontal proliferation is poor, it is not impossible. A number of approaches, some of which are being pursued already by Australia, are available to reduce the danger of continued horizontal proliferation.

5.4 This Chapter begins by discussing the dangers of horizontal proliferation and how nuclear weapons are acquired. An understanding of the techniques and costs of acquiring nuclear weapons provides a basis for determining how best to control their spread. It then looks at the present means of controlling

the spread of weapons and where nuclear weapons are and are likely to be in the future. Finally, some of the problems facing the current non-proliferation regime are discussed, together with current controls and their prospects of success.

The Dangers and Risks of Horizontal Proliferation

5.5 The dangers of nuclear weapons proliferation were noted by the Palme Commission as follows:

> Each additional nuclear power increases the risk that nuclear war will occur. The more people there are with access to nuclear weapons, the greater the chance that a human error or the act of a madman could result in catastrophe. The more national systems there are controlling nuclear weapons, the greater the risk of mechanical or electronics failure that could lead to war. And the more nations there are with nuclear weapons, the greater the odds that one day, by deliberate intent or miscalculation, someone would initiate what might become the ultimate war.[1]

5.6 The risks of horizontal proliferation are compounded by the fact that nuclear weapons, or the capacity to produce them, are being introduced into areas of instability throughout the world. The past 40 years have witnessed a succession of conventional military conflicts in these areas. It is unlikely that such conflicts will cease in the future. Continuing nuclear weapons proliferation could set up a chain reaction - where all states contemplating the prospects of nuclear proliferation in the region decide that the only appropriate response is to join in. There is some evidence that such arms races are already evident in the Middle East and Southern Asia.

5.7 It would seem unlikely that the spread of nuclear weapons could create a series of stable regional balances of power or enhance overall stability. This is because the political and military conditions that enhance nuclear stability between the superpowers would not operate for long in confrontations between, say, Israel and the Arab states or Pakistan and India. A further problem is that few of the new nuclear weapon states are likely to possess the elaborate system of command and control, safety devices or mutual verification procedures which underlie the stability of the power balance between the superpowers. A regional nuclear war could involve the superpowers, and risk a nuclear exchange between them. Also, it would end the taboo on the use of nuclear weapons in anger - a taboo that has persisted since 1945 as one of our most powerful restraints on nuclear warfare.

5.8 Horizontal proliferation increases the chances of nuclear weapons falling into the hands of subnational or terrorist groups since:

a. The number of trained personnel who are familiar with the process of building nuclear weapons will increase;

b. the amount and distribution of fissionable material that is subject to theft or hijacking will increase; and

c. there will be greater opportunities to either purchase or steal weapons from either sympathetic or unsafeguarded suppliers.

5.9 Finally, the spread of nuclear facilities - military and non-military - would add to the effects of a nuclear war, should it begin. Power plants and munitions depots are attractive targets in war. The destruction of nuclear reactors and nuclear stockpiles could result in extra radiation and radioactivity being released into the environment.

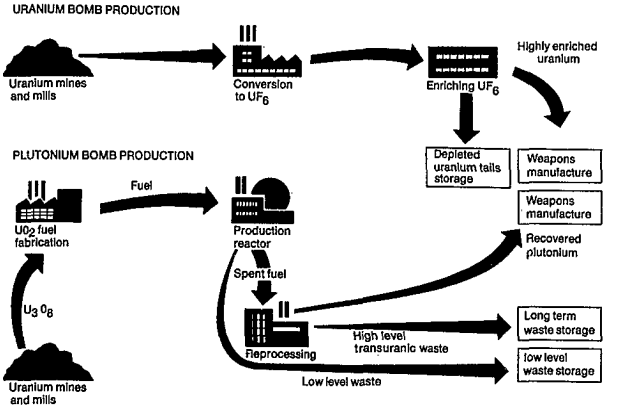
Deciding to Go Nuclear

5.10 National acquisition of nuclear weapons depends basically on the strength of the motivation for nuclear weapons acquisition, relative to the height of the technical, economic and political barriers to acquiring such a capability.

5.11 The motivations for acquiring nuclear weapons are largely political and strategic. A government may see nuclear weapons as a means of enhancing national prestige or international influence. It may acquire a nuclear capability as a means of deterring aggressive neighbours or enhancing national security against undetermined threats. The strength of its motivations will in turn depend on a range of factors including the state of the global and regional environment, domestic political concerns and the actions of neighbouring states.

5.12 While a country intent on acquiring nuclear weapons may be prepared to ignore the political costs of such a decision, such as triggering a regional arms race or attracting international sanctions or both, it still has to overcome a number of significant technical and economic barriers. The amount of material required to make a bomb (defined as the critical mass) is typically 10-15kg for uranium and 5kg for plutonium. As shown in Figure 5.1 the production of weapons-grade material is a complex undertaking requiring relatively advanced expertise and technologies. The fissile isotope of U235 forms only about 0.7 per cent of natural uranium. This fraction needs to be increased to between 40 to 90 per cent. The enrichment of uranium involves conversion of the basic uranium ores ('yellowcake') into uranium hexafluoride, and then separation of U235 from U238 by either

Figure 5.1: Production of uranium and plutonium for weapons use.



Source: ASTEC, *Australia's role in the nuclear fuel cycle*, Canberra, AGPS, 1984, p.68.

gaseous diffusion or centrifuge methods. Plutonium occurs as a product of the fission of either Uranium-235 or Uranium-238 and so is normally produced in a nuclear reactor. The plutonium must then be separated chemically from the residual uranium and other fission products contained in the spent fuel by a method known as 'reprocessing'. It is generally easier to construct a plutonium production reactor than use conventional power reactors although the latter (particularly 'breeder' reactors) can be used to supply weapons-grade material.

5.13 The production of weapons-grade plutonium is a relatively expensive exercise. A 1981 UN study[2] estimated that the investment costs for a simple type of reactor giving enough plutonium-239 for one or two weapons annually (10 kg plutonium) would be in the range of $13 to $26 million (1976 prices). A further $25 million would be needed for a reprocessing plant to extract the plutonium from the irradiated fuel. The study estimated that such a capability would take about four years to develop. In addition to the explosive substance, there are the further expenses of warhead assembly and weapon testing. The UN study estimated that a plutonium weapon program that produced ten 20-KT devices over ten years would cost approximately $20 million per warhead. The development of advanced delivery systems from scratch would cost thousands of millions of dollars extra, although cheaper but less effective solutions could be considered including the use of conventional weapons platforms, especially tactical combat aircraft.

5.14 While the cost and infrastructural barriers can be high, it is clear that governments with a reasonable technical and industrial capacity and sufficient will to procure weapons-grade uranium or plutonium would eventually be able to develop and manufacture their own nuclear weapons, although it may take a good deal longer than initially expected. At present, only a relatively small number of countries seem to have both the motivation and capability to acquire nuclear weapons (See Table 5.1). Attempts to prevent further proliferation by these states should take into account both sides of the proliferation equation. Policies should seek to improve and strengthen the barriers to the acquisition of nuclear weapons while at the same time reducing the motivations for states to go nuclear. An important question here is whether the existence of a civil power industry in a potential threshold state significantly lowers the barriers to the acquisition of nuclear weapons?

5.15 Both civil reactor grade material and the basic technologies used in civil nuclear programs are common to, and have the potential to be used in the production of nuclear weapons. These fundamental links between the civil and military uses of nuclear energy can be seen by examining the nuclear fuel cycle (described in Chapter 17). As noted by the Australian Science and Technology Council's (ASTEC) recent report, Australia's Role in the Nuclear Fuel Cycle, the key risk areas for diversion of nuclear material from civilian use into military production are the enrichment and reprocessing technologies. The security of yellowcake (concentrated uranium ore which is the form in which Australian uranium is exported) is 'not as

Table 5.1 Nuclear Weapons Capability Within this Century

Possession:	Little Motivation:	Some Motivation:	High Motivation:
United States	Australia	Argentina	Iraq
Soviet Union	Austria	Brazil	Libya
Great Britain	Belgium	Chile	Pakistan
France	Canada	South Korea	South Africa
China	Czechoslovakia	Taiwan	
India	Denmark		
Israel (?)	East Germany		
	Egypt		
	Finland		
	Iran		
	Italy		
	Japan		
	Mexico		
	Netherlands		
	Norway		
	Poland		
	Romania		
	Saudi Arabia		
	Spain		
	Sweden		
	Switzerland		
	West Germany		
	Yugoslavia		

Source The Harvard Nuclear Study Group, Living with Nuclear Weapons, Harvard University Press, Cambridge, Massachusetts, 1983, p.222.

necessary as it is in later stages of the fuel cycle; yellowcake is usually treated just as a valuable, and mildly radioactive product'.[3] Other areas of the fuel cycle, including the handling of wastes and the storage and transportation of nuclear materials were also found to be less risky but nonetheless cannot be ignored.

5.16 The possibility that key materials and technologies may be diverted from the civil nuclear fuel cycle and used for military purposes is recognised by Governments and industry. This has led to the adoption of an extensive system of internationally recognised safeguards which cover all elements of the nuclear fuel cycle and which are administered by the International Atomic Energy Agency (IAEA). In addition, a number of countries, including Australia, have their own bilateral safeguards agreements which complement and extend the IAEA procedures and requirements. The safeguards systems, detailed shortly,

constitute a further technical barrier to the acquisition of nuclear weapons, but one which has taken some time to establish and develop. As a result, there has been in the past some diversion of civil materials and technologies into military uses. That this will continue is less likely but cannot be discounted particularly in view of some of the potential limitations of the safeguard systems. This issue is taken up in more detail in Chapter 17.

Barriers to Horizontal Proliferation

5.17 Current efforts to restrain the spread of nuclear weapons are based on a loose combination of treaty commitments not to acquire nuclear weapons; informal and voluntary understandings of nuclear supplier states to limit certain nuclear cooperation with other states; bilateral agreements between some nuclear supplier states and their clients; and a general predisposition against nuclear weapons.

5.18 The principal institutional and legal elements of the non-proliferation regime are depicted in Figure 5.2. They comprise the Nuclear Non-Proliferation Treaty (NPT), the Partial Test Ban Treaty, the Treaty for the Prohibition of Nuclear Weapons in Latin America (the Treaty of Tlatelolco) the South Pacific Nuclear Free Zone, and the International Atomic Energy Agency (IAEA) and its working bodies. These elements are supplemented by an array of formal arrangements which are aimed largely, but not exclusively, at nations outside the NPT regime. These components include the Guidelines of the Nuclear Suppliers Group (or London Club), Zangger Committee understandings on sensitive nuclear exports and associated trigger lists, the Convention on the Physical Protection of Nuclear Materials and various international forums in which non-proliferation aspects are discussed. There are also numerous bilateral nuclear safeguard agreements and export controls for controlling the export and use of sensitive nuclear materials. Taken together, these measures generally aim to:

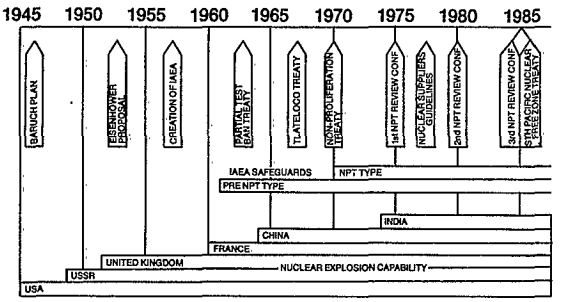
a. Create a regional and global environment in which there is no need for non-weapon states to acquire nuclear weapons; and

b. assure that the peaceful uses of nuclear energy do not contribute to the proliferation of nuclear weapons.

Treaty on the Non-Proliferation of Nuclear Weapons (NPT)

5.19 The NPT was opened for signature on 1 July 1968, and entered into force on 5 March 1970. The Treaty's objectives (Articles I and II) are to prevent the manufacture or acquisition of nuclear weapons or nuclear explosive devices by states other than those nuclear weapon states which were classified (Article IX 3) as such at the time (the United States, Soviet Union, Great

Figure 5.2: Main international steps or proposals for stopping horizontal proliferation.



Source: Adapted from *Australia's role in the Nuclear Fuel Cycle*, Canberra, AGPS, 1984, p.101.

Britain, France and China); to further disarmament negotiations (Article VI); to assure that nuclear materials and technology are used only for peaceful purposes (Article III); but, at the same time, to facilitate the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy (Article IV). Non-nuclear weapon states undertake to conclude safeguards agreements with the International Atomic Energy Agency (IAEA) for preventing diversion of nuclear energy to non-peaceful uses.

5.20 The Treaty, open to any state, presently has 132 parties - including Australia.[17] Signatories can withdraw from the Treaty on three month's notice to the UN Security Council. A further four countries have signed but not ratified the Treaty. Eighty-two of the 132 members have concluded agreements with the IAEA to apply safeguards to their nuclear industry, where these exist. Those countries not party to the NPT are listed in Table 5.2. The NPT provided for an initial Treaty Review Conference which took place in 1975 to review the operation of the Treaty. Two subsequent review conferences were held in 1980 and 1985. In 1995 the parties must decide whether the Treaty should continue in force indefinitely or be extended for a further limited period.

TABLE: 5.2

COUNTRIES WHICH ARE NOT MEMBERS OF THE NPT(1)

Albania	France	Saudi Arabia
Algeria	Guyana	South Africa
Andorra	India	Spain
Angola	Kuwait	St. Christopher and Nevis
Argentina	Malawi	Trinidad and Tobago
Burma	Mauritania	United Arab Emirates
Chile	Monaco	United Republic of Tanzania
China, People's Republic of	Mozambique	Yemen, Arab Republic
Colombia	Niger	Zambia
Comoros	Oman	Zimbabwe
Cuba	Pakistan	
Djibouti	Qatar	

Note (1) Colombia, Kuwait, Trinidad and Tobago and Yemen, Arab Republic have signed but not ratified the Treaty.

Sources: Australia's Role in the Nuclear Fuel Cycle, AGPS, Canberra 1984, p. 294; Department of Foreign Affairs, Disarmament Newsletter, 16 August 1985; and SIPRI Yearbook 1986, pp.562-76.

5.21 Recognising that the NPT forms the centrepiece of the non-proliferation regime, Australia has consistently expressed its strong support for the continuation and strengthening of the Treaty and is actively promoting its universal acceptance. Australia currently supplies uranium only to non-nuclear weapon states (NNWS) which are parties to the NPT and have concluded the necessary safeguards agreements with the IAEA. It considers that, as a minimum, non-NPT parties should not be supplied with nuclear materials or technologies unless all their facilities are subjected to IAEA safeguards (so-called 'fullscope' safeguards). According to Mr D.A. Townsend of the Department of Foreign Affairs, this latter approach:

> ...recognises that technology can flow from safeguarded to unsafeguarded portions of the fuel cycle; that IAEA safeguards are more effective the wider their coverage; and that NNWS non-NPT Parties should not have a better deal than 127 NNWS NPT Parties (which are obliged by Treaty membership to accept complete safeguards coverage and whose position is the norm). The objective is to provide an inducement to accept the Treaty, recognising that a refusal to cooperate in certain circumstances is better than to proceed and perhaps jeopardise international security.[18]

5.22 Such a strategy of denying assistance unless 'fullscope' safeguards are in operation in the receiving country is limited by the fact that a number of non-NPT NNWS have relatively mature nuclear capabilities and that some are becoming potential suppliers in their own right. This has led some major suppliers to favour a more 'constructive' approach to trading with non-NPT parties, in part to retain some influence over the activities of this new group, but also in recognition of the changing structure of the supply regime.

5.23 Australia acknowledges that there:

> ...are pressures on the Treaty, resulting from widespread frustration at the lack of progress towards nuclear disarmament ... but also from the dissatisfaction of some countries as to the benefits they receive in terms of international cooperation in the peaceful uses of nuclear energy which they see as their entitlement under the Treaty.[19]

In seeking to counter these pressures, Australia has stressed the importance of reaching a Comprehensive Test Ban (CTB) Treaty as soon as possible. Such a treaty is seen as a direct counter to horizontal proliferation in that it would place an important barrier between developing the capacity to explode a nuclear device and developing a nuclear weapon. A CTB is also seen to

'have an important symbolic effect in that it would demonstrate to non-nuclear countries that the nuclear weapon states are serious about nuclear disarmament'.[20] Australia has been urging both the United States and the Soviet Union to appreciate the concern among non-nuclear weapon states over their lack of progress on disarmament and its likely implications for the NPT and the non-proliferation regime in general.

