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New Forms of War and Arms Control in the Middle East

The Revolution in Military Affairs, Asymmetric Warfare, Superterrorism, and Other New Forms of Warfare

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The Changing Impact of Technology

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Part Two

The Impact of the Revolution in Military Affairs

The "Revolution in Military Affairs" (RMA) – Part One

- *Decoupling of political and military responsibility:* No war is ever free of command controversy or friction between political and military leadership. However, the Coalition forces fought the Gulf War with effective delegation of responsibility for military decisions to military commanders. RMA forces are likely to enjoy the same advantage in mid-to-high-intensity wars where rival military forces will be more politicized, and organized more to suit the regime's internal security needs than to conduct modern joint operations.

- *Unity of command:* The level of unity of command, and "fusion," achieved during the Gulf War was scarcely perfect, but it was far more effective than that possible in most states. Advanced powers have improved its unity of command and ability to conduct joint operations h.

- *Jointness, Combined operations, combined arms, and the "AirLand Battle":* Advanced powers can use technology to train and integrate in ways that allow far more effective approaches to jointness, combined arms and combined operations. They have developed tactics that closely integrated air and land operations..

- *Emphasis on maneuver:* The US had firepower and attrition warfare until the end of the Vietnam War. In the years that followed, it converted its force structure to place an equal emphasis on maneuver and deception. This emphasis has been adopted by Britain and France, and other advanced states...

- *Emphasis on deception and strategic/tactical innovation:* No country has a monopoly on the use of deception and strategic/tactical innovation. High technology powers with advanced battle management and information systems will, however, be able to penetrate the enemy's decision-making system and react so quickly that the opponent cannot compete..

- *"24 hour war" - Superior night, all-weather, and beyond-visual-range warfare:* "Visibility" is always relative in combat. There is no such thing as a perfect night vision or all-weather combat system, or way of acquiring perfect information at long-ranges. Advanced technology air and land forces, however, have far better training and technology for such combat than they ever had in the past, and are designed to wage warfare continuously at night and in poor weather. Equally important, they are far more capable of taking advantage of the margin of extra range and tactical information provided by superior technology.

- *Near Real-Time Integration of C^4I/BM/T/BDA:* New C^4I/BM/T/BDA organization, technology, and software systems make it possible to integrate various aspects of command, control, communications, computers, and intelligence (C^4I); battle management (BM); targeting (T); and battle damage assessment (BDA) to achieve a near real time integration and decision making-execution cycle.

- *A new tempo of operations:* Superiority in virtually every aspect of targeting, intelligence gathering and dissemination, integration of combined arms, multi-service forces, and night and all-weather warfare make it possible to achieve both a new tempo of operations and one far superior to that of the enemy.

- *A new tempo of sustainability:* Advanced forces will have maintainability, reliability, reparability, and the speed and overall mobility of logistic, service support, and combat support force activity that broadly match their maneuver and firepower capabilities. The benefits of these new capabilities are already reflected in such critical areas as the extraordinarily high operational availability and sortie rates of Western combat aircraft, and the ability to support the movement of heliborne and armored forces

The "Revolution in Military Affairs" (RMA) – Part Two

- *Beyond-visual-range air combat, air defense suppression, air base attacks, and airborne C^4I/BM:* The Coalition in the Gulf had a decisive advantage in air combat training, beyond-visual-range air combat capability, anti-radiation missiles, electronic warfare, air base and shelter and kill capability, stealth and unmanned long-range strike systems, IFF and air control capability, and airborne C^4I/BM systems like the E-3 and ABCCC. These advantages allowed the Coalition to win early and decisive air supremacy. Advanced forces will steadily improve the individual capability of these systems and their integration into "netrocentric" warfare..

- *Focused and effective interdiction bombing*: Advanced forces will organize effectively to use its deep strike capabilities to carry out a rapid and effective pattern of focus strategic bombing where planning is sufficiently well coupled to intelligence and meaningful strategic objectives so that such strikes achieve the major military objectives that the planner sets. At the same time, targeting, force allocation, and precision kill capabilities will advance to the point where interdiction bombing and strikes are far more lethal and strategically useful than in previous conflicts..

- *Expansion of the battle field: "Deep Strike":* As part of its effort to offset the Warsaw Pact's numerical superiority, US tactics and technology emphasized using AirLand battle capabilities to extend the battlefield far beyond the immediate forward "edge" of the battle area (FEBA). The Coalition exploited the resulting mix of targeting capability, improved air strike capabilities, and land force capabilities in ways during the Gulf War that played an important role in attriting Iraqi ground forces during the air phase of the war, and which helped the Coalition break through Iraqi defenses and exploit the breakthrough. Even in Kosovo, the US and NATO were only beginning to employ advanced "deep strike" targeting technologies and precision strike systems and far more advanced systems are in development.

- *Technological superiority in many critical areas of weaponry:* The West and GCC scarcely had a monopoly on effective weapons during the Gulf War, but they had a critical "edge" in key weapons like tanks, other armored fighting vehicles, artillery systems, long-range strike systems, attack aircraft, air defense aircraft, surface-to-air missiles, space, attack helicopters, naval systems, sensors, battle management, and a host of other areas. This superiority went far beyond the technical "edge" revealed by "weapon on weapon" comparisons. Coalition forces exploited technology in "systems" that integrated mixes of different weapons into other aspects of force capability and into the overall force structure.

- *Integration of precision-guided weapons into tactics and force structures:* Advanced forces will exploit a technical "edge" in the ability to use precision-guided weapons with far more realistic training in using such weapons, and the ability to link their employment to far superior reconnaissance and targeting capability.

- *Realistic combat training and use of technology and simulation:* During the Gulf War, the US and Britain used training methods based on realistic combined arms and AirLand training, large-scale training, and adversary training. These efforts proved far superior to

previous methods and were coupled to a far more realistic and demanding system for ensuring the readiness of the forces involved. They show the value of kinds of training that allow forces to rapidly adapt to the special and changing conditions of war.

- *Emphasis on forward leadership and delegation:* Technology, tactics, and training all support aggressive and innovative leadership.

The "Revolution in Military Affairs" (RMA) – Part Three

- *Heavy reliance on NCOs and highly skilled enlisted personnel:* Advanced forces will not rely on conscripts or reserves, but will place heavy reliance on the technical skills, leadership quality, and initiative of non-commissioned officers (NCOs) and experienced enlisted personnel..

- *High degree of overall readiness:* Military readiness is a difficult term to define since it involves so many aspects of force capability. RMA forces, however, will have more realistic standards for measuring readiness and ensuring proper reporting, and adequate funding over a sustained period of time.

Platforms vs. Battle Management Systems, Sensors, and Smart Munitions

- **Past measures of military power focused on force size, key weapons platforms.**

- **Force quality is now critical,**

- **C4I (command, control, Communications, and Computers/Intelligence/Battle management/Strategic reconnaissance-Targeting/Battle Damage Assessment can substitute for conventional forces.**

- **Smart munitions and highly lethal warheads can compensate for force numbers.**

- **Platform performance may be becoming less important than other capabilities.**

- **Support and sustainability critical in determining war fighting; have high technology, infrastructure, and training dimension.**

- **No meaningful difference between "offensive" and "defensive" systems in roughly balanced force.**

Technology Vulnerabilities of Less Advanced Powers – Part One

- *Authoritarianism and over-centralization of the effective command structure:* The high command of many countries is dependent on compartmentalized, over-centralized C^4I/BM systems that do not support high tempo warfare, combined arms, or combined operations and lack tactical and technical sophistication. Many forces or force elements report through a separate chain of command. C^4I/BM systems often are structured to separate the activity of regular forces from elite, regime security, and ideological forces. Systems often ensure major sectors and corps commanders report to the political leadership, and separations occur within the branches of a given service. Intelligence is compartmentalized and poorly disseminated. Air force command systems are small, unit oriented and unsuited for large scale force management. Coordination of land-based air defense and strike systems is poorly integrated, vulnerable, and/or limited in volume handing capability. Combined operations and combined arms coordination are poor, and command interference at the political level is common.

- *Lack of strategic assessment capability:* Many nations lack sufficient understanding of Western war fighting capabilities to understand the impact of the revolution in military affairs, the role of high technology systems, and the impact of the new tempo of war. Other countries have important gaps in their assessment capabilities reflecting national traditions or prejudices.