5.24 In addition, in accordance with Article II of the NPT, Australia has provided nuclear technical assistance directly to other NPT parties and through the International Atomic Energy Agency (See para 5.55). Australia has also played a significant role in the NPT Review Conferences, chairing one of the two committees formed during the 1980 Conference and promoting an initiative at the 1985 Conference requiring parties not to transfer nuclear material, equipment or technology to non-nuclear-weapon states not party to the Treaty unless those states accept IAEA safeguards over all of their nuclear activities. Australia has also circulated papers on Article III (safeguards) and IV (peaceful nuclear cooperation) to try and influence the direction of debate on these matters.

The Partial Test Ban Treaty (PTBT).

5.25 This Treaty entered into force on 10 October 1963. The PTBT prohibits the carrying out of any nuclear weapon test explosion or any other nuclear explosion:

a. in the atmosphere, in outer space, or under water, whether territorial waters or high seas; or

b. *in any other environment if such explosion causes* radioactive debris to be present outside the territorial limits of the state under whose jurisdiction or control the explosion is conducted.

5.26 The Treaty is open to all states and is of unlimited duration. Any party may withdraw on three months notice if it decides that extraordinary events related to the subject matter of the Treaty have jeopardised its supreme interests. At present there are 112 parties, the most notable exceptions being France and China.

5.27 Australia signed the Partial Test Ban Treaty in 1963. It has consistently expressed strong objections to French nuclear testing in the Pacific and has sought to mobilise regional and world opinion against continuation of these tests. In 1973, Australia and New Zealand brought the matter before the International Court of Justice, claiming that nuclear testing in the atmosphere over the Pacific Ocean was not consistent with international law. Shortly after this action, France announced that it had reached a stage in its nuclear technology where is could continue its program by relying exclusively on underground testing. It is still not a member of the PTBT and continues to

test weapons at Moruroa Atoll in French Polynesia. Australia has continued to express its concern over the French underground testing and, following France's explosion of a large nuclear device in May 1983, suspended all shipments of uranium to France, although this decision was subsequently revoked in August 1986.The dissatisfaction of South Pacific Forum member countries with French nuclear testing was a factor contributing to the creation of the South Pacific Nuclear Free Zone.

The Tlatelolco Treaty

5.28 This Treaty was concluded at Mexico City in 1967 and entered into force in 1968. It prohibits the testing, use, manufacture, production or acquisition by any means, as well as the receipt, storage, installation, deployment and any form of possession of any nuclear weapons by Latin American countries. The parties are required to conclude agreements with the IAEA for the application of safeguards to their nuclear activities. The Treaty is open to signature by all the Latin American states situated in their entirety south of latitude 35°N. The Treaty is to remain in force indefinitely, but any party may withdraw on three months notice. Execution of the Treaty is to be suspended for all members in the event of the rise of a new power having nuclear weapons. The SIPRI Yearbook 1986[21] shows that of the eligible states, Cuba, Guyana and Saint Lucia have not signed the Treaty. Argentina has signed on the understanding that parties are able to carry out, by their own means or in association with third parties, explosions of nuclear devices for peaceful purposes. A similar position was taken by Brazil. Both Chile and Brazil have ratified the Treaty but it is not yet in force for them because they require prior ratification by all eligible states.

5.29 Under Additional Protocol 1, annexed to the Treaty, state parties which are internationally responsible for territories lying within the limits of the geographical zone established by the Treaty (France, the Netherlands, the U.K. and the U.S.), undertake to apply the statute of military denuclearization, as defined in the Treaty, to such territories. Under Additional Protocol 11, annexed to the Treaty, the nuclear weapon state parties undertake to respect the statute of military denuclearization of Latin America, as defined and delimited in the Treaty, and not to contribute to acts involving a violation of the Treaty, not to use or threaten to use nuclear weapons against the parties to the Treaty. The Treaty does not prohibit transit of nuclear weapons through the zone or entry to ports or airports of weapons-carrying ships or aircraft.

5.30 While Australia is not directly concerned with the Treaty of Tlatelolco, at a more general level it supports the concept of nuclear free zones or zones of peace as a means of limiting the spread of nuclear weapons and building confidence in the arms control process. In line with this belief, it proposed and signed the recently concluded Treaty of Rarotonga establishing a South Pacific nuclear free zone (this is described in more detail in Chapter 16). Also, it has affirmed Australia's support for an international conference on the Indian Ocean zone of peace proposal, and is directly contributing to a UN study on the broad question of nuclear weapon free zones.

Other Treaties

5.31 Other treaties that are relevant to nuclear non-proliferation include the Antarctic Treaty, the Outer Space Treaty and the Sea-Bed Treaty. These are described in Chapter 2. Australia is a party to all these treaties. In addition to these, a Convention on the Physical Protection of Nuclear Materials was adopted in Vienna in late 1979 and was signed by Australia in 1984. The Convention provides guidelines for physical protection of nuclear materials during international shipments and seeks to establish a general framework for cooperation among states in the recovery and return of stolen nuclear material.[22]

The International Atomic Energy Agency

5.32 The operating arm of the non-proliferation regime is the International Atomic Energy Agency (IAEA). The Agency was established in 1957. It is an intergovernmental organisation which is directed by a Board of Governors, composed of representatives from 34 Member States (including Australia), and a General Conference of the entire membership (about 110 states). Although autonomous, the IAEA is a member of the United Nations System and sends reports on its work to the General Assembly and other United Nations organs.

5.33 The IAEA has two broad roles: first to foster and advise on the development of peaceful uses of nuclear energy throughout the world; secondly to apply safeguards to ensure that nuclear materials and equipment intended for peaceful uses are not diverted to military purposes or that safeguarded facilities are not used to produce unsafeguarded nuclear materials for military or explosive purposes. Non-nuclear weapon States party to the NPT are required under that Treaty to conclude safeguards agreements with the IAEA covering all nuclear materials in all their peaceful nuclear activities. The safeguards system involves (1) examination of the design characteristics of a nation's existing and planned nuclear plants; (2) maintenance of detailed records of plant operations and the flow and inventory of nuclear materials and submission of reports on these to the IAEA; (3) on-site inspection by agency officers.

5.34 Since the 1960s no diversion of safeguarded nuclear material or misuse of any safeguarded facility has been recorded by the IAEA, although there has been one case where a re-transfer of depleted uranium from an NPT party to a non-NPT party was detected and on two occasions in 1982 the Agency reported to the Board of Governors that it was not in a position to perform adequate verification of one facility.[23] While the system of IAEA safeguards has generally been successful, they remain subject to a number of limitations which could allow future diversion or undermine confidence in the effectiveness of the Agency's procedures. These include inadequate staffing, reliance on periodic rather than continuous inspection with the notice of inspection being given in advance, inadequate instrumentation and procedures covering new technologies, measurement errors and tolerances and the potential inconsistency in both promoting the peaceful use of nuclear power and preventing its misuse.[24]

5.35 The number of countries and nuclear facilities covered by IAEA safeguards has steadily increased. There remain, however, a significant number outside the recognised nuclear weapon states which are not subject to IAEA or bilateral safeguards. These are listed in Table 5.3. In addition, as described earlier, the five recognised nuclear weapon states are not required under the NPT to apply safeguards on their civil facilities.

5.36 Since the founding of the IAEA in 1957, Australia has held a 'designated seat' on the Agency's Board of Governors. Continued membership of the Board is seen by the Government to be important as it 'provides Australia with a platform from which to work effectively for strengthened non-proliferation controls'.[25] This view was supported by the ASTEC report which recommended that Australia take steps to maintain and strengthen its credentials for designation to the Board of Governors of the IAEA. The report also noted that through its Board membership, Australia has played an important role in promoting consensus on some of the difficult areas facing the IAEA such as spent fuel management and plutonium storage.

5.37 Australia's role in strengthening the NPT was described earlier in this section. In addition to these initiatives, and its Board membership, Australia supports the IAEA through annual budgetary contributions, funds to the IAEA Technical Assistance and Cooperation Program and the Regional Cooperative Agreement. Australia provides expert assistance to a number of IAEA programs and specialist working groups. It is conducting research into the application of safeguard techniques in centrifuge enrichment operations and reprocessing plants and is developing new generation safeguards equipment. Australia is also a member of the Standing Advisory Group on Safeguards Implementation (SAGSI), which formulates guidelines for the form and content of the IAEA's Safeguards Implementation Report, the mechanism through which the IAEA reports on the extent, efficiency and efficacy of its verification activities. The SAGSI also reviews the detection goals to be used in the IAEA safefuards approaches and can recommend to the Board of Governors safeguards procedures, covering individual states' systems of accounting for and control of nuclear material, as well as new safeguards approaches.

Australia's Bilateral Safeguards Agreements

5.38 In addition to its NPT obligations, Australia has established bilateral agreements with a number of countries and institutions covering the supply of uranium and other purposes. The basic purpose of the agreements is to ensure that 'when AONM (Australian origin nuclear material) is involved, international nuclear trade takes place under safeguards and non-proliferation conditions acceptable to Australia'.[26] The fundamental undertaking Australia requires from all importing countries is 'that Australian origin nuclear material (AONM) will be used for peaceful purposes and that AONM will be covered by IAEA safeguards to certify compliance to this'.[27]

TABLE 5.3: NUCLEAR FACILITIES NOT SUBJECT TO IAEA OR BILATERAL SAFEGUARDS

Country	Facility
Argentina	Heavy water production plant Pilot enrichment plant Uranium hexafluoride plant
Brazil	Uranium hexafluoride plant
India	Six heavy water power reactors Six research reactors Three reprocessing plants (1 under safeguar while processing safeguarded fuel) Fuel fabrication plant Two uranium oxide conversion plants Thorium oxide fuel fabrication plant Fast breeder fuel fabrication plant
Israel	Research reactor Reprocessing plant Heavy water production plant Fuel fabrication plant
Pakistan	Two reprocessing plants Pilot enrichment plant Fuel fabrication plant Two heavy water production plants Uranium hexafluoride plant
South Africa	Enrichment plant Fuel fabrication plant Two uranium oxide conversion plants Uranium hexafluoride plant.

Source: Extracted from SIPRI Yearbook 1986, pp.495-7.

5.39 Other basic elements of the agreements include 'fall-back' safeguards in the event IAEA safeguards lapse (in the case of non-nuclear weapon states) or should the Agency cease to apply safeguards in the case of nuclear weapon states; prior consent rights over sensitive operations such as reprocessing of spent fuel, enrichment of AONM beyond 20 per cent U235 and retransfer of AONM to a third party; and adequate physical protection to ensure against possible sabotage or theft of AONM in nuclear facilities or during transport. In addition, current policy and agreements provide administrative arrangements to ensure effective fulfilment of the obligations contained in the agreements, and regular consultation to monitor their operations. There are also provisions for arbitration in case of dispute as well as sanctions in the event of non-compliance including, ultimately, the suspension or cancellation of further transfers of AONM. The safeguards agreements are administered by the Australian Safeguards Office, which is part of the Department of Resources and Energy.[28]

Horizontal Proliferation: The Current Status

The Minor Nuclear Powers

5.40 The United Kingdom, France and China all maintain independent nuclear forces which, while small compared with those of the United States and the Soviet Union, are nonetheless significant in terms of their destructive potential. Even though they are fully accepted under the NATO alliance and are subject to U.S. nuclear guarantees, both Britain and France maintain their own strategic nuclear forces to deter the Soviet Union from carrying out a nuclear attack upon their home territories or interests. China maintains its small but credible nuclear deterrent to counter encirclement by what it considers to be real or potential enemies such as the Soviet Union, Vietnam and India.

United Kingdom

5.41 The British nuclear forces are shown in Table 5.4. Following the phase-out of its Vulcan bomber force in 1982, the United Kingdom's strategic nuclear deterrent capability is based entirely on the submarine launched ballistic missiles of its SSBN force. It currently has 4 Resolution SSBN each fitted with 16 Polaris A3 missiles, each with three 200KT nuclear warheads. These missiles are being replaced by the Chevaline system, designated A3-TK, which have two 40KT warheads and can be delivered with greater accuracy over a greater range. The U.K. Government has decided to replace its current submarine force from the mid-1990s with four new SSBNs. Each submarine will have 16 launchers and will carry the Trident II SLBM. This will provide it with the capability of launching up to 896 nuclear warheads each with an explosive yield of 355KT.

5.42 The United Kingdom also has a number of short-range and intermediate-range, nuclear-capable strike aircraft in the form of its Buccaneers, Tornadoes and Harriers. The aircraft are presently limited to carrying free-fall bombs, but the possibility of arming the Tornado with a cruise missile has been considered.

Table 5.4: British Nuclear Forces, 1986[a]

Weapon system				Warheads	
Type	No deployed	Year deployed	Range (km)[b]	Warhead x yield	No in stockpile
Aircraft					
Buccaneer S2	30	1962	1 700	2 x bombs	60
Tornado GR-1[c]	180	1982	1 300	2 x bombs	360
SLBMs					
Polaris A3[d]	16	1968	4 600	3 x 200 kt	48
Polaris A3-TK	48	1982	4 700	2 x 40 kt	96
Carrier Aircraft					
Sea Harrier	30	1980	450	1 x bombs	30
ASW helicopters					
Sea King	69	1976	..	1 x depth bombs	69
Wasp	16	1963	..	1 x depth bombs	16
Lynx	35	1976	..	1 x depth bombs	35

a. 34 Nimrod ASW aircraft, 12 Lance launchers and artillery guns (five regiments) are also certified to use US nuclear weapons.
b. Range for aircraft indicates combat radius, without refuelling.
c. 220 Tornado attack aircraft (GR-1) are on order for the Royal Air Force. Some Buccaneer and Jaguar aircraft already withdrawn from bases in FR Germany may be assigned nuclear roles in the UK.
d. The Polaris A3-TK (Chevaline) is deployed on all 3 operational SSBNs. The HMS Repulse is credited with 16 Polaris A3-TK missiles, even though it will be in refit until mid-1986 and will not go on its first patrol with Chevaline until 1987.

Source: SIPRI Yearbook 1986, p.62.

Table 5.5: French Nuclear Forces, 1986

Weapons System				Warheads		
Type	No. deployed	Year deployed	Range (km)[a]	Warhead x yield	Type	No. in stockpile
Aircraft						
Mirage IVA[b]	16	1964	1 500	2 x 70kt	AN-22	32
Mirage IVP[c]	9	1986	1 500	1 x 150kt	ASMP	12
Jaguar A	45	1974[d]	750	1 x 6-8/30kt	[e]	50
Mirage IIIE	30	1972[d]	600	1 x 6-8/30kt	[e]	35
Refuelling aircraft						
C-135F/FR	11	1965	..	..	..	..
Land-based missiles						
S3	18	1980	3 500	1 x 1 Mt	TN-61	18
Pluton	42	1974	120	1 x 15-25kt	ANT-51	120
Submarine-based missiles						
M-20	80	1977	3 000	1 x 1 Mt	TN-61	80
M-4	16	1985	4 000	6 x 150 kt	TN-70	96
Carrier aircraft						
Super Etendard	36	1978	650	1 x 6-8/30 kt	[e]	40

a Range for aircraft indicates combat radius, without refuelling.

b The AN-51 warhead is also possibly a secondary bomb for tactical aircraft, and the AN-52 is also possibly a secondary bomb for the Mirage IVA.

c A second squadron of 9 aircraft will be operational by the end of 1986, replacing an equal number of Mirage IVA variants (which have already been deducted from the above total of 16). It is assumed that the remaining 16 Mirage IVAs will no longer operate in a nuclear strike/attack mode.

d The Mirage IIIE and Jaguar A aircraft were first deployed in 1964 and 1973, respectively, although they did not carry nuclear weapons until 1972 and 1974, respectively.

e Warheads include ANT-51, ANT-52 and possibly a third type.

Source: SIPRI Yearbook 1986, p.64.

France

5.43 The French force de dissuasion (or force de frappe) maintains, at least nominally, a full strategic triad, comprising bombers and both land-based and sea-based ballistic missiles. France also has considerable tactical nuclear forces. (See Table 5.5)

5.44 The land component of its strategic triad comprises 18 intermediate-range SSBS S-3 missiles, each with a 1MT thermonuclear warhead and a maximum range of 3500 km. The S-3 will eventually be replaced by a mobile ICBM, the SX (sometimes referred to as the SSB-X) which will be a solid-propellant, two-stage mobile missile, probably using the guidance system developed for the MSBS M4 SLBM, and carrying a single 150KT warhead. The SX was originally expected to enter service in 1985 but development and deployment has been delayed, and it is now unlikely to be operational until the 1990s. French scientists are also believed to be conducting final tests on a neutron bomb.

5.45 The French naval strategic deterrent is based on six SSBNs, five equipped with 16 MSBS M-20 SLBMs, which have a range of some 3 000 km and carry a 1MT warhead. The sixth SSBN, l'Inflexible, is armed with the new MSBS M-4. According to SIPRI, the M-4 SLBM is a MIRV system, carrying six 150KT warheads and with a range of 4 000km (this will be extended to 5 000 km with the introduction of a new modification designated TN-71). All France's SSBNs are being successively refitted to carry the M-4 missile.[29]

5.46 The air leg of France's strategic triad rests on the Mirage IVA and IIIE medium bombers. France currently has in operational readiness 16 Mirage IVA aircraft, each capable of carrying one AN-22 70 KT nuclear bomb. The French have converted a further 9 Mirage IV to carry an air-to-surface cruise missile designated the ASMP (Air-Sol Moyenne Portee). The ASMP is an air-breathing missile powered by an integral rocket/ramjet. It will be armed with a 150KT warhead, its maximum range is around 100 km, its top speed is around Mach 3 and at least part of its mission will be flown in a terrain-following mode. SIPRI reports that initially, a total of some 100 ASMP missiles will be produced and that they will be deployed later on the Mirage 2 000N and the Super Etendard aircraft.

5.47 France also possesses a range of tactical nuclear warheads which can be delivered by its nuclear-capable tactical aircraft - Mirage IIIEs, Mirage 2 000Ns (replacing the Mirage IIIEs from 1988) and the Super Etendard - or by its land-based Pluton missile system. Pluton is a short range (10-120 km) tactical nuclear missile held by the French Army, capable of carrying either a 10KT or 25KT warhead. The Pluton system is to be replaced by a cruise missile, designated Hades, which will be similar to the ASMP but with a range of some 350 km.

5.48 The tactical nuclear forces are linked with France's strategic deterrent both physically and conceptually. France does not subscribe to the NATO concepts of 'extended deterrence' or 'flexible response' which assumes nuclear war-fighting or escalating exchanges. Rather France's tactical nuclear forces serve to mark the last warning prior to initiating its strategic nuclear response.[30] France's nuclear weapons are intended to deter nuclear strike against its home territories through maintaining a credible and independent second strike capacity which would inflict disproportionate damage on the Soviet Union. As part of maintaining such a posture, France has refused to be limited by any doctrine of 'no first use'.

French Nuclear Testing

5.49 Since 1960, France has continued to conduct nuclear explosions in order to develop and maintain its nuclear forces and to check the safety of its weapons. According to SIPRI, France has carried out 134 nuclear explosions between its first test conducted in the Sahara Desert on 13 February 1960 and the end of 1985. France carried out a further three underground tests in the first half of 1986 at Moruroa in French Polynesia, where it began testing in 1966, with the initial 41 tests being conducted in the atmosphere. Following international condemnation, France announced in 1974 that it would continue its program by relying exclusively on underground tests. The continued underground testing has raised concern that the tests are creating risks for the environment from possible radioactivity leakage and that the atoll itself is being severely damaged. These concerns may be unfounded however. In answer to a question in Parliament on 16 September 1985, the Foreign Minister, Mr Hayden, stated that conditions at Moruroa Atoll had recently been reviewed by a team of scientists which included New Zealand and Australian participants. The review report concluded that 'ambient radiation levels in the base accommodation area of Moruroa Atoll are generally lower than they are elsewhere in the world' and '[r]adiation doses to the French Polynesian population from natural radiation and fall-out radioactivity are lower than world average levels'. Mr Hayden also noted that the report 'points out that over the long term there may be some degradation in the geological structures causing leakages but it is an extremely long term, 300 years to 1 000 years'.[31]

5.50 In view of the modernisation and upgrading of France's nuclear weapons systems, and the absence of any substantial dissension in France or in French Polynesian territory over continued nuclear testing, it is likely that testing will continue as long as the French government deems it necessary. France's attitude to nuclear testing is also reflected in its refusal to accede to the Partial Test Ban Treaty, its non-participation in the Nuclear Non-Proliferation Treaty and its consistent position in the Conference on Disarmament that it will not participate in negotiations for a comprehensive test ban treaty without the prior establishment of the framework for effective nuclear disarmament. There is further concern that France's position is continuing to undermine the effectiveness of the non-proliferation regime.

5.51 The modernisation and upgrading of France's nuclear forces is likely to require extra supplies of fissionable material, principally plutonium. While much of the required plutonium will be recovered from obsolete weapons, the size of the nuclear update raises the question of whether France will need to make use of its commercial power facilities to make up the shortfall. A possible source of the additional plutonium is the new commercial breeder reactor Superphenix under construction in France.[32] Superphenix is an international project directly involving six European countries and will be operated by an international consortium, Centre Nucleaire de Neutrons Rapides S.A. (Nersa), comprising French, Italian, Belgian, Dutch, German and British interests. All participants in Nersa, except the United Kingdom, are contributing plutonium to the initial and later cores of Superphenix. In return, they will receive a portion of the plutonium produced in the core (estimated to be 200 kg annually).

5.52 At this stage it is uncertain whether France would use Superphenix to obtain weapons-usable plutonium. While the French Government does not generally distinguish between civilian and military nuclear installations, French officials have refused to rule out the military use of plutonium produced by Superphenix. France would be aware of the global and European repercussions of such a decision. Such refusal weakens the non-proliferation regime by its a bad example to countries that might be considering using their civilian programs to obtain nuclear explosives. French use of plutonium from Superphenix in nuclear weapons could also violate the Euratom Treaty - which requires that nuclear materials are not diverted from their intended use 'as declared by the users' - and the United States-Euratom Agreement for Cooperation which places restrictions on the use of US - controlled plutonium in Superphenix. France would still be able to use its share of plutonium that is produced by Superphenix.

China

5.53 China's nuclear weapons and delivery systems are less advanced than those of the other nuclear weapons states. Nevertheless, the PRC's stockpile of weapons, both fission and fusion, is growing and there are continuing advances in missile development. As shown in Table 5.6, the PRC nuclear forces are structured in a 'triad' of land-based missiles, bombers and submarine-launched missiles. The majority of its forces consist of ballistic missiles with ranges varying from 1 000km to over 12 000km, although the number of long-range missiles is relatively small. All Chinese nuclear missiles currently carry only a single warhead and there is no indication that China can deploy multiple-warhead systems. So far all ballistic missiles have been liquid fuelled although the IISS reports that solid propellants are being developed and may even power the newest DF-5 ICBM. Little is known of the extent of China's tactical nuclear capabilities although it is believed that large numbers of FROG-type battlefield surface-to-surface missiles carrying nuclear warheads have been deployed along the Sino-Soviet border. China has also a number of nuclear-capable tactical aircraft in its inventory.

Table 5.6: Chinese Nuclear Forces, 1986

Weapon system				Warheads	
Type	No. deployed	Year deployed	Range (km)	Warhead x yield	No. in stockpile
Aircraft[a]					
Tu-4 Bull (B-4)	10-30	1966	6 100	1-4 x bombs[b]	10-30
IL-28 Beagle (B-5)	10-20	1974	1 850	1 x bombs	10-20
Tu-16 Badger (B-6)	100	1966	5 900	1-3 x bombs	100
Land-based missiles[c]					
CSS-1 (DF-2)	40-60	1966	1 100	1 x 20 kt	40-60
CSS-2 (DF-3)	85-125	1972	2 600	1 x 2-3 Mt	85-125
CSS-3 (DF-4)	~10	1978	7 000	1 x 1-3 Mt	20
CSS-4 (DF-5)	~10	1980	12 000	1 x 4-5 Mt	20
Submarine-based missiles[d]					
CSS-N-3	26	1983	3 300	1 x 200 kt-1 Mt	26-38

a All figures for these bomber aircraft refer to nuclear-capable versions only. Hundreds of these aircraft are also deployed in non-nuclear versions.

b Yields of bombs are estimated to range from below 20 kt to 3 Mt.

c Perhaps 30 SRBMs (DF-1s) were deployed in 'theatre support' roles, although they are presumed to be inactive. Some of the MRBM and IRBM missiles are assigned to 'regional nuclear roles'. China has tested a number of warheads with yields from 2 to 20 kt for possible tactical roles.

d Two missiles are presumed to be available for rapid deployment on the Golf Class submarine (SSB). Additional missiles are being built for new Xia submarines.

Source: SIPRI Yearbook 1986, p.104.

5.54 China conducted its first nuclear test on 16 October 1964 and by the end of 1985 had carried out a further 28 tests including a thermonuclear explosion. China continues to test nuclear weapons in the atmosphere and it has not signed the NPT. China has only a fledgling nuclear industry.[33] Its first nuclear power station is now under construction near Shanghai and is expected to commence operation in 1988. Further facilities are planned using Western resources. In 1984 Beijing and Washington initialled an agreement concerning peaceful nuclear cooperation between the two countries.

The Threshold States

5.55 As mentioned earlier, in addition to the five recognised nuclear weapons states, there are a number of countries which either have nuclear weapons or have both the desire and capacity to develop such a capability in the short term. The principal threshold states are Israel, India, Pakistan, South Africa and Iraq. Other potential threshold states include Libya, Argentina, Brazil, Chile, South Korea and Taiwan. All these countries have nuclear power or research reactors or both - some subject to safeguards, others not (see Table 5.3) - and most have some enrichment or reprocessing facilities (which can be used to develop nuclear explosive material).

5.56 According to Dr T.B. Millar, formerly of the Department of International Relations of the Australian National University, Israel 'has produced sufficient plutonium for at least 20 bombs, and most observers believe that Israel has untested bombs stored for despatch by missile or dropping by aircraft'.[34] Much of the fissionable material used in the Israeli weapons was obtained from its 25 megawatt Dimona research reactor and reprocessing plant. Israel is reported to be planning to build at least one small nuclear power plant, a 250 megawatt, natural uranium, heavy-water reactor designated ISDU for Israeli-Deukrium-Uranium. If this facility is completed and is not placed under IAEA safeguards it could significantly enlarge Israel's nuclear weapons production capability.[35]

5.57 South Africa continues to operate an unsafeguarded pilot enrichment plant at Velindaba which is thought to be capable of producing weapons grade uranium. Some observers believe that South Africa exploded a nuclear device in the South Atlantic in September 1979 although the evidence for this is inconclusive.[36]

5.58 Iraq's interest in acquiring a nuclear weapons capability remains strong despite the destruction of its Osiraq reactor by Israel in 1981. Libya is moving towards developing an indigenous nuclear capability. In May 1984, it formally inaugurated its Soviet-supplied research centre at Tajura and completed negotiations with Belgium on a nuclear cooperation agreement. Belgium is apparently to supply a plant for producing uranium tetrafluoride and extensive engineering services. In conjunction with the purchase of two nuclear power plants from the Soviet Union, this has raised concern in the United States

that the tetrafluoride plant might be used to assist Libya in producing uranium metal for irradiation in a clandestine reactor.[37]

5.59 In Latin America, the apparent movement towards acquisition of nuclear weapons capabilities in Argentina and Brazil seems to be continuing.[38] The recently elected civilian government in Argentina has continued to support the completion of reprocessing and previously secret enrichment facilities which could provide nuclear weapons material. The government also has backed away from pre-inauguration statements that it would support ratification of the Tlatelolco Treaty on the Prohibition of Nuclear Weapons in Latin America. Brazil has reacted strongly to these developments, with a number of officials declaring that Brazil would acquire its own nuclear weapons capability by 1990. Brazil's nuclear research centres are also engaged on uranium enrichment programs.

Nuclear Proliferation in South Asia

5.60 Of particular concern to Australia are the continuing developments in India and Pakistan. The prospects for nuclear proliferation there are serious and, by most accounts, expanding. India exploded a plutonium device underground in 1974 and continues to pursue an ambitious nuclear program which covers most of the nuclear fuel cycle. Pakistan seems to be close to achieving at least the capability to explode a nuclear bomb. As Dr T.B. Millar submitted to the Committee:

> Pakistan must be close to being able to produce a nuclear explosion, and if (which is uncertain) it is currently deterred by the U.S. from taking the final step, this is presumably only temporary. A Pakistani explosion would almost certainly prompt India either to create a nuclear weapons program, or (conceivably) to build a hydrogen bomb, or both.[39]

5.61 According to Richard Cronin of the Congressional Research Service of the U.S. Library of Congress, India maintains a broad-based, energy oriented nuclear program which envisions a three stage effort involving (1) natural uranium fueled reactors; (2) a fast breeder reactor program fueled with plutonium from the first phase; and (3) a thorium-uranium fuel cycle utilizing India's large reserves of thorium sands. Cronin argues that:

> Except for the use of plutonium produced by a small research reactor to conduct its nuclear test in 1974, the Indian effort is not overtly geared to a weapons program. The comprehensiveness of the Indian effort, however, provides a natural cover for developing a nuclear weapons option, especially given India's emphasis on 'self-sufficiency', a code word for the maximum avoidance of international safeguards.[40]

5.62 India's nuclear activities date from the establishment of the Tata Institute of Fundamental Research in 1945 and the formation of the Indian Atomic Energy Commission three years later. Over the ensuing forty years, India has developed an indigenous capability to produce its own uranium fuel, fabricate the fuel, construct CANDU type power reactors, produce heavy water to modulate them and reprocess the spent fuel into weapons grade plutonium.[41] It currently has six research reactors which can be used to produce weapons grade plutonium. One of these, the Canadian supplied 40 megawatt CIRUS heavy water natural uranium reactor, was the source of the plutonium used in India's 1974 nuclear explosion. Three of the research reactors, including CIRUS, are not subject to international safeguards. It has at least five nuclear power stations either in operation or under construction, five heavy water plants and two operational reprocessing facilities. There is a small pilot plant near Bombay which probably reprocessed fuel waste from the CIRUS research reactor to produce the material for the 1974 explosion, and a larger facility at Tarapun. Neither reprocessing facility is fully subject to international safeguards.

5.63 Despite these advances, India's present capacity to produce nuclear weapons remains limited by a number of technical factors including the unreliability of its heavy water facilities and the relatively modest output of its reprocessing facilities. Nonetheless, these factors would not prevent India from quickly establishing a small nuclear arsenal if it so chose. As Richard Cronin argues:

> The comprehensiveness of its nuclear and space programs is such that a nuclear weapons capability is readily achievable. In addition to the warhead requirements, which are presumed to be within its capability from indigenous sources, India's sizable force of Jaguar and MiG-23 aircraft, if suitably modified, could easily carry even primitive nuclear weapons. India has already put three satellites in orbit, the most recent weighing 38 kg. The present satellite launch vehicle (SLV-3) is only comparable in payload to the US Scout rocket, but a later generation launch vehicle planned for the late 1980s will have a 800-100 kg payload capability, enough for an intermediate range ballistic missile. It is uncertain whether India has the necessary guidance technology for an accurate IRBM, but presumably hitting a city in Pakistan would not be a difficult technological feat.[42]

5.64 Pakistan currently has one power reactor and a small research reactor, both operating under international safeguards, although there has been some speculation that it may have been secretly diverting weapons grade material from one or both of these. The principal concerns over Pakistan's nuclear intentions surround its reprocessing and enrichment facilities. Pakistan is

thought to have constructed a clandestine centrifuge at Kahuta, near Islamabad which is capable of producing 15 kg of highly enriched uranium per year, adequate for a single device. In addition, Pakistan has continued to develop a plutonium-enrichment facility at its Institute of Nuclear Science and Technology (PINSTECH) in Islamabad, although it is not certain whether this facility has been used for this purpose. Initial revelations over Kahuta and PINSTECH led the Carter Administration in April 1979 to cut off US development assistance and military sales to Pakistan.