- *Major Weaknesses in battle management, command, control, communications, intelligence, targeting, and battle damage assessment:* No Middle Eastern country has meaningful access to space-based systems, or advanced theater reconnaissance and intelligence systems. Most lack sophisticated reconnaissance, intelligence, and targeting assets. Beyond-visual-range imagery and targeting is restricted to largely vulnerable and easily detectable reconnaissance aircraft or low performance UAVs. Many rely on photo data for imagery, and have cumbersome download and analysis cycles in interpreting intelligence. Many have exploitable vulnerabilities to information warfare. Most are limited in the sophistication of their electronic warfare, SIGINT, and COMINT systems. Their communications security is little better than commercial communications security. They have severe communications interconnectivity, volume handling, and dissemination problems. Additionally, they cannot provide the software and connectivity necessary to fully exploit even commercial or ordinary military systems. They lack the C^4I/BM capability to manage complex deep strikes, complex large-scale armor and artillery operations, effective electronic intelligence, and rapid cycles of reaction in decision-making.

- *Lack of cohesive force quality:* Most countries' forces have major land combat units and squadrons with very different levels of proficiency. Political, historical, and equipment supply factors often mean that most units have much lower levels of real-world combat effectiveness than the best units. Further, imbalances in combat support, service support, and logistic support create significant additional imbalances in sustainability and operational effectiveness. Many states add to these problems, as well as lack of force cohesion, by creating politicized or ideological divisions within their forces.

- *Shallow offensive battlefields:* Most states face severe limits in extending the depth of the battlefield because they lack the survivable platforms and sensors, communications, and data processing to do so. These problems are particularly severe in wars of maneuver, in wars involving the extensive use of strike aircraft, and in battles where a growing strain is placed on force cohesion.

- *Manpower quality:* Many states rely on the mass use of poorly trained conscripts. They fail to provide adequate status, pay, training, and career management for NCOs and technicians. Many forces fail to provide professional career development for officers and joint and combined arms training. Promotion often occurs for political reasons or out of nepotism and favoritism.

Technological Vulnerabilities of Less Advanced Powers – Part Two

- *Slow tempo of operations:* Most military forces have not fought a high-intensity air or armored battle. They are at best capable of medium tempo operations, and their pace of operations is often dependent on the survival of some critical mix of facilities or capabilities.

- *Lack of Sustainability, Recovery, and Repair:* These initial problems in the tempo of operations are often exacerbated by a failure to provide for sustained air operations and high sortie rates, long-range sustained maneuver, and battlefield/combat unit recovery and repair. Most forces are heavily dependent on re-supply to deal with combat attrition whereas Western forces can use field recovery, maintenance, and repair.

- *Inability to prevent air superiority:* Many states have far greater air defense capability on paper than they do in practice. Most have not fought in any kind of meaningful air action in the last decade, and many have never fought any significant air action in their history. C^4I/BM problems are critical in this near real-time environment. Most countries lack sophisticated air combat and land-based air defense simulation and training systems, and do not conduct effective aggressor and large-scale operations training. Efforts to transfer technology, organization, and training methods from other nations on a patchwork basis often leaves critical gaps in national capability, even where other capabilities are effective.

- *Problems in air-to-air combat:* Air combat training levels are low and unrealistic. Pilot and other crew training standards are insufficient, or initial training is not followed up with sustained training. There is little effective aggressor training. AWACS and ABCCC capabilities are lacking. EW capabilities are modified commercial grade capabilities. Most aircraft lack effective air battle management systems, and have limited beyond-visual-range and look down shoot down capability. Most Soviet/Communist supplied air forces depend heavily on obsolete ground-controlled vectoring for intercepts. Key radar and control centers are static and vulnerable to corridor blasting.

- *Problems in land-based air defense:* Many states must borrow or adapt air defense battle management capabilities from supplier states, and have limited independent capability for systems integration -- particularly at the software level. They lack the mix of heavy surface-to-air missile systems to cover broad areas, or must rely on obsolete systems that can be killed, countered by EW, and/or bypassed. Most Middle Eastern short-range air defense systems do not protect against attacks with stand-off precision weapons or using stealth.

- *Lack of effective survivable long-range strike systems:* Many nations have the capability to launch long-range air and missile strikes, but also have severe operational problems. Refueling capabilities do not exist or are in such small numbers as to be highly vulnerable. Long-range targeting and battle damage assessment capabilities are lacking. Training is limited and unrealistic in terms of penetrating effective air defenses. Platforms are export systems without the full range of supplier avionics or missile warheads. Assets are not survivable, or lose much of their effective strike capability once dispersed.

- *Combined (Joint) Operations, Combined Arms, and the Air-Land Battle:* Many states fail to emphasize the key advances in the integration of warfighting capabilities from the last decade. When they do emphasize combined arms and joint operations, they usually leave serious gaps in some aspects of national warfighting capability.

Technological Vulnerabilities of Less Advanced Powers – Part Three

- *Rough/Special terrain warfare:* Although many forces have armed helicopters, large numbers of tracked vehicles, and can create effective rough terrain defenses if given time, they have problems in conducting high tempo operations. Many tend to be road-bound for critical support and combined arms functions, and lack training for long-range, high-intensity engagements in rough terrain. Many are not properly trained to exploit the potential advantages of their own region. They are either garrison forces, or forces that rely on relatively static operations in pre-determined field positions. These problems are often compounded by a lack of combat engineering and barrier crossing equipment.

- *Night and All-Weather Warfare:* Most forces lack adequate equipment for night and poor weather warfare, and particularly for long-range direct and indirect fire engagement, and cohesive, sustainable, large scale maneuver.

- *Armored operations:* Most countries have sharply different levels of armored warfare proficiency within their armored and mechanized forces. Few units have advanced training and simulation facilities. Most land forces have interoperability and standardization problems within their force structure -- particularly in the case of other armored fighting vehicles where they often deploy a very wide range of types. Many are very tank heavy, without the mix of other capabilities necessary to deploy infantry, supporting artillery, and anti-tank capabilities at the same speed and maneuver proficiency as tank units. Most forces have poor training in conducting rapid, large-scale armored and combined operations at night and in poor weather. Effective battle management declines sharply at the force-wide level -- as distinguished from the major combat unit level -- and sometimes even in coordinating brigade or division-sized operations.

- *Artillery operations:* Many states have large numbers of artillery weapons, but serious problems in training and tactics. They lack long-range targeting capability and the ability to rapidly shift and effectively allocate fire. Many rely on towed weapons with limited mobility, or lack off-road support vehicles. Combined arms capabilities are limited. Many units are only effective in using mass fire against enemies that maneuver more slowly than they do.

- *Combat training:* Training generally has serious problems and gaps, which vary by country. Units or force elements differ sharply in training quality. Training problems are complicated by conversion and expansion, conscript turnover, and a lack of advanced technical support for realistic armored, artillery, air-to-air, surface-to-air, and offensive air training. Mass sometimes compensates, but major weaknesses remain.

- *Inability to use weapons of mass destruction effectively:* Any state can use weapons of mass destruction to threaten or intimidate another, or to attack population centers and fixed area targets. At the same time, this is not the same as having an effective capability and doctrine to obtain maximum use of such weapons, or to manage attacks in ways that result in effective tactical outcomes and conflict termination. Many states are acquiring long-range missiles and weapons of mass destruction with very limited exercise and test and evaluation capabilities. This does not deny them the ability to target large populated areas, economic centers, and

fixed military targets, potentially inflicting massive damage. At the same time, it does present problems in more sophisticated military operations. Many will have to improvise deployments, doctrine, and war fighting capabilities. In many cases, weaknesses and vulnerabilities will persist and they will only be able to exploit a limited amount of the potential lethality of such systems.

Raises Critical New Issues for Arms Control

- **How do you measure and take account of asymmetries in capabilities and force quality?**

- **What new measures of strength and effectiveness should be used.**

- **How large is the area that must be secured and controlled.**

- **How do you measure quality.**

  - **Limited values of games and scoring methods.**

  - **Scenario and area specific impacts.**

- **Technology is only part of the story:**

  - **Readiness and systems integration are critical.**

  - **System of systems versus glitter factor.**

- **Software upgrades?**

Simplicity and Focus on Conflict Prevention May Be the Answer

- **Freeze status quo**

- **Accept reasonable degree of non-parity.**

- **Too complex to control; allow to compete.**

- **Focus on limiting the worst case, worst capability.**

- **Transparency/Confidence Building Measures.**

- **Exercise notification and inspection.**

- **Agreed surveillance/inspection.**

- **Commercial, shared, arms control satellites.**

- **Transparency and warning of all Acquisitions, order of battle changes.**

- **Monitoring of electronic order of battle.**

- **Localized deterrence. Extended deterrence?**

- **Supplier transparency and controls.**

- **External inspection and verification**

CFE Treaty: Conventional Force Reductions in Europe

- **Signed Before Break-up of FSU and Warsaw Pact**
  - **Involved mass asymmetric reductions. Creating effective parity**
  - **Key constraints were actively forces, total inventory, and zones.**
  - **Controlled combat aircraft and highly visible land weapons.**
  - **Rejected combat unit and manpower approaches.**
  - **Like SALT and INF, relied largely on national intelligence means.**
  - **Backed by wide range of confidence building measures under CSCE.**
- **The Technology**
  - **Largely ignored technology and quality**
  - **Freedom to upgrade and down-size selectively.**
  - **Did not anticipate the "revolution in military affairs."**
  - **Largely moot:**
    - **West and East Europe down-size faster than treaty limits.**
    - **Russia resource limited.**
    - **Odd cases like Balkans and Near Abroad create new forms of conflict.**