5.65 The embargo on U.S. military aid was waived by Congress in 1981. Recent reports over Kahuta, however, together with allegations that China has transferred nuclear weapons design information to Pakistan and the indictment in Houston, Texas of three Pakistani nationals charged with attempting to export 50 high speed electron switches apparently used in the triggering mechanisms of nuclear devices, have again placed U.S. aid under Congressional scrutiny.

5.66 Pakistan's efforts clearly indicate a desire to develop a nuclear weapons capability, where, largely for economic reasons, it has sought to achieve this capability in advance of a balanced civil nuclear program. Despite the difficulties involved, it is likely that Pakistan now has sufficient fissionable material to be able to manufacture some sort of explosive device. While capable of doing so, it seems unlikely that Pakistan would test such a device in the near term, primarily to avoid jeopardising the substantial amount of American aid that it is now receiving.

5.67 Both India and Pakistan seem to be determined to eventually become nuclear weapons states in their own right, and they are unlikely to abandon this objective. It is also clear that there is now very little that can be done from outside the region to reverse the proliferation process. Largely because of the earlier failure to control the export of critical technology, the long-run prospect for proliferation will be governed by the dynamics of the India-Pakistan relationship rather than by external pressure.

5.68 At present the relationship between the two countries is relatively stable although this stability could easily be undermined either by unilateral actions of the states involved or by a re-emergence of traditional racial or territorial disputes. The overall security of the region, including the cause of non-proliferation, would be served by normalisation of relations between the two countries which would include either an overt or tacit agreement on the limits of their respective nuclear activities. As Richard Cronin argues, one important step in the non-proliferation process is 'to continue to press for improvements in IAEA safeguard procedures, if only to give credibility to supplier demands for such inspection and to prevent backsliding on export controls by countries seeking short term economic or foreign policy goals'.[43]

Horizontal Proliferation: Problems and Prospects

5.69 While the non-proliferation regime has been relatively successful in terms of preventing the open testing and production of nuclear explosives and weapons other than by the nuclear weapon states, it has not stopped the spread of nuclear technology or the ability to make fission weapons. Many states are closer to nuclear weaponry now than they were when the NPT took effect in 1970. In terms of their nuclear-weapons producing capacity, the nations of the world now comprise three camps:

a. the recognised nuclear weapon states - the U.S., the Soviet Union, Britain, France and China - which maintain, and progressively modernise substantial nuclear arsenals. To date, none of these nuclear powers have shown any inclination to either relinquish or substantially reduce their nuclear power status;

b. non-nuclear-weapon states comprising the vast majority of nations. Most of these, including Australia, are parties to the NPT and so have willingly forgone any opportunities to seek nuclear weapons. A significant number of these countries have a considerable civil nuclear capacity, others have the expectation that they may be able to develop such a capability, with assistance from other NPT parties, both nuclear and non-nuclear; and

c. a small number of states which are suspected of possessing nuclear weapons or are on the threshold of conducting a nuclear explosion and appear determined, for a variety of reasons, to develop their own nuclear arsenals. Most of these states are not parties to the NPT and there seems little prospect that they will become so in the foreseeable future.

5.70 It is unlikely that this present position will be reversed. Neither the recognised nuclear-weapon states nor the principal threshold states show any sign of abdicating their current or proposed nuclear weapon status, and all seem to be making progress - with varying degrees of difficulty - towards their nuclear objectives. A number of threshold states have already reached nuclear self-sufficiency and others are getting closer to doing so. While the continued spread of nuclear weapons is dangerous, it is not yet out of control. The number of threshold states that pose proliferation risks has stabilised and remains relatively small. These nations are not rushing to demonstrate their nuclear weapons capabilities and there are indications in some areas at least that they may be prepared to accept a status quo based on a known capacity to construct or deploy a single explosive device rather than seek to establish a sophisticated nuclear arsenal. This is due in no small part to the development of the non-proliferation regime which has slowly established a general presumption against nuclear weapon spread and use.

5.71 The pressures toward proliferation have also been diminished by the present declining demand for nuclear power and allied technologies. The international economic recession has slowed the introduction of the fast breeder reactor and restricted the diffusion of peaceful nuclear technologies and materials. The contraction of the nuclear market has brought its own problems however. Nuclear suppliers are threatened with the loss of expensive production and technical capabilities and so may go to extreme lengths to supply their wares. Governments may be under pressure to facilitate the export of nuclear materials, including into regions where proliferation risks are high. Continued commercial and government interest in nuclear power is enhanced by the expectation that towards the end of the century, rising energy prices and the need to begin replacing aging power plants of all types may bring some recovery in nuclear power investment.

5.72 Any recovery of demand for nuclear power could place greater pressure on the non-proliferation regime. The problems of controlling proliferation will be compounded by the fact that the nuclear industry is no longer completely dominated by the United States. A number of other countries, including Japan, Canada, the United Kingdom, France, West Germany and the Soviet Union have built up substantial nuclear industries and, in some cases, have shown no hesitation in offering nuclear reactors and fuels to nations outside the NPT. This changing structure is increasing the difficulties of achieving accord among suppliers of nuclear materials and technologies concerning common trade policies and guidelines. Also, some states not party to the NPT may soon be able to export a fairly comprehensive range of nuclear goods and services including natural and enriched uranium, research reactors, components of power reactors, fuel cycle technology and training services. Control over the supply of nuclear materials and technologies is complicated further by the need to identify and restrict 'dual-use' items, - items that can be used in nuclear and non-nuclear industrial applications - and by the absence of a general 'fullscope' safeguards regime.

5.73 Despite the present economic recession and the growing strength of the non-proliferation regime, horizontal proliferation, as defined in paragraph 5.2, and its attendant risks are gradually increasing. The danger lies in any increase in the rate of horizontal proliferation or any sudden vertical escalation by the existing threshold states. In such a situation, general restraints and presumptions break down and nuclear self-restraint is reconsidered against the plea that 'everyone else is doing it'. Any scramble for weapons may heighten the incentives for pre-emptive attacks of the type employed against Iraq by Israel in 1981. Nations building forces in haste may also tend to build less secure or more accident-prone weapons.

5.74 The slower the spread of nuclear weapons, the more likely that their destabilising effects can be managed and nuclear conflict averted. Controlling the rate of proliferation involves more than merely preventing nuclear explosions. There is a long way between being able to explode a nuclear device and developing the capacity to produce and deliver nuclear weapons.

Actions that can either prevent or delay the progress from one critical step in the weapons development program to the next can reduce the risks inherent in proliferation. Governments need not wait until a nuclear explosive test is imminent before trying to discourage that test nor should they give up the effort once a test has occurred.

5.75 These basic considerations seem to suggest that future non-proliferation efforts should have two basic aims: first, to prevent further spread of nuclear weapons or nuclear weapons-producing capabilities beyond the existing nuclear weapons and recognised threshold states; and secondly to minimise the potential dangers posed by further proliferation of the threshold states and minor nuclear powers - in short, to contain the problem rather than seek to eradicate it. The achievement of these aims would involve:

- strengthening the existing political, economic and technical barriers to acquiring a nuclear weapons-producing capacity or, in the case of the threshold states, to moving up the proliferation ladder;
- monitoring and controlling the development and introduction of new technologies, such as the breeder reactor and the laser-enrichment process, which could increase the risk and pace of proliferation; and
- fostering an international strategic and political environment in which individual nations feel more secure with less incentive to develop and maintain nuclear weapons.

5.76 The principal means for achieving these objectives is already in place in the form of the elaborate set of rules, norms and procedures which constitute the non-proliferation regime. The prospects that the present regime, or an improved version of it, can be used to control further proliferation is enhanced by an increasing awareness of the dangers of horizontal proliferation, the growth in safeguard standards and technologies and the continuing difficulties of the threshold states in perfecting nuclear weapons and acquiring sensitive technologies.

5.77 The centrepiece of the non-proliferation regime is the Nuclear Non-Proliferation Treaty (NPT). The NPT has often been posited as the most important and successful multilateral arms control agreement and one with the most widespread and effective system of verification. It can be reasonably argued however that the NPT has tended more to reflect the evolving nuclear proliferation situation than shape it. It is true that the NPT has been instrumental in limiting the spread of nuclear weapons or weapons-producing capabilities to non-nuclear weapons states, but it has not stopped it. Nor is the Treaty universally accepted. There are still a large number of countries outside the

NPT including most of the 'problem countries' - Argentina, Brazil, India, Israel, Pakistan and South Africa. The NPT, then, has been signed largely by countries which did not want to acquire nuclear weapons and not by those that did or may want to at some time in the future.

5.78 Nor can the future effectiveness or even existence of the NPT - and other elements of the non-proliferation regime - necessarily be taken for granted. Both are continuing to be subject to strong pressures such as continuing doubts about security assurances, the spread and development of sensitive technologies, challenges to verification of no-nuclear-weapons pledges and the continued existence of non-member states and unsafeguarded facilities.

5.79 More specifically, the NPT itself is threatened by a number of problems which stem from the basic trade-offs and bargains that are contained in the Treaty. A major problem is the lack of progress in nuclear disarmament or arms control which is slowly eroding the moral authority of the NPT. Under Article VI of that Treaty, the nuclear weapons states are committed to seek to negotiate effective disarmament and arms control measures. Many non-nuclear weapon states complain that while they are expected to honour their no-nuclear-weapons pledges, the United States and the Soviet Union can delay disarmament with impunity. This problem is compounded by the further requirement under the NPT (Article IV) that the industrial countries promote peaceful nuclear energy especially through the transfer of nuclear technology. The export restrictions introduced by the Nuclear Suppliers Group in the late 1970s were seen by many as incompatible with this pledge. Many Third World countries in particular claim that the suppliers are trying to create a cartel to restrict access to nuclear technologies and delay their industrialisation. These same countries are also aware that nations such as Argentina, Brazil and Spain (which are not parties to the NPT) have been able to obtain nuclear items from countries which are NPT parties, whereas some parties to the Treaty appear not to have had such ready access. In addition, in some cases, countries outside the NPT have received nuclear material and technology on conditions less stringent than those applied to NPT countries. Under these conditions, potential threshold states may see advantage in withdrawing from the NPT or continuing to remain outside it. While there have been no withdrawals as yet, the possibility of such an eventuality is increasing. All these issues figured prominently in the 1980 and 1985 review conferences of the NPT and are expected to be raised again in subsequent reviews.

5.80 These kinds of pressures and problems have led some to suggest that there may be merit in breaking the link between non-proliferation and bilateral arms control and disarmament. This would have the effect of enforcing a status quo that is patently inequitable but would at least remove the most immediate, and difficult, threat to the non-proliferation regime. It may even enhance the prospects of improving the NPT regime since horizontal proliferation would then be seen as an issue in its own right, less susceptible to the politics of East-West

rivalry. This important change would need to be compensated for by increased attention to the energy and economic concerns of the poorer members of the NPT, and by increased pressures against threshold states outside the NPT regime. Such actions could include:

a. development and promotion of more proliferation - resistant fuel cycles for nuclear power generation;

b. identification and strengthening of control over reprocessing and enrichment technologies and 'dual-use' items that have application in nuclear and non-nuclear industries;

c. encouragement of multilateral actions to restrict access to proliferation-prone technologies and to punish proliferative action by withholding assistance and considering other economic and political sanctions; and

d. in light of the greater effectiveness and acceptance of IAEA safeguards, relaxation of the present supplier guidelines as they affect member states of the NPT, but strengthening control over access for states that are not parties to the NPT.

5.81 Others argue that it is also important to develop and encourage the world-wide use of a variety of non-nuclear energy options, including those more suitable for use in developing countries. Their most compelling energy needs are often small in scale, dispersed and remote from electricity grids, and may be better served by portable fuels rather than capital intensive programs such as nuclear power. Still others suggest that the NPT is discriminatory and should be scrapped as it prevents non-nuclear weapon states from pursuing national security policy objectives that are readily available to the nuclear weapon states.

5.82 It is true that in some respects, the NPT has been overtaken by events. The effectiveness of the Treaty in preventing horizontal proliferation was originally dependent on restricting the number of nuclear weapon states to the small group that existed at the time of the Treaty's establishment. While the proliferation of nuclear powers has not been as great as initially feared - during the 1960s and 1970s many countries which had the technical capacity and material resources to build nuclear weapons, such as Australia, Canada, West Germany, Japan, Italy and South Korea, chose not to do so - it has nonetheless occurred.

5.83 On the other hand, the broad changes that have taken place may have served to increase the importance of multilateral treaties such as the NPT. Nuclear resources and knowledge are now so widespread that independent actions even by a major power can only have a limited effect on horizontal proliferation. Change can now only come about through the collective action of groups of nations. In this respect, the NPT remains very important since

it provides a focus for continuing international concern over, and opposition to, horizontal nuclear proliferation and its potential consequences. It also serves as a constant and timely reminder to the major nuclear powers of their responsibilities to reduce the dangers of vertical proliferation. This important moral component of the Treaty should not be diluted.

5.84 Consideration of the NPT and the non-proliferation regime generally should not be divorced from its broader political context. Just as important is the continued work toward a world of reduced tensions among nations and international agreements that will lessen the appeal of possessing nuclear weapons as an approach to dealing with international conflict. The principal goal here is to improve relations between the superpowers and reduce political and economic tensions throughout the world. The other elements of a successful non-proliferation regime - such as a Comprehensive Test Ban and the establishment and spread of nuclear weapons free zones - need also to be pursued as part of an overall approach to the problems posed by the existence of nuclear weapons. We return to this theme in later chapters.

CHAPTER FOUR
ENDNOTES

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20. Department of Foreign Affairs, Submission, p.12.

21. SIPRI Yearbook 1984, pp.669-70.

22. See Australia and Disarmament: Steps in the right direction, Canberra, Australian Government Printing Service, 1986, p.16.

23. Townsend, 'The Relationship Between Uranium Exports, the Spread of Nuclear Weapons and the Non-Proliferation Treaty', p.8. In the latter case, it is common knowledge that the country concerned was Pakistan, which is not a member of the NPT although the facility was subject to IAEA safeguards. The situation has been subsequently rectified to the satisfaction of the IAEA Board of Governors. See Australia's Role in the Nuclear Fuel Cycle, p.153.

24. See Australia's Role in the Nuclear Fuel Cycle, Section 6.7; Townsend, 'The Relationship Between Uranium Exports, the Spread of Nuclear Weapons and the Non-Proliferation Treaty', footnote 11; and J. Falk, 'Australia's Uranium Export Policy: A Critical Perspective'. Paper presented at the Conference on The Future of Arms Control, 21-23 August 1985, SDSC, Australian National University, Canberra, 1985, pp.9-11.

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CHAPTER 6

THE THREAT AND CONSEQUENCES OF NUCLEAR WAR

The Threat of a Nuclear War

6.1 As long as nuclear weapons exist, nuclear war is possible. While there has been no military use of nuclear weapons since 1945, this does not mean that nuclear war might not take place sometime in the future. If nuclear weapons were used in sizeable numbers, they would result in destruction and suffering beyond experience and could possibly spell the end of mankind. Most people recognise the tremendous devastation that would occur in the event of a nuclear war. Because of this, we tend to assume that nuclear war is an unlikely contingency. No sane political leader would either initiate a nuclear war or take steps which could increase its danger substantially. How valid is this assumption? Is there an increasing risk of nuclear war occurring? Has the avoidance of nuclear war for four decades and our growing familiarity with, and acceptance of, nuclear weapons made us complacent about the dangers and risks of nuclear conflict? Or can we take comfort in the common abhorrence of nuclear war and the constant efforts of the superpowers and others to avoid it?

6.2 These kinds of concerns have formed a major part of the submissions made to this inquiry and they are the principal subject of this Chapter. First there is an examination of the threat of nuclear war - how it might begin, whether it can be controlled, and what are the risks of it occurring. We also examine how Australia might be involved. Secondly the Chapter looks at the consequences of nuclear war should it occur. While unpleasant to contemplate, these issues need to be raised and discussed. An awareness of the ways in which nuclear weapons may be used, and their ultimate consequences, can help us to understand and participate in the nuclear debate and to devise how best to avoid nuclear war.

How Might Nuclear War Begin?

6.3 Nuclear war could begin in a range of circumstances and for a variety of reasons. A government could initiate war to seek its own economic, political or military gains. Alternatively, a war could occur through miscalculation or accident. War could be the culmination of a prolonged international crisis, or it could come as a 'bolt from the blue'. The following sections discuss the possible paths to nuclear war. Some are more plausible than others. But all have been cited in the literature and have been raised in submissions received by the Committee. They are not exhaustive but are intended to illustrate how nuclear war might begin.

A Surprise Attack by One Superpower on Another

6.4 This involves one side striking its adversary without warning. Such an attack might aim to destroy all or a significant part of its opponent's strategic nuclear forces, particularly its retaliatory forces. The surprise attack may be completely

premeditated (a so-called 'first-strike') or it may be launched during a crisis in anticipation of a first-strike by the other side and in order to limit the damage that the aggressor would suffer in the event of a nuclear exchange ('pre-emptive strike').

6.5 The necessary pre-conditions for an all-out first-strike are that most of the adversary's retaliatory forces would need to be vulnerable to an initial attack and that the attacker's defences could reduce, to 'acceptable' levels, the damage caused by any surviving retaliatory forces. Such an attack would involve enormous problems of coordination and would depend on complete surprise being maintained prior to the launch. In view of the considerable intelligence and surveillance capabilities of the two superpowers, this latter requirement is unlikely to be met. Any warning of a possible first strike would lead the superpower to either disperse its own forces or place them on alert (or both) which would make the completion of a successful first-strike an even more difficult prospect still.

6.6 The general view of expert witnesses appearing before the Committee was that neither the United States nor the Soviet Union has, at present, the capacity to carry out a successful first strike against the whole of its adversary's strategic forces. Any such attack would invite a devastating response from the other's largely invulnerable submarine-launched ballistic missiles. Even though these submarines are themselves becoming counterforce and potential first-strike weapons (capable of destroying an adversary's military targets including hardened ICBMs) they are likely to remain less vulnerable to attack for the foreseeable future. A major, unpremeditated nuclear attack therefore is considered to be highly unlikely although it cannot be ruled out completely. Different considerations may apply in the event that one or both sides may, in the future, be able to deploy effective defences against ballistic missiles. (See Chapter 12 for a discussion on the Strategic Defense Initiative).

6.7 Similar arguments could be advanced against an all-out pre-emptive strike, although in this case the rationale for striking first arises out of fear and is not as easily deterred by any likelihood of retaliation. It is entirely conceivable that in a deep and apparently irreconcilable crisis, one of the superpowers might launch its nuclear weapons first with the full knowledge of the consequences for its own population, but fearing far worse consequences if it allowed the other side to attack first. The pre-conditions for a pre-emptive strike are a belief that the other side intends to strike first and soon, that it could do so relatively successfully and that a pre-emptive strike would significantly reduce the casualties and damage that would ultimately be suffered by the pre-emptor.

6.8 A number of witnesses have suggested that this kind of scenario is becoming more plausible particularly with the introduction of counterforce weapons and technologies into the arsenals of both sides and their increasing emphasis on damage-limiting strategies. As Andrew Mack has argued, these trends undermine the constraints that have operated in the past on any first use of nuclear weapons.

> The real danger is not of one side coldly and deliberately launching a 'bolt-out-of-the-blue' (BOOB) attack against the other, but rather of an unintended slide into confrontation in a crisis situation which gets out of hand. The constraints on nuclear first use by either side are deep-seated but they are threatened by the 'first strike' characteristics of modern strategic weapons (which provide an incentive for damage-limiting pre-emption), by the war-fighting doctrines which both superpowers embrace, and by the intense hostility and suspicion which characterises their relationship.[1]

6.9 Another surprise attack scenario, and one which has concerned some American strategists, is a limited strike against a portion of the nuclear arsenal of either side. This concern underlies the current incentive in the United States to deploy the MX missile (the replacement for the Minuteman ICBM). United States' analysts claim that the growing accuracy of Soviet land-based missiles give the Soviet Union the capability to destroy, in a single disarming first-strike, almost all of the United States ICBMs and a significant proportion of its strategic bomber and in-port missile submarine fleets. In the aftermath of such an attack, the United States would be able to retaliate with its surviving submarine missile forces but the relative inaccuracy of its SLBMs means that it could only target Soviet cities. The United States would be threatened to refrain from doing this however since this action would invite a similar response from the Soviet Union. Hence the United States' forces have a 'window of vulnerability' which, prior to the introduction of Trident II and MX, could be exploited by the Soviet Union for political or military advantage.

6.10 Some observers believe that the 'window of vulnerability' thesis is overstated and, like the full-scale first-strike, a Soviet strike against U.S. ICBMs is far less likely than many other possible paths to nuclear war. The Soviet Union cannot assume that the United States would not launch its ICBMs on warning of a missile attack or that it would not retaliate. Furthermore, American submarines and intermediate-range nuclear forces are capable of attacking Soviet military targets. The Soviet Union would therefore gain little advantage in attacking the United States ICBMs (or any other leg of the triad). If it decided to launch an attack against the United States, it would have greater incentive to attack all its adversary's forces simultaneously.

Escalation of a Conventional War

6.11 Another way in which nuclear war could begin is through the escalation of a conventional conflict between the military forces of two nuclear-weapon states particularly those possessing tactical nuclear weapons. The possibility of such an escalation has always concerned defence planners and so far has produced prudence; major nuclear states have been reluctant to use even conventional forces against each other. The reasons for this are

obvious. Once a conventional war has begun, the possibility of escalation increases since:

a. the use of battlefield nuclear weapons would probably be authorised beforehand by the political authorities in order to give their potential use greater credence;

b. there would be increased pressure to use tactical nuclear weapons, especially in the event that one side was about to suffer a serious defeat, or the attacker felt it was not able to achieve its objectives with conventional forces;

c. the likelihood of use of nuclear weapons through miscalculation or mistake would greatly increase;

d. once tactical nuclear weapons are used by one side, the other is almost sure to respond either in kind or with a higher order attack; and

e. once the fighting began, one side may decide that full scale use of nuclear weapons was inevitable and so, despite the risks involved, may decide to launch a pre-emptive strike in the hope of terminating the conflict at an early stage or at least limiting the damage that it may suffer in the event of a nuclear exchange.

6.12 There are a number of potential flashpoints, but the areas of greatest concern are Europe, the Sino-Soviet border and the Middle East. In the first two cases the potential adversaries are directly confronted by military forces armed with thousands of nuclear warheads which are deliverable by artillery, aircraft or short-range missiles. In the case of Europe, NATO forces employ a strategy of 'flexible response' to offset the conventional superiority of opposing Warsaw Pact forces. This strategy seeks to deter Soviet aggression by allowing early use of tactical nuclear weapons in the event of military conflict. Flexible response also allows for nuclear warfighting and controlled nuclear exchanges thereby endangering escalation should a conflict break out (See Chapter 2). Two possible examples of escalation scenarios that could lead to nuclear war between the superpowers are as follows:

a. War in Europe. West Germany, growing doubtful about American strategic assurances and the continued support of its other NATO allies, decides to develop its own nuclear weapons. Fearing the consequences of its traditional enemy 'going nuclear', the Soviet Union invades West Germany with conventional military forces. As the Soviet advance continues, other NATO forces - American, British and Dutch - become involved in the fighting. NATO publicly warns the Soviets to withdraw immediately or 'suffer the gravest consequences'. Four airfields along the Polish-Soviet border are attacked with nuclear-tipped cruise missiles as 'a demonstration of NATO resolve'. The Soviet Union immediately fires nuclear missiles to destroy American nuclear weapons sites in West Germany ...

b. War in the Persian Gulf. The Iranian Communist Party overthrows the regime of Ayatollah Khomeni. Civil war erupts throughout Iran and the new government requests that Soviet troops enter the country 'to restore order'. Despite American warnings against such an action, Soviet forces cross into Iran and move toward Teheran. The U.S. 101st Airborne Division and elements of the Marine Corps are deployed to southwestern Iran to protect the West's oil supply sources. Advance parties of the two forces meet and engage in combat. The Soviet Union begin to deploy heavy armoured units into northern Iran. U.S. carrier-based aircraft launch a series of conventional attacks against Soviet lines of communication in the northern mountain regions of Iran. The U.S. aircraft carrier and many of its support ships are destroyed by nuclear-tipped, air-launched cruise missiles fired from Soviet aircraft. The United States responds by attacking the Soviet aircraft bases with tactical nuclear weapons ...

6.13 A further possibility is a nuclear war breaking out between two threshold nuclear states. Such an event may be more likely than nuclear conflict between the superpowers because many of the conditions that have led to the global balance and maintenance of peace - such as stable governments, strict control over nuclear weapons and the invulnerable second-strike capabilities - may be absent. As described earlier, the dangers of this kind of nuclear war may be comparatively small today, but they would increase in the future if more countries acquire nuclear weapons. Such disputes could also involve the superpowers with far greater consequences. As Australia's Ambassador for Disarmament, Mr Richard Butler, warned:

> I cannot conceive readily of a rational decision by Moscow or Washington to directly engage in a nuclear war with the other side as such, coming out of their own relationship. However, it is not impossible to conceive of a regional situation - and the obvious example would be in the Middle East - where there was a significant political failure and breakdown and where real interests were ever increasingly involved which would tend to suck in the superpowers to a very damaging conflict and move us closer to the nuclear threshold. I think that is something we all have to be concerned about.[2]

One way in which the superpowers could be drawn into a nuclear exchange is the so-called 'catalytic war' scenario in which an unidentified third party uses nuclear weapons against one of the adversaries in a conventional conflict between the United States and the Soviet Union.

Nuclear Accidents

6.14 A common concern among many witnesses was that nuclear war could begin purely by accident. The Queensland Branch of the People for Nuclear Disarmament, for example, argued that the growing complexity of nuclear weapons technology and national security systems are increasing the likelihood of false alarms of nuclear attack and reducing the time that is available to decide whether the alarm is real. PND concluded that the probability of accidental firing of nuclear missiles is therefore high and 'continuously rising'.[3]

6.15 In his recent book Taking Australia off the Map, Dr Jim Falk has argued that 'absolutely reliable technology is necessary to ensure that nuclear war does not accidentally spark' and that there is 'little basis for confidence that the control systems can continually provide the required inhuman perfection'.[4] Falk states that at least 82 accidents involving U.S., Soviet, French and British nuclear weapons are known to have occurred and that there is evidence that many other accidents have gone unreported or unconfirmed. These incidents are said to include collisions between nuclear armed submarines, accidental release of nuclear weapons from aircraft and over 150 early-warning false alarms that were generated by either human error or equipment malfunction.

6.16 To date, none of these incidents have led to an accidental nuclear detonation, nor have they come close to leading the superpowers into war. Both the United States and the Soviet Union go to considerable trouble to minimise the chances of unauthorised or accidental use of nuclear weapons and so the possibility of nuclear war beginning by accident is small. It cannot be completely eliminated however, particularly in view of the increasing complexity of the nuclear arsenals which is increasing the number of chains of possible circumstances - whether accidental or deliberate - that could lead to the use of nuclear weapons.

Nuclear Terrorism

6.17 Another concern among many groups is that nuclear weapons may ultimately fall into the hands of terrorists or other sub-national groups. The growth of terrorist activities on both the national and international levels in the past few years has been well documented. The nature of terrorism is such that nuclear weapons and nuclear threats would seem to be ideal and almost inevitable instruments for organisations seeking to achieve difficult objectives such as the overthrow of a government or the reversal of its policies. As described earlier, the likelihood of nuclear terrorism increases with increasing horizontal nuclear proliferation. It remains questionable whether nuclear terrorism could precipitate a nuclear war. The most likely contingency would be where nuclear terrorism was used as a form of surrogate warfare in a regional dispute during a time of great political tension. Plausible examples of such incidents could be established in any confrontation between, say, Israel and the Arab world, North and South Korea or India and Pakistan, and the reluctant involvement of the superpowers would be possible.

Could Limited Nuclear War Be Controlled?

6.18 Can nuclear war, once it begins, be controlled or terminated? While both the United States and the Soviet Union emphasise the destructiveness of nuclear weapons and assert that their main purpose is to deter military conflict, continuing technological developments, the accelerated development of strategic defences (SDI) and the concept of counterforce strategies and relevant targeting doctrines have led some to put forward the idea that nuclear war need not result in global conflagration. Some have even contemplated that nuclear wars can be 'limited' or even 'fought and won'.

6.19 The general consensus of witnesses appearing before the Committee was that limited nuclear war is a dangerous illusion. A witness from the Australian Department of Defence, for example, argued that neither superpower:

> ...can have any confidence that a limited nuclear war would remain just that. There are real dangers that a limited war would escalate very quickly into a global nuclear war.[5]

A similar view was presented by Dr Jim Falk who argued that it would be possible to limit a nuclear exchange 'only if the control systems work with precision, humans interact in particular ways, and the missiles behave as intended'. Falk doubted that any of these conditions would continue to apply during a nuclear exchange where destruction and civilian casualties would inevitably be high, control systems would be destroyed and pressures to escalate would grow sharply as the conflict continued.

> In the final analysis, once nuclear engagements have begun, there is no way of determining what would happen. The sequence of events would rest in the hands of human beings operating with incomplete and conflicting information ... But although the sequences cannot be predicted, there is little basis for believing that the limited nuclear exchanges which now form a central pillar of much of the thinking of those who are responsible for the development and control of the nuclear weapons systems, would be anything but the precursor for all-out nuclear war.[6]

6.20 The possibility that a war between the United States and the Soviet Union would remain limited either in scope or geographically was also dismissed by Professor Michael Howard who informed the Committee that:

> There are two ways in which a war, nuclear or otherwise, can be limited. One is by the area in which it is fought and the other is by the nature

> of the weapons that are used. In speaking of a limited nuclear war, people normally mean a war which is confined to a certain geographical area, usually, unfortunately, Europe. But there are those who also think in terms of a war which could be a central interchange of weapons between the United States and Soviet Union, targeted on very limited and precise military targets. I personally do not think that either of those eventualities is in the least feasible. A war fought in Europe in which nuclear weapons are used would involve, in the first place, nuclear weapons used against Eastern Europe almost certainly escalating to the western region of the Soviet Union. Nuclear weapons used against Western Europe would create appalling casualties among the masses of American armed forces and their dependants who are there. Whether or not the United States has weapons stationed in Western Europe, the likelihood of the United States responding to that provocation by a direct attack on the Soviet Union or the possibility of its doing so seems to me to be very, very strong. I think the idea of a limited war is an academic pipe dream which it is impossible to visualise in actuality.[7]

What Are the Risks of a Nuclear War Occurring Now or in the Future?

6.21 From the foregoing it is clear that nuclear war could occur in any number of ways, some more likely than others. What is the risk of these kinds of events taking place either now or at some time in the future?

6.22 A number of submissions and witnesses have indicated that at present the likelihood of general war between the superpowers or a massive surprise attack by one side is small. The Australian Government, for example, considers that such a direct conflict between the United States and the Soviet Union is only a 'remote' prospect although the remoteness 'depends upon the immediacy and effectiveness of deterrence'. This view was supported by many witnesses including Professor Michael Howard who told the Committee that both superpowers are very conscious of the dangers involved in any potential conflict and they go to considerable lengths to avoid direct confrontations particularly during periods of crisis or political tension.