CFE Treaty Limits

The CFE Treaty sets equal ceilings from the Atlantic to the Urals on key armaments essential for conducting surprise attack and initiating large-scale offensive operations. Collectively, the treaty participants have agreed that neither group of states in Europe may have more than:

- **20,000 tanks**
- **20,000 artillery pieces**
- **30,000 armored combat vehicles (ACVs)**
- **6,800 combat aircraft**
- **2,000 attack helicopters**

To further limit the surprise attack potential of armed forces, the treaty sets equal ceilings on equipment that may be held in active units. Other ground equipment must be in designated permanent storage sites. The limits for equipment each group may have in active units are:

- **16,500 tanks**
- **17,000 artillery pieces**
- **27,300 armored combat vehicles (ACVs)**

The treaty limits the proportion of armaments that can be held by any one country in Europe to about one third of the total for all countries in Europe—the "sufficiency" rule. These limits are:

- **13,300 tanks**
- **13,700 artillery pieces**
- **20,000 armored combat vehicles (ACVs)**
- **5,150 combat aircraft**
- **1,500 attack helicopters**

CFE Regional Arrangements

- **The Treaty divides the ATTU (with the cumulative group totals) into four nested zones with group limits on TLE in each zone, beginning with the Central European states; separate sublimits for equipment are assigned in the outer northern and southern zone known as the "flanks".**

- **Limits are imposed concentrically to avoid concentration of armed forces. This configuration has the effect of permitting free movement of forces centrifugally from, but not centripetally toward, Central Europe, thus inhibiting a surprise attack in this critical region.**

- **Following the disintegration of the USSR in 1991, its eight successor states signed the "Tashkent Agreement" in 1992, in which they divided the equipment entitlements of the USSR among themselves, thus permitting implementation of the Treaty.**

CFE Destruction/Reduction

- **Equipment reduced to meet the ceilings was destroyed, or, in a limited number of cases, converted to non-military purposes. The difference between a State Party's entitlement in a given equipment category and the higher of its holding at Treaty signature and entry into force (EIF) nominally constituted its reduction liability.**

- **The prescribed reduction process followed a graduated schedule, requiring 25 percent completion by November 1993, 60 percent by November 1994, and 100 percent by November 1995, after which the CFE limits are fully in force.**

- **During the reduction period, well over 48,000 pieces of equipment have been destroyed, including tanks, armored combat vehicles, artillery, combat aircraft, and attack helicopters. More than 2,500 on-site inspections have been undertaken, including inspections of declared sites, specified sites, and reduction sites.**

- **Specifically, at the end of the reduction period, the parties to the Treaty have destroyed more than:**

- **18,000 battle tanks**

- **8,900 artillery**

- **17,500 armored combat vehicles**

- **280 combat aircraft**

- **2,100 attack helicopters**

CFE Verification

- **The treaty includes provisions for detailed information exchanges, on-site inspections, challenge inspections, and on-site monitoring of destruction. NATO has established a system to cooperate in monitoring the treaty. Parties have rights to monitor the process of destruction without quota limits.**

- **A Protocol on Notification and Exchange of Information stipulates an annual exchange of mandated data that helps ensure verification of compliance with the Treaty.**

- **A Protocol on Inspection details procedures for verification. Inspections are conducted routinely during the (indefinite) duration of the Treaty; they focus on "objects of verification" (e.g., military organizations), and are conducted at "declared sites" (e.g., military facilities). These OOVs and sites are listed in each information exchange.**

- **The CFE Treaty enjoined States Parties to seek additional measures to limit conventional military manpower within the ATTU. Consequently, the Parties signed a political agreement in July 1992 -- The Concluding Act of the Negotiation on Personnel Strength of Conventional Armed Forces in Europe outlined below.**

CFE-1A

- **Article XVIII of the CFE Treaty called for follow-up negotiations with the objective of concluding agreement on additional measures to strengthen security and stability in Europe, including limitations on military manpower. These negotiations, known as the CFE-1A talks, involved the same participants and used the same mandate as the negotiations on the CFE Treaty. They were concluded on July 6, 1992. CFE-1A was implemented beginning July 17, 1992.**

- **CFE-1A constitutes a political commitment by its signatories to limit (and, where applicable, reduce) the personnel strength of their conventional armed forces. In contrast to the CFE Treaty, CFE-1A is not a legally binding agreement, and thus not subject to ratification by parliaments.**

- **The heart of the CFE-1A agreement is a "ceiling" on the military personnel of each participating state within the CFE Treaty's area of application. Each participating state determined its own ceiling, taking into consideration its national defense plans and security interests. These numerical ceilings were not subject to negotiation among the participants, although the levels were open to discussion prior to adoption of the agreement. In general terms, the CFE-1A limitation applies to military personnel based on land in the area of application.**

- **The CFE-1A agreement also provides for a broad, detailed exchange of information on the military manpower of the participating states.**

- **In general, information provided for most categories is broken down to show the strength of individual units at the level of brigade/regiment and higher.**

- **To further enhance security and promote transparency among the participating states, the CFE-1A agreement includes three**

stabilizing measures, requiring notification of significant increases in unit strength, call-up of reserves or resubordination of units.

Continuing CFE Implementation Issues

- **Unfinished equipment reductions by a few parties are prompting consideration of administrative means to continue Treaty reduction procedures and monitoring to conclusion.**

- **Some accounting still remains in order for FSU states' reduction liabilities to reach collectively the obligation formerly attributable to the Soviet Union, a commitment made at the 1992 Oslo Conference implementing their succession.**

- **A legally binding agreement bringing Soviet, and consequently Russian and Ukrainian, naval infantry and coastal defense forces within overall CFE limits requires reductions in those categories that remain to be completed.**

- **A politically binding agreement on destruction of Russian military equipment redeployed east of the Urals still requires considerable reductions there.**

- **The Joint Consultative Group (JCG) is the multilateral forum, located in Vienna, charged with addressing and, where possible, resolving these issues. This group meets on a regular and continuing basis.**

- **In November 1999, 30 nations of OSCE meet in Istanbul and sign agreements further reducing main battle tanks, artillery, and other controlled weapons.**

  - **MBT s down from 39,142 to 31,740.**

  - **The US level of permitted MBTs dropped from 4,006 to 1,812, but the US only had 846 in Europe.**

  - **ACVs down from 59,822 to 56,570.**

  - **Artillery down from 38,286 to 35,312.**

  - **Attack helicopters up by 102 to 3,994.**

  - **Combat aircraft up by 80 to 13,282**

- **Russian levels higher than permitted in Caucasus and Chechnya.**

Part Three

The RMA and Arms Transfers

Is Controlling Arms Transfers A Viable Approach?

- **Are conventional arms really a controllable problem for the 21st Century:**

  - **Armed world fully equipped to launch a war anywhere.**

  - **Massive races in quantity seem to be thing of the past.**

  - **Races in quality present major and possible unsolvable technical problems.**

  - **Regional and national level arms races probably only solvable through conflict resolution.**

  - **Suppliers/UN can sanction real "aggressor" states.**

  - **If can't get reasonable flows, will turn to proliferation.**

  - **Economic dynamics indicate demographics, entitlements, massive state civil projects are the key problems, not cost of arms transfers.**

- **The Technology**

  - **Controlling major weapons platforms has increasingly little value.**

  - **No meaningful distinction between offense and defense – strong offense frees powers to use offensive assets.**

  - **C4I/BM/SR/BDA/AWX/DN involves wide range of commercial and dual use technologies -- key "force multiplier."**

  - **Precision-guided, deep strike, stand-off, and smart area weapons already proliferating -- another key "force multiplier.".**

Arms Transfers and Transfer of Technology

- **Sanctions and Poverty: North Korea, Iran, Iraq, Libya**

- **Decentralized: Rogue sellers and rogue buyers.**

- **End of Cold War sometimes means first line technologies go directly to world market: F-16 Block 60.**

  - **"Dual use" technologies aid in proliferation and the C^4I/BM/SR side of the "RMA."**

- **Patterns in conventional arms sales down:**

  - **World sales drop from $75.9 billion in 1985 to $42.6 billion in 1996, in constant 1996 US dollars.**