> If one observes the way in which they have handled the various crises in the Middle East over the last eighteen months or two years, the restraint which both of them have shown, the degree of communication which I understand has gone on between them, especially with relation to the Gulf War and the care and sensitivity with which they handle their relations wherever there is a serious conflict situation, these do indicate that both of them are concerned above all to avoid any local conflict escalating to involve both of them, let alone a nuclear confrontation.[8]

6.23 The risk of such a conflict occurring however is likely to be greater during periods of crisis. Dr Barrie Pittock suggested that while nuclear wars could begin by accident or a premeditated strike:

> ...what is more probable is that there will be a failure in crisis management, such as the sort of thing that went on during the Cuban missile crisis. We were told when George Rathjens was here recently that during the Cuban missile crisis John Kennedy thought he had the situation very much under control ... but in fact the U.S. naval forces in the northern Atlantic were at that time forcing Russian submarines to surface ... unbeknown to the President. If those submarines had resisted, there could have been war, and it would have been quite outside the crisis management that John Kennedy thought he had. Those are the sorts of risks which I think we run every time there is a crisis.[9]

It is likely that periods of acute tension or crisis similar to the 1962 Cuban missile crisis or the 1973 Middle East conflict will continue to occur, enlarging the potential for superpower conflict and increasing the need for cooperation. The seriousness of the situation is evidenced by the increased attention being given to crisis management in recent years by both the United States and the Soviet Union.

6.24 Others argued that while the risks of superpower confrontation may be small now, it is nonetheless increasing. The combined submission by the Medical Association for Prevention of War (Australian Branch), Scientists Against Nuclear Arms, the United Nations Association of Australia (NSW Branch) and the International Peace and Security Committee of the Law Council of Australia suggested that:

> The last fifteen years have seen a dramatic increase in the risk of nuclear war. Although a deterioration in relations between the U.S. and the Soviet Union has played a part, the most important factors in this increased risk have been the following changes in nuclear weapons technology:
>
> - the three-fold increase in the number of strategic nuclear warheads;
> - the increased accuracy of strategic nuclear weapons;
> - the introduction of a counterforce targeting strategy and the consequent striving for a first strike capability;

- the decreased warning time following the increased deployment of submarine-launched missiles and of Pershing II missiles in Europe;
- the computerisation of the retaliatory decision-making process with progression to a launch-on-warning response;
- the lateral proliferation of nuclear weapons with the consequent increased risk of their use in a regional conflict;
- the decreasing conceptual gap between conventional and nuclear weapons with the introduction of smaller battlefield nuclear weapons and the neutron bomb, thereby increasing the risk of escalation of a conventional war; and
- the planned introduction of laser and particle weapons in space, which, because of their accuracy will have anti-submarine and therefore first-strike capability.

There is no doubt that a continuing arms race can only end in nuclear holocaust.[10]

6.25 Similar points were made by the Queensland Branch of the People for Nuclear Disarmament which also concluded that:

> ...the concept of nuclear deterrence relies upon the fact that there is a finite probability of the use of nuclear weapons. Thus, if current policies continue, the eventual destruction of our civilisation, if not our entire environment, may for all practical purposes be regarded as a certainty.[11]

6.26 The idea that recent changes in strategic doctrine and weapons technology are increasing the likelihood of eventual nuclear conflict was also put by Andrew Mack who stated that:

> ...the threat of nuclear war arises not from any aggressive Soviet or American intent to use nuclear arms, to do so could serve no conceivable interests for either superpower but rather from the highly destabilising strategic imperatives of the system itself. Minimising the risks of nuclear war requires at minimum the following: first, a serious commitment to arms control, second, a move away from war-fighting strategies which place a premium on first strike tactics, third, an amelioration of the confrontational rhetoric which has soured relations and heightened tensions between the superpowers during the 1980s.[12]

6.27 Others have argued that developments in technology do not necessarily increase the risks or consequences of war. In his 1984 Alfred Deakin Lecture, Professor Michael Howard argued that:

> ... the whole trend of technology today is in the direction of making weapons not more indiscriminate and destructive, but less; of improving their accuracy and the mechanisms for their control. Applied to nuclear weapons, these improvements have made possible the reduction of stockpiles ... [and] they hold out greater opportunities for non-nuclear defence and thus improve the prospects for stability at moments of crisis.[13]

Howard further suggested that advances in scientific knowledge 'may take us into a new era of warfare in which nuclear weapons became almost unusable'. He also warned that current trends in technology should not be allowed to disguise the awesome nature of nuclear weapons.

> Let me ... remind those who think that these technical improvements in nuclear weapons would somehow make wars 'clean' and 'fightable', that we would still be dealing with destruction on the scale, at its very lowest, of Hiroshima; a scale still amply adequate to act as a 'deterrent' to any rational power.[14]

Would Australia be a Nuclear Target?

6.28 There is a range of opinion over the likelihood and extent of a direct nuclear attack on Australia in the event of a nuclear war between the United States and the Soviet Union. A number of submissions to the Committee suggested that Australia would be subjected to:

- direct attacks on the Joint Defence facilities at North-West Cape, Pine Gap and Nurrungar;
- direct attacks on the RAAF Base at Darwin and the RAN Base at HMAS Stirling at Cockburn Sound; and
- direct attacks on Australian cities.

6.29 In the first two categories, the strikes would be aimed primarily at destroying United States' facilities or preventing their deployment there. With respect to the third category, the combined submission from the Medical Association for Prevention of War (Australia) and their colleagues argued that there are two reasons why such attacks are probable.

> Some military strategists believe that the U.S. will disperse its B52 fleet from Guam and Clark Air Base to prevent the destruction of the fleet

> by a small number of missiles. Australian airfields such as Amberley, Williamtown and Richmond would be likely to receive B52s and may well be targeted by the Soviet Union. A second scenario suggests that the Soviet Union could inhibit a U.S. recovery after a nuclear war by bombing Australian ports and preventing the shipping of oil and other desperately required resources. Worst case scenarios of single warhead attacks upon the port areas of Newcastle, Sydney, Wollongong, Melbourne, Geelong, Port Adelaide and Fremantle would leave up to 2 000 000 dead and up to 3 000 000 seriously injured or ill survivors.[15]

6.30 The possibility of nuclear strikes against joint Australian-U.S. facilities located in Australia has been acknowledged in the past both by this Committee and by the Australian Government. The Committee in its earlier report Threats to Australia's Security: their nature and probability, concluded for example, that:

> ...it would be prudent for Australian defence planners to assume that the joint facilities at North West Cape, Pine Gap or Nurrungar are on the Soviet target list and might be attacked in the course of a nuclear conflict between the two superpowers. In other words, there is a finite risk that one or all of the facilities would be attacked during a Soviet-United States war that involved their nuclear strategic forces.[16]

This assessment is also accepted by the Department of Defence and the Government. As one Departmental witness stated to the Committee:

> ...The Government has accepted that we cannot enter into the minds of Soviet planners; we cannot assert that the joint defence facilities would not be nuclear targets, simply for the same reason that we cannot assert that the joint defence facilities would be nuclear targets. The position we are in is that they might be.[17]

6.31 A similar view was put to the Committee in an earlier inquiry in 1981 into the implementation of the Australian Government's announced Defence programs, by Dr Desmond Ball of the Strategic and Defence Studies Centre at the Australian National University. Dr Ball also raised a number of other issues:

> I have no doubt in my mind whatsoever that those three installations would be targeted by the Soviet Union. However, that should not be the

> whole point of the question. At least three other issues should be addressed. One is that whilst they would be targets in the event of a nuclear war, I do not see a nuclear war as being very likely. One could argue that the existence of these installations deters the outbreak of a nuclear war. But one still has to come to the conclusions that if a nuclear war does come, those stations are going to be targeted. A second point is that the consequences of them being targets really are not so great. I do not like the idea of nuclear bombs falling on Australia, but the vision that some people have of what it would involve seems to be quite exaggerated. I cannot imagine any scenarios involving nuclear bombs falling on Australian cities. It seems that one draws the line at those three installations, but one has to include those installations as targets.
>
> ...There is no doubt that the notion of limited controlled nuclear wars has been gaining acceptability. I think to that extent the possibility of the use of nuclear weapons becomes somewhat greater and the possibility of North West Cape, Pine Gap and Nurrungar being targets becomes somewhat greater. I would still put the possibility of a general nuclear war and even the growing possibility of limited controlled nuclear war over to one side in terms of practical considerations in the foreseeable future. I am very disturbed by the way the developments are tending, but I do not think the most horrendous prospects are really that imminent.[18]

6.32 In a recent publication, Uranium, The Joint Facilities, Disarmament and Peace, the Foreign Minister, Mr Hayden, argued that regardless of the presence of the joint facilities, Australia could not escape the consequences of nuclear war. He argued that once a nuclear exchange began, the superpowers may seek to eliminate countries such as Australia 'for the simple reason that they would not wish to leave any immune areas which could be built up as enclaves for the regroupment of their opponent'.[19] Moreover, a new phenomenon known as the nuclear winter effect (described later on) could lead to the devastation of Australian society, especially in the event of a full-scale strategic nuclear exchange, even if we were not struck by a single weapon. Mr Hayden concluded therefore that:

> ... since Australia would suffer the consequences of nuclear war whether or not we have the facilities, we cannot become immune by removing the facilities. The real question is: do these facilities contribute to arms control, disarmament and peace? The Government considers that they do contribute fundamentally to deterrence, the only option open for the time being. They also contribute vitally to verification of arms control and disarmament agreements.[20]

6.33 Not all agree with the assertion that the joint facilities contribute to arms control, disarmament and peace. A number of submissions to the Committee have suggested that, as a result of recent changes in the United States strategic doctrine, the joint facilities, and particularly the naval communications station at North West Cape, are now part of a nuclear war-fighting system. While aimed at deterring Soviet aggression, the new 'war-fighting' and 'counterforce' doctrines are said to be undermining deterrence and could lead to armed conflict, either in the form of an American first-strike or a Soviet pre-emptive strike. Some witnesses suggested that North West Cape would be used to transmit firing orders to U.S. ballistic missile submarines in time of war, and argued that:

> The greatest disadvantage for Australia in hosting this base is our Government's lack of control over, or even knowledge of, the nature of the orders transmitted there. ... It is essential that, in keeping with diplomatic efforts to have the U.S. move toward a policy of 'no first use' of nuclear weapons, Australia (a) gain firm assurances that the base will not be used to initiate a nuclear strike, and (b) be granted the right to give or withhold consent for any military action ordered through this facility. If, as Mr Hayden stated in 1981, the U.S. does not accept these conditions, we should ask it to wind down operations at the base.[21]

6.34 The Australian Government, on the other hand, is satisfied that these conditions are already satisfied. In a statement to the Parliament on 6 June 1984, the Prime Minister, Mr Hawke, described the general role and functions of the joint facilities in Australia and concluded that:

> ... these facilities are jointly managed and operated by the Australian and American governments. All functions and activities require, and have, the full knowledge and concurrence of the Australian Government. We monitor this and we are satisfied that the operations of the facilities in no way derogate from Australian sovereignty.[22]

More specifically, the publication Uranium, The Joint Facilities, Disarmament and Peace states that:

> Properly qualified Australian Government personnel participate in all areas of activity at these facilities. Australia is therefore able to ensure that nothing takes place in those facilities which is contrary to Australian Government policy, including the Australian Government's opposition to so-called nuclear war fighting and any concept of first strike capability.[23]

There remains a question, however, that it seems unlikely that even properly qualified Australian personnel would be in a position to control all the data communicated. There is considerable debate in Australia over the efficacy of deterrence and the role of the joint facilities. These issues are examined in detail in Chapter 15.

6.35 While the chances of Australia being directly involved in a nuclear conflict may be remote, the potential consequences of such an involvement should be taken into account in assessing Australia's position in these matters. The remainder of this Chapter examines the characteristics of nuclear explosions and the primary consequences both direct and indirect of nuclear explosions.

6.36 Also important for Australia are the longer-term climatic, biological and ecological consequences of large-scale nuclear war. A growing body of scientific evidence and opinion suggests that Australia could be seriously affected by these secondary consequences of a nuclear war in the Northern Hemisphere. Australia would have no defence against these effects. Accordingly, it is very much in our interests to be at least critically aware of these secondary effects of nuclear war. These are considered in the discussion of nuclear winter at the end of this Chapter.

The Consequences of Nuclear War

Characteristics of Nuclear Explosions[24]

6.37 The basic physics of nuclear explosions is described in the Appendix to this Chapter. The explosions are characterised by an immediate, rapid and brief release of nuclear radiation, a rapidly developing fireball which emits intense thermal radiation in the form of heat and light, and gives rise to a powerful pressure pulse which travels out from the point of burst; this is the shock or blast wave. In most weapons about half the energy released goes into the blast wave, about 35 per cent into heat and about 15 per cent into radiation.

a. Blast. Any nuclear explosion causes a strong shock wave that propagates outwards from the centre of the explosion at just over the speed of sound. The shock wave and accompanying winds crush objects, collapse structure and project objects at high speeds. The typical effects of blast from a one-megaton nuclear explosion are described in Table 6.1.

b. Heat or Thermal Radiation. Nuclear explosions emit immense heat, peaking in the tens of millions of degrees. Most of the thermal energy is emitted in a few seconds, travelling outward at the speed of light. The thermal radiation is capable of incinerating people and objects in close proximity to the blast and causing blindness and severe burns at considerable distances away from the point of

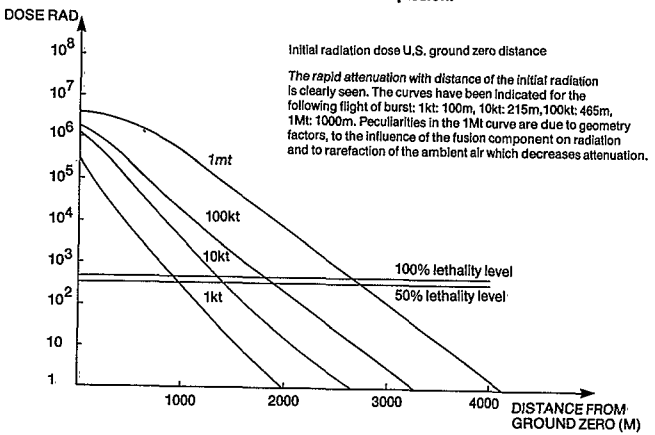
the explosion (a one-megaton explosion on a clear day, for example, would cause third-degree burns to exposed skin at a distance of five or six miles and ignite paper and other combustibles at four or five miles). While people located indoors would have some protection against the direct impact of thermal radiation, they would be faced with the threat of fires arising from both heat and blast. Under certain circumstances, individual fires could merge into a single 'fire storm' which would be impossible to extinguish until there were no more materials to burn.

c. **Nuclear Radiation.** The radiation emitted from a nuclear explosion can be divided into two categories: immediate and residual. Immediate (or 'prompt') radiation is defined as the radiation emitted within one minute of the explosion and travels directly outwards from the fireball. It comes from the fission products of the weapon and largely comprises neutrons and gamma rays. The typical ranges of immediate radiation for different yield weapons are shown in Figure 6.1. The radiation is highly penetrative and damaging to living organisms. It can also damage electronic equipment. For weapons of medium or high yield, the effects of immediate radiation are usually well exceeded by heat and blast effects.

Residual radiation is that radiation which persists for more than one minute after the explosion. It is made up of radiation emanating from the fission fragments of the explosion and other radio-active nuclei that have been formed by the collision of high energy neutrons with the earth or other matter in the vicinity of the explosion. These radioactive nuclei become attached to small bits of matter that are sucked up into the mushroom cloud and are eventually deposited in a wide area away from the site of the explosion. This deposition is known as *fallout*. The radioactive nuclei in the fallout decay, emitting further radiation over periods ranging from weeks to thousands of years. Fallout is much less for an airburst than an explosion at ground level.