  - **Sales to developing world drop from $53.1 billion in 1985 to $23.7 billion in 1996, in constant 1996 US dollars.**

- **May not be a stable:**

  - **Past flows highly cyclical in terms of rises and falls.**

  - **Iran, Iraq, Libya, North Korea, and Syria have all faced critical economic problems and/or sanctions may break out of.**

  - **Russia may rebuild former volume of sales of FSU.**

  - **Proliferation and asymmetric warfare are key alternatives.**

- **Relative free transfer of new weapons for new types of wars and battles: Information warfare.**

Decline in Arms Deliveries to the World

($US1996 Billions)
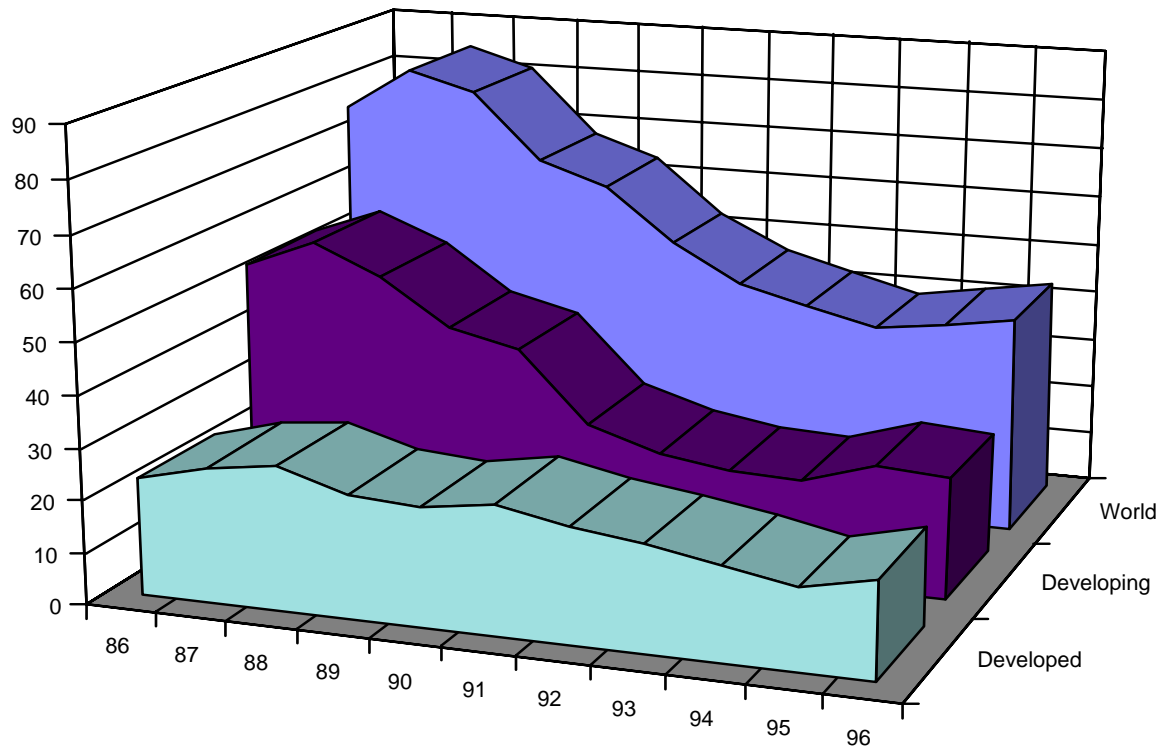
	86	87	88	89	90	91	92	93	94	95	96
☐ Developed	22.7	26.3	27.9	23.9	23.2	25.2	22.5	20.7	18.4	15.9	19
■ Developing	53.1	58.3	52.7	44.1	40.7	27.4	23	21.1	20.3	24.9	23.7
☐ World	75.9	84.4	80.6	67.7	63.4	52.5	45.5	42.1	38.5	40.6	42.6

Adapted by Anthony H. Cordesman from ACDA, World Military Expenditures and Arms Transfers, various editions.

Technology Transfer to MENA is Declining But Is Still An Issue

(In constant $US1996 Billions)
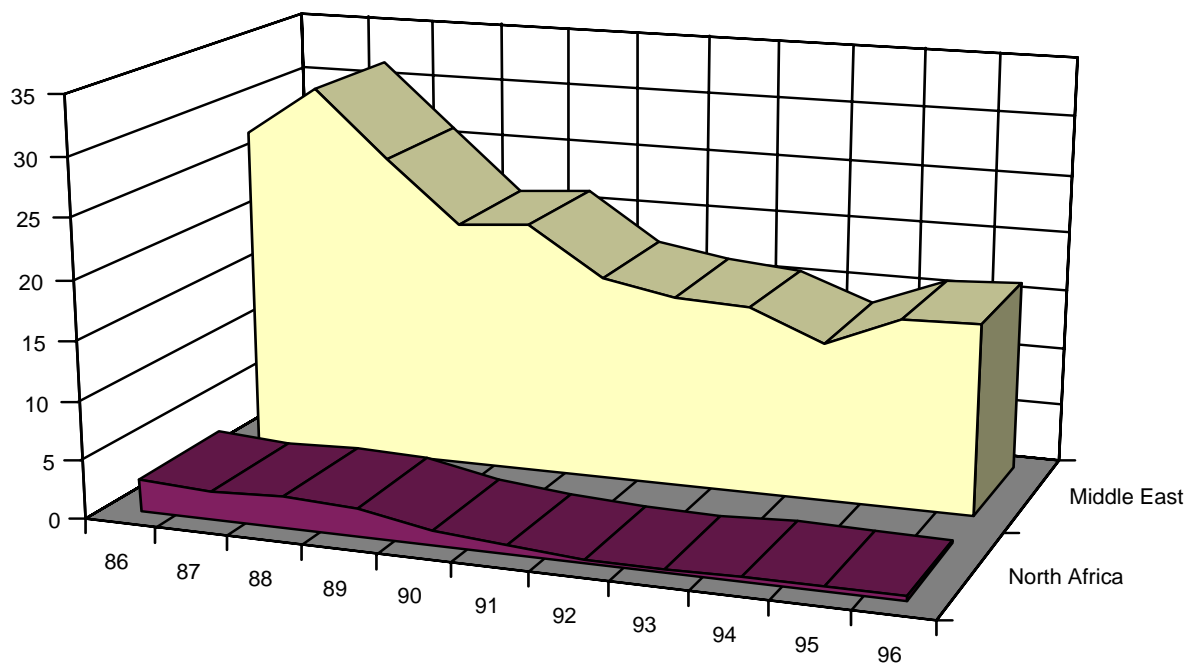
	86	87	88	89	90	91	92	93	94	95	96
■ North Africa	2.7	2.3	2.6	2.3	1.1	0.64	0.23	0.13	0.37	0.35	0.25
□ Middle East	27.4	31.6	26.1	20.8	21.3	17.3	16.2	15.8	13.4	15.9	16.2

Adapted by Anthony H. Cordesman from ACDA, <u>World Military Expenditures and Arms Transfers</u>, various editions.

New Arms Agreements Are Dropping Faster than Deliveries

(Arms Agreements and Deliveries to the Developing World vs. Total Sales to the Middle East: 1987-1997 in $Current Millions)

	Agreements: 87-90	Agreements: 91-94	Agreements: 95-98	.	Deliveries: 87-90	Deliveries: 91-94	Deliveries: 95-98
☐ Developing Nations	158877	83906	64458		-	-	-
☐ Near East	92696	58112	28600		-	-	-
☐ Developing Nations	-	-	-		146659	83573	100600
☐ Near East	-	-	-		78118	47270	38600
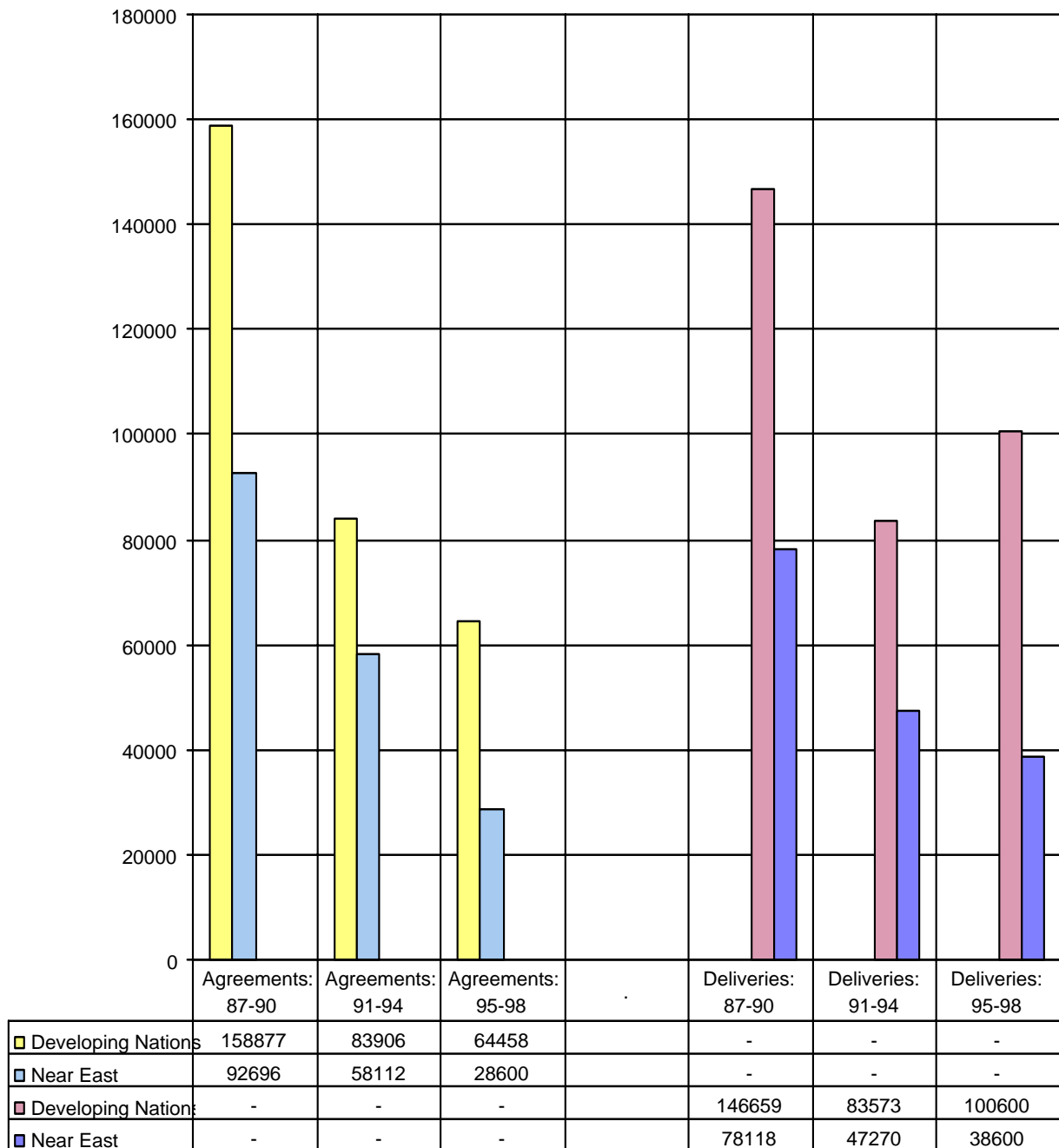
Includes Gulf states, Arab-Israeli states, North Africa, and Yemen
0 = less than $50 million or nil, and all data rounded to the nearest $100 million.

Source: Richard F. Grimmett, <u>Conventional Arms Transfers to the Developing Nations</u>, Congressional Research Service, various editions.

Transfers of New Weapons Are Still Substantial

(Arms Agreements and Deliveries to the Developing World vs. Total Sales to the Middle East: 1987-1997 in $Current Millions)

	Tanks/S Guns	Artillery	APCs and OAFVs	Major Surface Combat	Minor Surface Combat	Guided Missile Boats	Submares	Anti-Ship Missile	Supersonic Combat	Subsonic Combat Aircraft	Other Aircraft	Helicopters	Surface to Air Missile	Surface to Surface
All Others		20			3						10		30	
All Other Euro	200	40	880	2	15				10		60	20		
Major W. Euro	220	10	340	2	14	8		20	30	30	50	10	350	
China		30				8		120	10		10			
Russia	290	30	610				1		10		10	90	140	
US	817	69	2727		13			287	126		2	90	1284	
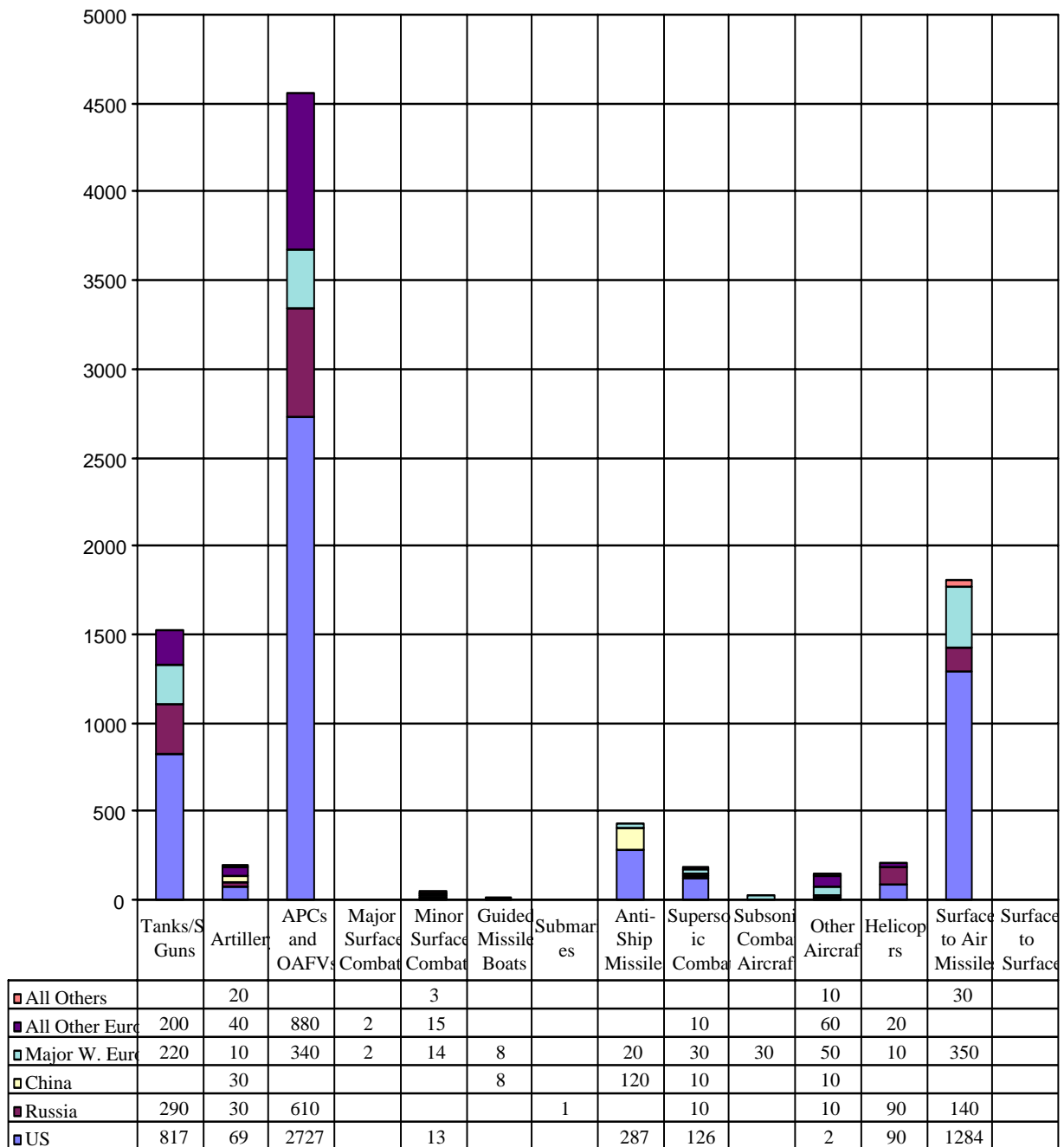
 Includes Gulf states, Arab-Israeli states, North Africa, and Yemen
0 = less than $50 million or nil, and all data rounded to the nearest $100 million.
Source: Richard F. Grimmett, <u>Conventional Arms Transfers to the Developing Nations</u>, Congressional Research Service, various editions.