Radiation dosage is normally measured in terms of 'rads' or 'rems'.[25] The biological effects of radiation stem from the accumulated dosage of radiation. Successive exposure to small amounts of radiation over a period of time can be just as harmful as a single, large dose. Table 6.2 summarises the effect of radiation on human beings. It indicates that serious effects begin to appear at 200 rems and that doses in excess of 600 rems are usually fatal.

Figure 6.1: Effects of blast from a nuclear explosion.



Source: United Nations Centre for Disarmament, *Comprehensive Study on Nuclear Weapons*, New York, 1981, p.163.

Table 6.1 Effects of Blast from a Nuclear Explosion

Peak over-pressure	Effects	Distance to which effects are felt[a]
20 psi[b]	Multi-story reinforced concrete buildings demolished; wind, 500 miles per hour	1.8 miles
10 psi	Most factories and commercial buildings collapsed; small wood and brick residences destroyed; wind, 300 miles per hour	2.7 miles
5 psi	Unreinforced brick and wood houses destroyed; heavier construction, severely damaged; wind 160 miles per hour	4 miles
2 psi	Moderate damage to houses (wall frames cracked, severe damage to roofs, interior walls knocked down); people injured by flying glass and debris; wind, about 60 miles per hour	7 to 8 miles

a One-megaton burst at 6,000 feet

b Pounds per square inch

Source: Leo Sartori, "When the bomb falls", Bulletin of Atomic Scientists, June/July 1983, p 41.

Table 6.2 Effects of Acute Radiation on Human Beings

Dose in rem	Symptoms	Treatment	Prognosis
0 to 100	Little or no visible sign; some blood changes detectable above 25 rems	No treatment required	Excellent
100 to 200	Vomiting, headache dizziness; moderate leukopenia (loss of white blood cells)	Hematologic surveillance; reassurance; hospitalization not required	Full recovery in a few weeks
200 to 600	Severe leukopenia; internal bleeding; ulceration; hair loss above 300 rems	Blood transfusion; antibiotics; hospitalization required	Guarded; probability of death near 0 at low end, 90 percent at high level
600 to 1,000	Same as above but more severe	Consider bone marrow transplant	Poor; probability of death 90 to 100 percent; long convalescent period for survivors
1,000 to 5,000	Diarrhea; fever; disturbance of electrolyte	Maintain electrolyte balance	No chance of recovery; death occurs in 2 to 14 days
over 5,000	Convulsions, tremor, ataxia	Sedatives	Death in 1 to 2 days or less

Source: Leo Sartori, "When the bomb falls", Bulletin of Atomic Scientists, June/July 1983, pp 41-2.

d. **Electromagnetic Pulse.** A small portion of the energy of a nuclear explosion is also released as an intense pulse of electromagnetic energy (electromagnetic pulse or EMP).[26] The pulse is similar to that emitted by lightning but is much sharper and of shorter duration and covers a much greater frequency range. The high energy fields produced by EMP can cause permanent, disruptive or transient damage to electrical and electronics equipment and can also cause insulation failures in cables as well as damage to computer and computer storage devices. A relatively high yield nuclear weapon exploded above the atmosphere can produce EMP effects over very large areas. EMP can thus pose a very serious threat to military command, control, communications and intelligence (C^3I) systems and hence the ability to control a nuclear conflict once it has begun.

Direct Effects of Nuclear War

Single Large Weapon on a Major City

6.38 In 1979, the United States Office of Technology Assessment of the Congress of the United States published a detailed description of the effects of a one-megaton bomb being exploded at night in the city of Detroit.[27] Similar effects could be expected for any other city including Australian cities. The report noted that if the weapon was exploded on the ground it would leave a crater about 1 000 feet in diameter and 200 feet deep. Within a central region about 1.7 miles in radius virtually all structures would be destroyed and no-one would be expected to survive. In a bordering region, between 1.7 and 2.7 miles from ground zero, individual residences would be destroyed, some commercial buildings might remain standing, but with walls blown out, and some industrial buildings might remain functional. There would be a considerable build-up of rubble and debris and approximately half the people in the region would be killed; almost all the survivors would be injured. In a third region, between 2.7 and 4.7 miles from ground zero, low residential buildings would be destroyed or severely damaged. Some 5 per cent of the inhabitants would be killed and nearly 50 per cent injured. Between 4.7 and 7.4 miles there would be light damage to commercial residences and moderate damage to residences. While fatalities would be small, nearly 25 per cent of inhabitants would be injured.

6.39 For the case of Detroit, the total number of fatalities was estimated to be 220 000 with a further 430 000 people injured (See Table 6.3). The number of dead and injured would be much greater if the bomb was exploded during working hours. The study estimated that secondary fires would be a major problem with over half the buildings in the third band (2.7 to 4.7 miles) being consumed. There would be considerable fallout, spreading as far as Pittsburgh some 200 miles away. Residual radiation levels in some areas of Detroit itself would remain above 'safe' levels for

as long as 10 years. The study found that if the weapon had been exploded in the air instead of at ground level then immediate fatalities would be almost doubled. There would be 50 per cent more people injured but the extent and level of radiation due to fallout would be substantially reduced.

6.40 In either case, the injured would face bleak prospects. Rescue efforts would be hampered by debris, fires and high levels of radiation. Most hospitals would have been demolished and specialist care facilities such as burn units would probably be non-existent. Large numbers of doctors and paramedical staff would themselves be victims. The containment of the effects of a nuclear explosion would depend greatly on whether the central government could mount rescue operations and move in resources from other regions.

Strategic Nuclear Exchange

6.41 There is general consensus that a single weapon exchange is an unlikely contingency. If nuclear war occurs, most experts agree that it would quickly escalate to an all-out exchange in which both the United States and the Soviet Union would unleash much of their strategic nuclear arsenals against their opponent's strategic forces, other military targets and major economic-industrial targets including cities. Thousands of high-yield warheads would be used in such an exchange.

6.42 Several studies of the likely consequences of an all-out nuclear war have been made. While the results differ in detail, all studies agree that the effects would be devastating. A 1979 study by the US Arms Control Agency[28] found that between 65 and 95 per cent of the key production capacity of both superpowers would be destroyed in a major exchange, and even non-targeted capacity would suffer 60 to 80 per cent destruction from collateral effects. In the Agency's scenario, the 200 largest cities in each country were destroyed and 80 per cent of all cities with 25 000 or more people were attacked by at least one weapon.

6.43 Similar results were reported by the Office of Technology Assessment which also concluded that:[29]

a. the effects of nuclear war that cannot be calculated are at least as important as those for which calculations are attempted;

b. the impact of even a 'small' or 'limited' nuclear attack would be enormous, involving severe economic damage, social dislocation and loss of life;

c. while effective sheltering and/or evacuation could save lives, it is not clear that a civil defence program based on providing shelters or planning evacuation would necessarily be effective;

Table 6.3

Casualty Estimates from a One-Megaton Weapon

Region (miles from ground zero)[a]	Area (square miles)	Population[b]	Fatalities	Injuries[b]	Uninjured[b]
0 to 1.7	9	70	70	0	0
1.7 to 2.7	14	250	130	100	20
2.7 to 4.7	47	400	20	180	200
4.7 to 7.4	103	600	0	150	450
Totals	173	1,320	220	430	670

a The weapon is assumed to explode on the ground, at night, in downtown Detroit.

b Figures are in thousands.

Source: The Effects of Nuclear War, Washington, D.C.: Office of Technology Assessment, 1979.

d. the situation in which the survivors of a nuclear attack would find themselves would be quite unprecedented. 'The surviving nation would be far weaker - economically, socially, and politically -than one could calculate by adding up the surviving economic assets and the numbers and skills of the surviving people. Natural resources would be destroyed; surviving equipment would be designed to use materials and skills that might no longer exist; and indeed some regions might be almost uninhabitable. Furthermore, prewar patterns of behaviour would surely change, though in unpredictable ways. Finally, the entire society would suffer from the enormous psychological shock of having discovered the extent of its vulnerability'; and

e. from an economic point of view, and possibly from a political and social viewpoint as well, conditions after an attack would get worse before they started to get better. 'For a period of time, people could live off supplies ... left over from before the war. But shortages and uncertainties would get worse. The survivors would find themselves in a race to achieve viability (i.e., production at least equating consumption plus depreciation) before stocks ran out completely. A failure to achieve viability, or even a slow recovery, would result in many additional deaths, and much additional economic, political, and social deterioration. This postwar damage could be as devastating as the damage from the actual nuclear explosions'.

6.44 The estimates of civilian casualties arising from such a conflict vary considerably. Recent estimates range from several hundred million to 1.1 billion people - the latter estimate is in a World Health Organisation study[30], in which targets were assumed not to be restricted entirely to Nato and Warsaw Pact countries. In most cases, the number of injured has been estimated to be of a similar magnitude to the number killed. Thus it is possible that nearly half of the earth's population would be killed or injured by the direct effects of a major nuclear war.

6.45 A considerable proportion of those who survive the blast, fire and heat will suffer from acute radiation sickness as a result of exposure to fallout. In addition, sub-lethal levels of ionising radiation will lower resistance to infection. A large number of people will suffer from a severe sense of shock and disorientation. As a recent study published under the auspices of the Royal Swedish Academy of Sciences stated:

> About one-third of the urban survivors will be in a state of acute anxiety, and about 20 per cent of the other survivors will be so incapacitated by psychological and pathopsychological conditions that they will be unable to care for themselves or others. Those who have witnessed

> the annihilation of their societies may suffer from profound apathy and disorientation. The staggering numbers of corpses to be cleared away and the pressing need to care for the wounded and ill will absorb much of the time and energy of those who are capable of purposeful action.[31]

6.46 The survivors of a nuclear war would face formidable problems. Unlike the case of a single city attack, devastated areas could not count on much help from outside since neighbouring communities would also be likely to have been hit. Millions of people would be homeless. Those shelters that existed would be overcrowded and overtaxed. There would probably be a shortage of basic essentials such as food, water and medical supplies. Many people will almost certainly be unable to avoid eating food contaminated with radioactivity. Communications would be virtually non-existent and only minimal hygiene and sanitation facilities would be in operation. Under such conditions, disease and sickness would be widespread and epidemic diseases could become more prevalent and deadly. Law and order would be difficult to maintain and the re-establishment of a complex, industrial society may require significant changes in the political and social systems. These kinds of effects and consequences are likely to bring urban civilisation as we know it to an end. As the Palme Commission noted:

> It is difficult to imagine the continuance of social discipline in the face of the devastation that would accompany a war involving hundreds, much less thousands, of nuclear explosions. Would people be willing to abide by the authority of a government that had just led its country to incredible disaster? If not, the basic services upon which modern society depends - such as protection from criminal elements, the banking and monetary system, the generation and distribution of electric power, the distribution of water and food to urban areas - could well come to a halt. Society could regress to autonomous bands of people living largely in the rural areas that had been spared the worst radiation, each surviving primitively on its own wits and resources.[32]

Under these conditions, society may be faced with a radical deterioration of conditions over a long term and the prospects of ever 'recovering' to anything like its earlier form may be small.

Indirect Effects of Nuclear War

6.47 As mentioned earlier, nuclear explosions occurring at ground level will propel large quantities of condensates and fine dust into the upper atmosphere. These condensates carry with them a range of radioisotopes which are deposited over a wide area as fallout. Those particles that are injected into the

troposphere (5 to 15 km above the earth) tend to fall out fairly rapidly - by gravitational settling, rainout, convection and other processes - and before the radioactivity has decayed to moderately safe levels. Particles injected into the stratosphere (above 15 km) settle out more slowly, and hence produce lower doses of ionising radiation than the fallout from the troposphere, but over a much wider area. Both effects can add to the overall levels of radioactivity that may be experienced in certain areas - levels that may be sustained for a considerable time. If the explosion occurs above ground level, the amount of fallout is reduced.

6.48 A second, longer term effect of high-yield nuclear explosions in particular is the partial destruction of the ozone layer in the atmosphere. The high temperature in the fireball ignites some of the nitrogen in the air, producing oxides of nitrogen, which in turn chemically attack and destroy the ozone in the stratosphere. Ozone absorbs ultraviolet radiation from the sun and so the partial depletion of the 'ozonosphere' will increase the flux of solar ultraviolet radiation at the surface of the earth. Any substantive increase in ultraviolet radiation can be harmful to various life-forms. This effect is unlikely to be significant in the case of a small number of explosions but could have serious consequences following an all-out exchange.

> Agricultural and natural ecosystems weakened by radiation and other environmental stress will be vulnerable to attack by pests that thrive on ailing plants. Cockroaches and rats, carrion birds and organisms of decay will increase in frequency ... All these factors will cause enormous problems for the survivors in the Northern Hemisphere and severe food shortages will persist in large areas for months or years following the war.[33]

Nuclear Winter

6.49 The primary consequences of 'nuclear war' both direct and indirect, have been known for some time. A more recently discovered phenomenon - and one which is attracting considerable scientific interest - is the longer term climatic effects of nuclear war. These effects have come to be described as 'nuclear winter'. It is known that both ground and air-bursts over cities or forests will tend to produce massive fires generating smoke and soot which would be carried into the atmosphere. A number of theoretical studies have indicated that the smoke and dust generated by a nuclear war could be sufficient to block out the sun from extensive areas of the Northern Hemisphere, thereby inducing a 'nuclear winter' in these regions. As one author described, within one or two weeks of a nuclear exchange:

> ...the individual plumes of dust and soot would coalesce in an enormous dark cloud shrouding most of the Northern Hemisphere, particularly the mid-latitude belt encompassing most of the United

States, Canada, the Soviet Union, Europe, China and Japan. Beneath the spreading clouds, very little sunlight - in the worst cases, as little as a tenth of one per cent of the normal light level, averaged over the hemisphere - could reach the surface...With most of the sunlight blocked, temperatures at the surface would plummet tens of degrees, dropping far below freezing in continental interiors a week or so after the exchange, whatever the season. Extremely cold temperatures would last for many weeks, even months, returning to normal only very slowly. Coastal areas and islands would be spared the extreme cold by the moderating influence of the oceans' vast thermal inertia. But the huge temperature difference between the oceans and the continental interiors would subject coastal areas to months of unremitting violent weather.[34]

6.50 The impact of low light intensities and freezing temperatures are manifold. One expert witness suggested that:

> If these conditions are severe enough and last for a significant length of time during the growing season they would lead to loss of at least one year's crops, the death of many plants and animals, and thus to mass starvation of many erstwhile human survivors. Fresh water supplied may freeze and become inaccessible to humans and animals, and other dire effects can be imagined.[35]

6.51 The American scientist Dr Carl Sagan has suggested that the long-term consequences of a nuclear war could constitute a global climatic catastrophe. While acknowledging that the nuclear winter studies are in their infancy and they contain a number of assumptions and uncertainties, Sagan argues that nonetheless:

> ...there is general agreement on the overall conclusions: in the wake of a nuclear war there is likely to be a period, lasting at least for months, of extreme cold in a radioactive gloom, followed - after the soot and dust fall out - by an extended period of increased ultraviolet light reaching the surface.[36]

6.52 Sagan and his colleagues suggest that the nuclear threshold for these kinds of effects is around 500 to 2 000 warheads which is well below the present arsenals of both superpowers and even inside a first strike capability in which one side would attempt to destroy the strategic nuclear forces of the other in a pre-emptive strike. Under these conditions a first strike capability has no meaning since it is tantamount to national suicide even if the attacked nation does not lift a

finger to retaliate. Sagan argues that national or global inventories above this rough threshold 'move the world arsenals into a region that might be called the "Doomsday Zone"'.