Limited Value of Controlling Arms Transfers versus Transfer of Technology

- **Proliferation is driven by dual-use exports, black market transfers and violations of agreements.**

- **Many forms of asymmetric warfare are not affected.**

- **Modifying the platform is increasingly as important as obtaining new platforms.**

- **Countries differ sharply in indigenous technology base and production capabilities.**

- **"Dual use" technologies aid in proliferation and the C^{4}I/BM/SR side of the "RMA."**

- **Transfers of "smart" weapons are very difficult to categorize, monitor, and control:**

  - **BVR/Advanced AAMs.**

  - **Smart precision and area munitions.**

  - **Black boxes.**

  - **Sensors and secure communications.**

- **Controlling the easy things can push nations towards proliferation and asymmetric warfare.**

- **Information warfare creates a whole new dimension.**

  - **Commercial satellites and secure communications.**

Part Four

The Counter to the RMA: Asymmetric Warfare

Asymmetric Warfare

- **Ranges from proliferation to use of media.**

- **Globalization is occurring:**

  - **Iraq helps Serbia.**

  - **Iran's focused use of Guards and naval power near Strait of Hormuz.**

  - **New Chinese book on modern methods to defeat Western conventional advantage.**

- **Proliferation most threatening, but includes information warfare, terrorism, human shields, guerrilla warfare, use of media.**

  - **Few rules and little practical experience.**

  - **Can use many types of asymmetric warfare simultaneously.**

- **Iraq and now Serbia show that can continue to fight asymmetric warfare even if formally accept defeat**

Asymmetric Warfare and the Vulnerabilities of Advanced Technology Powers

- *Sudden or surprise attack:* Power projection is dependent on strategic warning, timely decision making, and effective mobilization and redeployment for much of its military effectiveness..

- *Saturation:* There is no precise way to determine the point at which mass, or force quantity, overcomes superior effectiveness, or force quality -- historically, efforts to emphasize mass have been far less successful than military experts predicted at the time. Even the best force, however, reaches the point where it cannot maintain its "edge" in C^4I/battle management, air combat, or maneuver warfare in the face of superior numbers or multiple threats. Further, saturation may produce a sudden catalytic collapse of effectiveness, rather than a gradual degeneration from which the Israeli Defense Force could recover. This affects forward deployment, reliance on mobilization and reliance on defensive land tactics versus preemption and "offensive defense."

- *Taking casualties:* War fighting is not measured simply in terms of whether a given side can win a battle or conflict, but how well it can absorb the damage inflicted upon it. Many powers are highly sensitive to casualties and losses. This sensitivity may limit its operational flexibility in taking risks, and in sustaining some kinds of combat if casualties become serious relative to the apparent value of the immediate objective.

- *Inflicting casualties:* Dependence on world opinion and outside support means some nations increasingly must plan to fight at least low and mid-intensity conflicts in ways that limit enemy casualties and collateral damage to its opponents, and show that Israel is actively attempting to fight a "humanitarian" style of combat.

- *Low-intensity combat:* Low-intensity conflict makes it much harder to cannot most technical advantages in combat -- because low-intensity wars are largely fought against people, not things. Low-intensity wars are also highly political. The battle for public opinion is as much a condition of victory as killing the enemy. The outcome of such a battle will be highly dependent on the specific political conditions under which it is fought, rather than RMA-like capabilities.

- *Hostage taking and terrorism:* Like low-intensity warfare, hostage-taking and terrorism present the problem that advanced technology powers cannot exploit their conventional strengths, and must fight a low-level battle primarily on the basis of infantry combat. HUMINT is more important than conventional military intelligence, and much of the fight against terrorism may take place in urban or heavily populated areas.

- *Urban and Built-Up Area Warfare:* Advanced military powers are still challenged the problem of urban warfare. They did not perform particularly well in urban warfare. Most western forces are not trained or equipped to deal with sustained urban warfare in populated areas during regional combat -- particularly when the fighting may affect large civilian populations on friendly soil.

- *Extended conflict and occupation warfare:* Not all wars can be quickly terminated, and many forms of warfare -- particularly those involving peace-keeping and peace- enforcement -- require prolonged military occupations.

- *Weapons of mass destruction:* The threat or actual use of such weapons can compensate for conventional weakness in some cases and deter military action in others.

Counterterrorism and Counterextremism; Limits on Asymmetric Warfare, May Have to Be New Focus of Arms Control

- **Include counterterrorism cooperation in arms control agreements.**
- **Limit ability to maintain and deploy forces for asymmetric warfare.**
- **Prohibit relevant deployments and exercises.**
- **External monitoring and intelligence aid.**
- **Transparency in special forces and intelligence work.**
- **Limits on training and arming of external groups.**
- **Exercise notification and inspection.**
- **Agreed surveillance/inspection.**
- **Commercial, shared, arms control satellites.**
- **Monitoring of electronic order of battle.**
- **Localized deterrence. Extended deterrence?**
- **Supplier transparency and controls.**
- **External inspection and verification**

Part Five

Proliferation and Asymmetric Warfare

Proliferation

- **A wide range of options:**
  - **Chemical weapons**
  - **Biological weapons**
  - **Nuclear weapons**
  - **Ballistic and cruise missiles**
  - **Superterrorism and covert warfare.**
- **Missile defense: A useful option, but**
  - **Selling what we don't have at a price we do not know with unestablished effectiveness and no clear timelines to resolve uncertainties.**
  - **Many alternative delivery methods.**
- **The race in biotechnology is globalizing capability and presents key uncertainties:**
  - **Advanced research and genetic engineering to microbreweries and dry storable food powders.**
  - **Offense now leading defense, but outcome hard to determine.**
  - **Full spectrum of warfighting capabilities from local incidents to city-busting.**

Who Has Weapons of Mass Destruction?

Country	Type of Weapon of Mass Destruction		
	Chemical	**Biological**	**Nuclear**
East-West			
Britain	**Breakout**	**Breakout**	**Deployed**
France	**Breakout**	**Breakout**	**Deployed**
Germany	**Breakout**	**Breakout**	**Technology**
Sweden	**-**	**-**	**Technology**
Russia	**Residual**	**Residual**	**Deployed**
US	**Residual**	**Breakout**	**Deployed**
Middle East			
Egypt	**Residual**	**Breakout**	**-**
Israel	**Breakout**	**Breakout**	**Deployed**
Iran	**Deployed?**	**Breakout**	**Technology**
Iraq	**Deployed**	**Deployed**	**Technology**
Libya	**Deployed**	**Research**	**-**
Syria	**Deployed**	**Technology?**	**-**
Yemen	**Residual**	**-**	**-**
Asia and South Asia			
China	**Deployed?**	**Breakout?**	**Deployed**
India	**Breakout?**	**Breakout?**	**Deployed**
Japan	**Breakout**	**Breakout**	**Technology**
Pakistan	**Breakout?**	**Breakout?**	**Deployed**
North Korea	**Deployed**	**Deployed**	**Technology**
South Korea	**Breakout?**	**Breakout**	**Technology**
Taiwan	**Breakout?**	**Breakout**	**Technology**
Thailand	**Residual**	**-**	**-**
Vietnam	**Residual**	**-**	**-**
Other			
Argentina	**-**	**-**	**Technology**
Brazil	**-**	**-**	**Technology**
South Africa	**-**	**-**	**Technology**

Weapons of Mass Destruction: What Are We Really Talking About?

- Differ radically in inherent lethality.

- Chemical weapons have marginal real-world status as weapon of mass destruction.

- Lethality models are terrible, both in terms of prompt and long-term effects.

- The actual process of weaponization is critical in determining effectiveness.

- Missiles are only one of many delivery systems and often not the best one.

The Comparative Effects of Biological, Chemical, and Nuclear Weapons Against a Typical Urban Target in the Middle East

<u>Using missile warheads</u>: Assumes one Scud sized warhead with a maximum payload of 1,000 kilograms. The study assumes that the biological agent would not make maximum use of this payload capability because this is inefficient. It is unclear this is realistic.

	Area Covered in Square Kilometers	Deaths Assuming 3,000-10,000 people
<u>Per Square Kilometer</u>		
<u>Chemical:</u> 300 kilograms of Sarin nerve gas with a density of 70 milligrams per cubic meter	0.22	60-200
<u>Biological</u> 30 kilograms of Anthrax spores with a density of 0.1 milligram per cubic meter	10	30,000-100,000
<u>Nuclear</u>:		
One 12.5 kiloton nuclear device achieving 5 pounds per cubic inch of over-pressure	7.8	23,000-80,000
One 1 megaton hydrogen bomb	190	570,000-1,900,000

<u>Using one aircraft delivering 1,000 kilograms of Sarin nerve gas or 100 kilograms of anthrax spores</u>: Assumes the aircraft flies in a straight line over the target at optimal altitude and dispensing the agent as an aerosol. The study assumes that the biological agent would not make maximum use of this payload capability because this is inefficient. It is unclear this is realistic.

	Area Covered in Square Kilometers	Deaths Assuming 3,000-10,000 people Per Square Kilometer
<u>Clear sunny day, light breeze</u>		
Sarin Nerve Gas	0.74	300-700
Anthrax Spores	46	130,000-460,000
<u>Overcast day or night, moderate wind</u>		
Sarin Nerve Gas	0.8	400-800
Anthrax Spores	140	420,000-1,400,000
<u>Clear calm night</u>		
Sarin Nerve Gas	7.8	3,000-8,000
Anthrax Spores	300	1,000,000-3,000,000

Source: Adapted by the Anthony H. Cordesman from Office of Technology Assessment, <u>Proliferation of Weapons of Mass Destruction: Assessing the Risks</u>, US Congress OTA-ISC-559, Washington, August, 1993, pp. 53-54.

The Relative Killing Effect of Chemical vs. Biological Weapons of Mass Destruction for a 1,000 Kilogram Bomb or Warhead

	Low	High
Sarin	60	200
Anthrax	30000	100000
12.5 KT	23000	80000
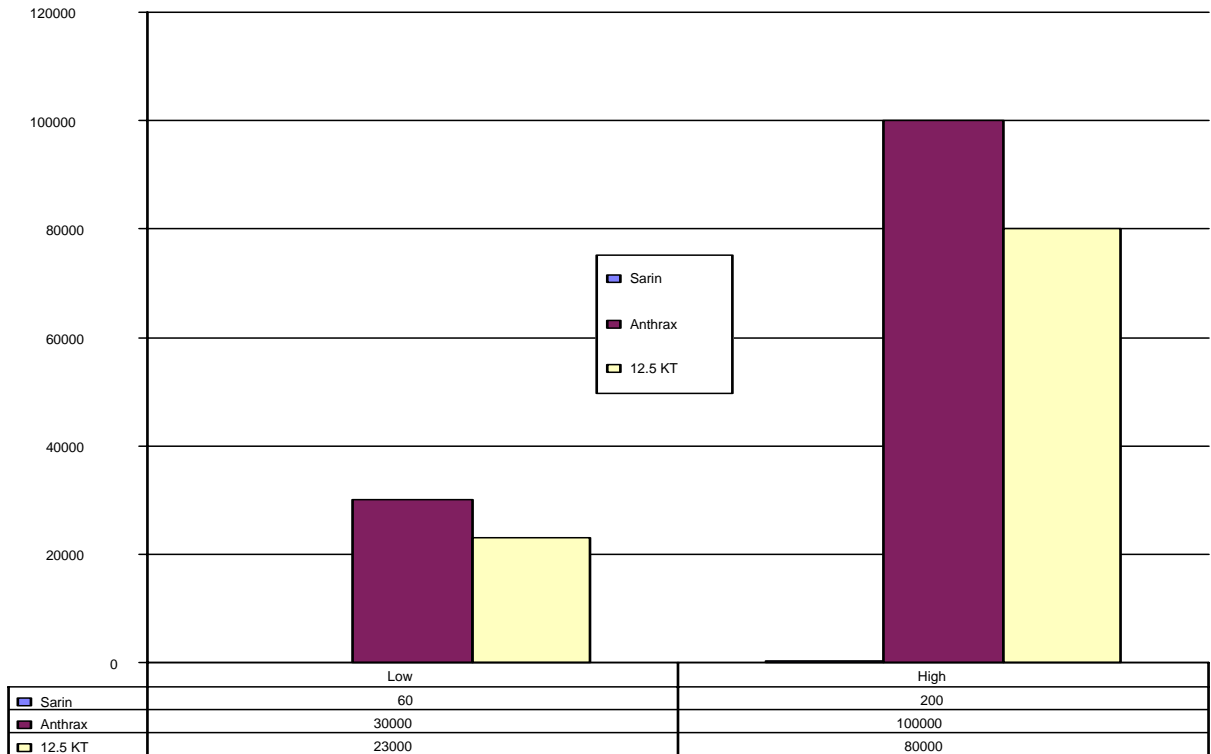
The Thermal and Blast Effects of Nuclear Weapons Radius of Effect in Kilometers

Yield in Kilotons	Metals Vaporize	Metals Melt	Wood Burns	3rd Degree Burns	5 psi/ 160 mph Winds	3 psi 116 mph Winds
100.	337	0.675	1.3	1.9	1.3	1.6
20	0.477	0.954	1.9	2.7	2.0	2.5
50	0.754	1.6	3.0	4.3	2.7	3.3
100	1.0	2.0	4.3	5.7	3.5	4.3
200	1.5	2.8	5.7	8.0	4.5	5.4

Source: Adapted by Anthony H. Cordesman from the Royal United Services Institute, Nuclear Attack: Civil Defense, London, RUSI/Brassey's, 1982, pp. 30-36.

Super-Terrorism

- **Covert warfare, proxy warfare, independent non-state actors.**

- **Strength of West/US creates a growing incentive for covert/indirect attack.**

- **Can use a variety of new methods of attack:**

  - **Access to weapons of mass destruction:**

    - **Chemical and biological weapons major issue.**

    - **Cell phones, GPS, weather models.**

  - **Information warfare attacks on critical systems.**

  - **Manportable and light precision weapons attacks on critical facilities like power plants, water/desalination plants/grids., high rise closed buildings and mall complexes.**

- **New issues for technology transfer.**

- **Body count may be secondary issue: Terror, intimidation, paralysis of state, limits to alliances.**

- **What form of arms control is relevant?**

  - **How can a regime be established to monitor covert/proxy/independent terrorist act?**

  - **What level of control on technology transfer is possible and relevant?**

The Problem of Terrorism, Proxy, and Unconventional Warfare: The Gulf as a Test Case

- A radiological powder is introduced into the air conditioning systems of Saudi high-rise buildings or tourist hotels. Symptoms are only detected over days or weeks and public warning is given several weeks later. The authorities detect the presence of such a power, but cannot estimate its long-term lethality and have no precedents for decontamination. Tourism collapses, and the hotels eventually have to be torn down and rebuilt.

- An Country X-backed terrorist group smuggles parts for a crude gun-type nuclear device into Israel or bought in the market place. The device is built in a medium sized commercial truck. A physics student reading the US Department of Defense weapons effects manual maps Tel Aviv to maximize fall out effects in an area filled with buildings with heavy metals and waits for a wind maximizing the fall out impact. The bomb explodes with a yield of only 8 kilotons, but with an extremely high level of radiation. Immediate casualties are limited but the long-term death rate mounts steadily with time. Peace becomes impossible and security measures become Draconian. Immigration halts and emigration reaches crisis proportions. Israel as such ceases to exist.

- Several workers move drums labeled as cleaning agents into a large shopping mall, large public facility, subway, train station, or airport. They dress as cleaners and are wearing what appear to be commercial dust filters or have taken the antidote for the agent they will use. They mix the feedstocks for a persistent chemical agent at the site during a peak traffic period. Large scale casualties result, and Draconian security measures become necessary on a national level. A series of small attacks using similar "binary" agents virtually paralyze the economy, and detection is impossible except to identify all canisters of liquid.

- Immunized terrorists visit a US carrier or major Marine assault ship during the first hours of visitor's day during a port call in the Middle East. They are carrying Anthrax powder in bags designed to make them appear slightly overweight. They slowly scatter the powder as they walk through the ship visit. The immediate result is 50% casualties among the ship's crew, its Marine complement, and the visitors that follow. The US finds it has no experience with decontaminating a large ship where Anthrax has entered the air system and is scattered throughout closed areas. After long debates over methods and safety levels, the ship is abandoned.

- An Country X-backed terrorist group seeking to "cleanse" a nation of its secular regime and corruption introduces a modified type culture of Ebola or a similar virus into an urban area. It scatters infectious cultures in urban areas for which there is no effective treatment. By the time the attack is detected, it has reached epidemic proportions. Medical authorities rush into the infected area without proper protection, causing the collapse of medical facilities and emergency response capabilities. Other nations and regions have no alternative other than to isolate the nation or center under attack, letting the disease take its course.

- An Country X-backed terrorist group modifies the valves on a Japanese remote-controlled crop spraying helicopter which has been imported legally for agricultural purposes. It uses this system at night or near dawn to spray a chemical or biological agent at altitudes below radar coverage in a line-source configuration. Alternatively, it uses a large home-built RPV with simple GPS guidance. The device eventually crashes undetected into the sea or in the desert. Delivery of a chemical agent achieves far higher casualties than any conventional military warhead. A biological agent is equally effective and the first symptoms appear days after the actual attack -- by which time treatment is difficult or impossible.

- A truck filled with what appears to be light gravel is driven through the streets of Riyadh, Kuwait City, Tehran, or Tel Aviv during rush hour or another maximum traffic period. A visible powder does come out through the tarpaulin covering the truck, but the spread of the power is so light that no attention is paid to it. The driver and his assistant are immunized against the modified form of Anthrax carried in the truck which is being released from behind the gravel or sand in the truck. The truck slowly

quarters key areas of the city. Unsuspected passersby and commuters not only are infected, but carry dry spores home and into other areas. By the time the first major symptoms of the attack occur some 3-5 days later, Anthrax pneumonia is epidemic and some septicemic Anthrax has appeared. Some 40-65% of the exposed population dies and medical facilities collapse causing serious, lingering secondary effects.