> If the world arsenals were well below this rough threshold, no concatenation of computer malfunction, carelessness, unauthorised acts, communications failure, miscalculation and madness in high office could unleash the nuclear winter. When global arsenals are above the threshold, such a catastrophe is at least possible. The further above threshold we are, the more likely it is that a major exchange would trigger the climatic catastrophe.[37]

6.53 Similar warnings were made by Australian atmospheric physicist, Dr Barrie Pittock, who stated that:

> My own assessment is that there is virtually no doubt that a nuclear war in which several hundred cities were set on fire would result in a major climatic disaster in the Northern Hemisphere and disturb the general circulation of the atmosphere sufficiently to cause considerable, if not totally disastrous effects in the Southern Hemisphere. The exact degree and extent of the disaster, especially as to how long the effects would last, remains uncertain, but could as easily have been under-estimated as exaggerated.[38]

6.54 These concerns and the need for further study of the phenomenon have been repeated in two recent reports that had been commissioned by the U.S. Department of Defense. In November 1984, a U.S. National Academy of Sciences Report entitled The Effects on the Atmosphere of a Major Nuclear Exchange concluded that:

> ...there is a clear possibility that great portions of the land areas of the northern temperate zone (and perhaps a large segment of the planet) could be severely affected. Possible impacts include major temperature reductions (particularly for an exchange that occurs in summer) lasting for weeks, with subnormal temperatures persisting for months. The impact of these temperature reductions and associated meteorological changes on the surviving population, and on the biosphere that supports the survivors, could be severe and deserves careful independent study.[39]

6.55 The NAS report emphasised the large number of uncertainties and assumptions associated with the modelling of the nuclear winter phenomenon and the consequent need for further

research. A similar view was expressed in a Department of Defence report, The Potential Effects of Nuclear War on the Climate, which was presented to the U.S. Congress in March 1985. The report recognised the importance of improving the understanding of the technical underpinnings of the nuclear winter hypothesis, stating that:

> We have very little confidence in the near-term ability to predict this phenomenon quantitatively, either in terms of the amount of sunlight obscured and the related temperature changes, the period of time such consequences may persist, or of the levels of nuclear attacks which might initiate such consequences. We do not know whether the long-term consequences of a nuclear war - of whatever magnitude - would be the often postulated months of subfreezing temperatures, or a considerably less severely perturbed atmosphere. Even with widely ranging and unpredictable weather, the destructiveness for human survival of the less severe climatic effects might be of a scale similar to the other horrors associated with nuclear war.[40]

The Pentagon report detailed the policy implications of nuclear winter for deterrence, arms control and the Strategic Defense Initiative.

Nuclear Winter and Australia

6.56 The more recent studies of the 'nuclear winter' also indicate that the longer term climatic effects do not seem to be restricted to the northern regions in which the nuclear exchange would mainly take place. Carl Sagan, for example, reported that:

> There is now substantial evidence that the heating by sunlight of atmospheric dust and soot over northern mid-latitude targets would profoundly change the global circulation. Fine particles would be transported across the equator in weeks, bringing the cold and the dark to the Southern Hemisphere...While it would be less cold and less dark at the ground in the Southern Hemisphere than in the Northern, massive climatic and environmental disruptions may be triggered as well.[41]

6.57 These findings are supported by Australian atmospheric physicist, Dr Barrie Pittock, who stated to the Committee that:

> One way in which war debris, including smoke, dust, radioactivity, and oxides of nitrogen could be rapidly transported into the southern hemisphere from a war essentially fought in the

> north is by an enhanced cross-equatorial flow of air in the lower atmosphere. This could occur because the dense clouds of smoke in the northern hemisphere would absorb so much of the incoming sunlight that the land surfaces would cool rapidly. Such cooling would not initially take place over the southern continents which would not be under such dense smoke clouds, so a north-south temperature difference would be set up which would cause air to flow at low levels from the cold northern land masses to the warmer southern continents.[42]

6.58 Dr Pittock argued that the perturbation of the normal air flow around the equator by smoke produced by a nuclear war could result in smoke, radioactive fallout and other debris being distributed over the Australian continent within a matter of weeks. In subsequent evidence, he stated that the latest climate modelling results showed that Australia's climate would be affected although it is still uncertain how serious these effects would be.

> They could range from coolings in inland areas of 10 to 15 degrees C for several weeks, with occasional colder periods as particularly dense clouds of smoke pass overhead in the first 2 or 3 weeks, to much less severe coolings. Rainfall could be reduced by 50% or so, possibly for months or even a year or two. Such effects could reduce our food production by 50% or more, but because we are normally a large food exporter it is probable that even in the worst case there would be no mass starvation in Australia in the short-term.
>
> The same is probably true of New Zealand, but probably not for many other Southern Hemisphere countries which do not have large food surpluses. New Zealand and Tasmania, being surrounded by the ocean, would not experience such large coolings as the Australian mainland.[43]

Dr Pittock agreed that more extensive studies are required with more elaborate computer models of climate before the results can become conclusive. On the basis of the evidence so far however, he considered that Australia is likely to 'be seriously affected'.

Current Evaluations of the Nuclear Winter Effects

6.59 All the scientists involved in the nuclear winter studies are aware of the interim nature of their findings and the uncertainties involved. Most studies to date are based on first-order calculations made with very simplified models of the burning process and of global atmospheric behaviour. Many

physical processes have been omitted or approximated in ways which could turn out to be important. To eliminate these uncertainties, more studies are being conducted. These include the Environmental Consequences of Nuclear War (ENUWAR) Project being carried out by the International Council of Scientific Unions as well as more specific studies by Australia's CSIRO into the likely impact for the Southern Hemisphere. Some of these latter studies are being funded by the Australian Government as part of the International Year of Peace.

6.60 Are these uncertainties enough to call into question the predictions of the nuclear winter thesis? Certainly, the authors of the studies do not think so. Dr Pittock, for example, stated that:

> I believe the results are extremely robust in the sense that you can vary the initial assumptions quite considerably and still come up with a serious nuclear winter effect.[44]

He further stated that more recent studies have confirmed the findings of the earlier nuclear winter predictions and even suggest that the earlier predictions were understated in several important regards. There have been no substantive criticisms within the scientific publications of the methods used nor have there been contrary findings. Pittock also suggested that the findings are being taken very seriously by both the United States and Soviet authorities. He stated that in a summary of the October 1983 conference in Washington for the Chief of Naval Operations, Vice Admiral J A Lyons, Jr., Deputy Chief of Naval Operations, stated, in a Memorandum dated 7 November, that:

> The findings presented in the conference, The World After Nuclear War, must be viewed as a serious, credible, result of scientific enquiry into possible consequences of nuclear war. However, a considerable amount of serious scientific work will be required before a better understanding of these consequences emerge.[45]

6.61 Similar sentiments have been expressed by Australian Defence officials. The Director of the Materials Research Laboratories of the Australian Department of Defence stated to the Committee that work on nuclear winter:

> ...is by no means complete and there are very significant uncertainties. However, there does appear, I think, to be general agreement that there is a real possibility of global atmospheric effects, which would cause severe climatic conditions in the Northern Hemisphere, at least, and possibly in the Southern Hemisphere too.[46]

6.62 One important criticism of the nuclear winter thesis is related to the strategic rather than scientific assumptions that are contained in the studies. Dr Desmond Ball stated to the Committee that:

> The strategic basis of the arguments to date for a nuclear winter are so far outside the realms of strategic reality that they would certainly not support the case for a nuclear winter. That does not mean that there are not other, more realistic scenarios than those of people who have put forward the nuclear winter idea which might lead to the conclusion of a nuclear winter. But so far, the arguments which have been put forward do not sustain that conclusion. For one thing, the arguments which are being put forward have in general involved extremely high levels of megatonnage, of the order of 10 000 or more megatonnes being expended in any all-out nuclear exchange. That figure is certainly higher by a factor of three, probably by a factor of four, probably by a factor of five. It involves basically assumptions that everything which exists in the arsenals on both sides is going to be used.[47]

6.63 From an examination of the likely targeting plans of both sides, Ball considers that the actual number of warheads which would be detonated over targets would amount to perhaps 2 500 to 3 500 megatons. Moreover, most of the targets would be military forces or installations. 'Only a few hundred, certainly less than 1 000 megatons, are going to go off over urban industrial areas where you are going to cause fires'. Ball states that even the warheads that are going to be detonated over urban industrial areas are going to be air bursts.

> With the general hardness of an urban industrial area - say, five pounds per square inch up to 25 pounds per square inch - you are going to get a much more significant lethal radius against that target set by air bursting, and if you are going to air burst then you are certainly not going to cause massive fireballs. You might cause some sporadic fires. So the actual amount of smoke and soot which is going to be generated is much, much smaller than that which is postulated as the basis of the nuclear winter.[48]

Ball qualified his remarks on nuclear winter however by concluding:

> That is not to say that one should totally rule out a nuclear winter but what it does say is that the strategic basis of every argument which has been put forward so far just does not support the nuclear winter.[49]

6.64 In response to these criticisms,[50] Dr Pittock and his colleagues acknowledged that scenarios involving megatonnages of 5 000 to 10 000 megatons may be strategically unrealistic in view of the lower-yield weapons now being deployed by both superpowers. They argued, however, that the crucial variable in whether nuclear winter occurs or not, is not megatonnage but the number of high fuel density targets that are set on fire. Only a relatively small number of such targets - cities, urban/industrial centres, major fuel storage depots and forests - would need to be set ablaze in order to create sufficient smoke to initiate climatic effects either locally or across a hemisphere. Thus there is no sharp dividing line between the amounts of smoke, or sizes of nuclear war, and serious climatic effects. Depending on a number of factors such as the targets chosen, weapons yields, ratio of air-burst to ground-burst explosions, the season, and even time-of-day, the latter could be affected by a range of strategic scenarios from relatively small exchanges to protracted nuclear war.

6.65 It was also agreed that the studies into the nuclear winter phenomenon will have important consequences for the strategic nuclear policies and targeting doctrines of both superpowers. As Dr Harry Redner stated to the Committee:

> ... one of the consequences of this work is quite clearly going to be that targeting doctrines are going to change and there are going to be a lot of rearrangements done as to what is targeted in the future and how. I think that is a crucial consequence, because even if the worst does come to the worst, and there is a nuclear war, it is clear that if the lessons of science of this kind are taken into account the effects would still be catastrophic but might not be quite as disastrous as it is likely they would have been before this was known. It follows, therefore, that this knowledge is extremely important, regardless of what the scientific uncertainties are as to the specific nature of the consequences. The scientists need not be absolutely certain to the last decimal point of what will happen to make absolutely certain that the strategists will change their targeting, simply going on the likelihood that even a 20 per cent or 30 per cent possibility is still an enormous danger, given what is at stake.[51]

Overview: The Dangers of Nuclear War

6.66 An awareness of, and ability to contribute to, the nuclear debate requires not only an understanding of the superpower competition and the spread of nuclear arms but also an appreciation of the potential dangers, if any, these developments entail. In particular, we need to be aware of the likelihood of

nuclear conflict and the consequences of such a conflict should it occur. Such an understanding provides both an incentive for avoiding nuclear war and a better appreciation of what needs to be done in the short and longer terms to meet this objective.

6.67 It is quite clear that the consequences of nuclear war have risen dramatically, principally as a result of the very large stockpiles of nuclear weapons that have been built up by the nuclear weapon states. General war between the two superpowers would result in unprecedented devastation and destruction for the major combatants and their allies in Europe, with many millions of people killed, millions more injured and homeless, large areas rendered uninhabitable due to high levels of radiation and much of modern society as we know it in ruins.

6.68 Even those nations not directly involved in the fighting - including Australia - are likely to be seriously affected. At the very least, they will be subjected to major dislocation and uncertainty stemming from the widespread disruption of existing social, economic and security structures. Australia, for example, is likely to suffer a significant disruption to its economy because of the massive destruction inflicted on some of its trading partners and the general dislocation of world trade. It is likely to be inundated by millions of refugees who may be carrying diseases, such as typhoid and cholera, that would pose additional threats to our well-being and livelihood. In the chaos ensuing from the disintegration of world order, we could even be faced with new and serious military threats to our national security.

6.69 The surviving nations would also be exposed to increased radiation dangers due to radioactive fallout and the partial depletion of the ozone layer in the atmosphere and could experience severe climatic effects due to dust and smoke generated by nuclear explosions reaching into the upper atmosphere and blocking out the sun for extended periods of time. This could reduce temperatures in the war zones by several tens of degrees centigrade and produce lesser, but still significant cooling in the northern subtropics and the tropics. The resultant animal and crop losses would lead to mass starvation and higher death rates, both in the already devastated combatant countries here and in many parts of the southern hemisphere as well.

6.70 The growing consequences of nuclear war, expecially a major war between the United States and the Soviet Union, make it of paramount importance that such an event does not take place. Just as the consequences of nuclear war have multiplied over the last few decades, so have the possible paths to nuclear war increased. As a result of the continuing development of the nuclear arsenals of the superpowers and the increasing integration of their nuclear and non-nuclear forces, any military conflict between the United States and the Soviet Union could lead to nuclear weapons being used - either on purpose or inadvertently - with a significant risk of escalation. In addition, the existence of formidable nuclear arsenals outside those of the two superpowers and the continuing spread of nuclear weapons to other states can now result in such weapons being used in a military conflict between a range of other nations or even

between them and the superpowers. The horizontal proliferation of nuclear weapons and nuclear technologies has also increased the possibility that weapons, or the basic resources required to build weapons, could be obtained by terrorist organisations or other sub-national groups.

6.71 Whether nuclear weapons will be used in the future and whether the chance of nuclear war occurring is increasing is a matter of considerable debate. Large numbers of nuclear weapons by themselves do not necessarily constitute an increased risk. Despite the existence of nuclear weapons for forty years, nuclear war has not occurred. Moreover, at present, the likelihood of nuclear war, expecially all-out war between the superpowers, appears to be small. This is probably due to a combination of good fortune and sound management. The number of nuclear powers has remained relatively small. The principal nuclear weapons states have tended to act responsibly at least in regard to any potential, or implied, use of nuclear weapons. The weapons themselves, by their very destructiveness, have established a steadily stronger predisposition against their use. And no nuclear power has ever been in a position where it could hope to use its weapons against another nuclear power without the fear of massive retaliation of one kind or another. This general situation could well have been otherwise.

6.72 While these conditions still largely apply, they should not allow us to become too complacent. The fact that there has been no use of nuclear weapons since 1945 does not guarantee that they will not be used in the future. Nuclear war is, and will continue to be possible. Moreover, there are important trends and developments in train which could increase the risk of a nuclear conflict occurring. These include:

a. the growing number and diversity of nuclear weapons, their increasing sophistication and greater geographical dispersion. This is making the potential use of nuclear weapons more difficult to control, particularly during a crisis, and has led both superpowers to develop and deploy highly complex and largely automated systems of command and control;

b. the advent or projected development of new weapons systems or technologies - such as the SS-18, MX and Trident II missile systems and anti-satellite and ballistic missile defence systems - which are perceived to threaten strategic stability and could provide one side or the other with the ability to launch a 'successful' first strike; and

c. the refinement by both sides of 'damage limitation' and 'war-fighting' nuclear doctrines and the growing official speculation that nuclear weapons do not only exist to deter their use but they can be used (or threaten to be used) to serve a variety of military purposes and help achieve foreign policy goals.

These broad trends and developments are complicating the successful management of superpower relations and producing increasing speculation that the relationship could break down particularly under the strains of a long-lasting and acute political crisis.

6.73 To some extent, the sheer magnitude of the consequences of a modern nuclear war tends to act to reduce its likelihood. No sane political leader would take actions that would lead to his own nation being destroyed. But we cannot rely on fear alone to maintain a nuclear peace. In some future crisis, rational expectations and ideals could give way to irrational behaviour, or prudence could be replaced by impulsive action. More plausible still, is the possibility that the two protagonists could become caught up in a complex sequence of actions and reactions which, without fully realising it, pushes them into direct confrontation.

6.74 The consequences of nuclear war and the possibility, however remote at present, that it could take place, require that all nations - but in particular the nuclear weapons states - devise policies and practices which address all the conceivable ways that nuclear war may occur and seek to reduce its potential consequences. In order to minimise the dangers of nuclear war in the short term at least, there is a need to constrain horizontal proliferation, prevent direct conventional conflict between the superpowers, maintain overall parity between their nuclear arsenals (including an invulnerable second strike capacity), avoid actions that might destabilise the current strategic balance and ensure they exercise extreme caution during periods of tension or crisis. There is also a need to reduce substantially the number of nuclear weapons in existence. Whether and how these objectives should and can be achieved is the subject of Part 5 of this Report.