- An Country X-backed terrorist group scatters high concentrations of a radiological, chemical, or biological agent in various areas in a city, and trace elements into the processing intakes to the local water supply. When the symptoms appear, the terrorist group makes its attack known, but claims that it has contaminated the local water supply. The authorities are forced to confirm that water is contaminated and mass panic ensues.

- Immunized terrorists carry small amounts of Anthrax or a similar biological agent onto a passenger aircraft like a B-747, quietly scatter the powder, and deplane at the regular scheduled stop. No airport detection system or search detects the agent. Some 70-80% of those on the aircraft die as a result of symptoms that only appear days later.

- Several identical nuclear devices are smuggled out of the FSU through Afghanistan or Central Asia. They do not pass directly through governments. One of the devices is disassembled to determine the precise technology and coding system used in the weapon's PAL. This allows users to activate the remaining weapons. The weapon is then disassembled to minimize detection with the fissile core shipped covered in lead. The weapon is successfully smuggled into the periphery of an urban area outside any formal security perimeter. A 100 kiloton ground burst destroys a critical area and blankets the region in fall out.

- The same device is shipped to Israel or a Gulf area in a modified standard shipping container equipped with detection and triggering devices that set it off as a result of local security checks or with a GPS system that sets it off automatically when it reaches the proper coordinates in the port of destination. The direct explosive effect is significant, but "rain out" contaminates a massive local area.

- Country X equips a freighter or dhow to spread Anthrax along a coastal area in the Gulf. It uses a proxy terrorist group, and launches an attack on Kuwait City and Saudi oil facilities and ports. It is several days before the attack is detected, and the attacking group is never fully identified. The form of Anthrax involved is dry and time encapsulated to lead to both massive prompt casualties and force time consuming decontamination. Country X not only is revenged, but benefits from the resulting massive surge in oil prices.

- An Country X-backed terrorist group scatters small amounts of a biological or radiological agent in a Jewish area during critical stages of the final settlement talks. Near panic ensures, and a massive anti-Palestinian reaction follows. Israeli security then learns that the terrorist group has scattered small amounts of the same agent in cells in every sensitive Palestinian town and area, and the terrorist group announces that it has also stored some in politically sensitive mosques and shrines. Israeli security is forced to shut down all Palestinian movement and carry out intrusive searches in every politically sensitive area. Palestinian riots and exchanges of gun fire follow. The peace talks break down permanently.

- Country X equips dhows to spread Anthrax. The dhows enter the ports of Kuwait as commercial vessels -- possibly with local or other Southern Gulf registrations and flags. It is several days before the attack is detected, and the resulting casualties include much of the population of Abu Dhabi and government of the UAE. The UAE breaks up as a result, no effective retaliation is possible, and Iran achieves near hegemony over Gulf oil policy.

- An Country X-backed terrorist group attempting to drive Western influence out of Saudi Arabia smuggles a large nuclear device into Al Hufuf on the edge of the Ghawar oil field. It develops a crude fall out model using local weather data which it confirms by sending out scouts with cellular phones. It waits for the ideal wind, detonates the devices, shuts down the world's largest exporting oil field, and causes the near collapse of Saudi Arabia.

- Alternatively, the same group takes advantage of the security measures the US has adopted in Saudi Arabia, and the comparative isolation of US military personnel. It waits for the proper wind pattern and allows the wind to carry a biological agent over a Saudi airfield with a large US presence from an area outside the security perimeter. The US takes massive casualties and has no ability to predict the next attack. It largely withdraws from Saudi Arabia.

- A freighter carrying fertilizer enters a Middle Eastern port and docks. In fact, the freighter has mixed the fertilizer with a catalyst to create a massive explosion and also carries a large amount of a chemical, radiological, and/or biological agent. The resulting explosion destroys both the immediate target area and scatters the chemical or biological weapon over the area.

- A large terrorist device goes off in a populated, critical economic, or military assembly area -- scattering mustard or nerve gas. Emergency teams rush in to deal with the chemical threat and the residents are evacuated. Only later does it become clear that the device also included a biological agent and that the response to this "cocktail" killed most emergency response personnel and the evacuation rushed the biological agent to a much wider area.

The Changing Technology of Concealment

- **Counter-Satellite: Covered buildings, monitor overhead coverage, deception (including media/commercial satellites), conversion of existing facilities, dual use facilities..**

- **Counter EW/ELINT/ESSM: Secure encryption, line of sight, pulse code modulation.**

- **Breakout versus openly deploy or stockpile.**

- **Cell-like structures.**

- **Parallel programs.**

- **Computer simulation backed by limited tests.**

- **C4I/BM/sensor advances, rather than hardware..**

The Changing Technology of Detection

- **Near advanced satellite imaging.**

- **Use of UAVs. Micro UAVs.**

- **New unattended sensors: soil and water.**

- **Non-encryption agreements.**

- **Challenge inspection.**

- **Sensors that can see through shelters, inspect underground facilities.**

Global Challenges: Arms Control

- **Arms control remains an extension of diplomacy and war by other means.**

- **A wide range of global agreements both support and bind national interests and create a form of "globalization" focused on weapons of mass destruction**

  - **Start I, II, and III**

  - **NNPT**

  - **CTBT**

  - **BWC**

  - **CWC**

- **Agreements affecting conventional arms have been discussed, but have shown little practice; controls on conventional technologies are uncertain.**

- **Regional agreements present added complications.**

- **The CNN Factor, the Geneva convention, and impact of international law:**

- **Bind the good guys; leave the bad guys free?**

NNPT: Nuclear Proliferation

- **<u>NNPT Regime:</u>**

  - **Most effective regime because requires massive production assets or transfer of fissile material.**

  - **Inspection regime can work if ruthlessly enforced.**

  - **IAEA did not enforce in Iran or Iraq.**

  - **Many nations are not members.**

- **<u>The Technology</u>**

  - **No major breakthroughs in enrichment: Cascade, centrifuge, or LIS.**

  - **FSU loose nuclear material is a risk: Estimate 30,000 weapons and 70,000 weapons equivalents in HEU and Plutonium.**

  - **Technology for fission weapons now well known. Major problem is to reduce size and boost yield.**

  - **Improved accuracy reducing need for thermonuclear and/or boosted weapons.**

  - **Critical uncertainties in terms of "point one safety," PAL systems, Fusing and height of burst, employment doctrine.**

Other Agreements Impacting on Nuclear Proliferation

- **Statute of the International Atomic Energy Agency (IAEA): July 29, 1957.**

- **Zanger Committee (Nuclear Exporters Committee): Nuclear suppliers committee dating back to 1970s.**

- **Nuclear Suppliers Group (NSG or London Group): Formed in 1975.**

- **Convention on Protection of Nuclear Material): February 8, 1987.**

- **Treaty for the Prohibition of Nuclear Weapons in Latin America (Tlatelolco): April 22, 1968, Argentina, Brazil, and Chile join in 1994, Cuba in 1995.**

- **South Pacific Nuclear Weapons Free Zone (Rarotonga): December 11, 1986. Does not prohibit nuclear transit. US, France, and Britain sign in 1996.**

- **African Nuclear Weapons Free Zone (Pelindaba): April, 1996.**

- **Southeast Asia Nuclear Weapons Free Zone (Bangkok): December 1995. (US says inconsistent with the law of the sea.**

- **US-North Korean Agreed Framework, October, 1994.**

Test Ban Treaties

- ## 1963 - Limited Test Ban Treaty:
  - ### Bans air, space, and underwater tests. *

- ## 1974 – Threshold Test Ban Treaty:
  - ### Bans any weapons tests of more than 150 kilotons. *

- ## 1976 – Peaceful Nuclear Explosion Treaty:
  - ### Extends 150 kiloton limit to peaceful explosions. *

- ## September 1996 – Comprehensive Test Ban Treaty:
  - ### Bans all nuclear tests in perpetuity.

* Ratified by the US.

BWC: Biological Weapons Convention

- **Concluded in 1972, US ratified in 1975.**

- **Bans development, production, and stockpiling of biological agents and toxins in types and quantities that have no justification for peaceful purposes.**

- **US unilaterally declared an end to its biological weapons program in 1968.**

- **US Biological Terrorism Act on 1989 (PL 101-298) adds criminal penalties to enforce the BWC.**

- **1996 BWC Review Conference acknowledges difficulty of developing verification protocol. Left to group of experts to study. Deferred action to 2001.**

  - **UK strongly argues for control regime..**

  - **Iran and many developing nations call for the removal of Australia Group controls and increased biotechnical cooperation in return for enhancement of BWC.**

  - **US argues for transparency of research.**

Biological Weapons: Known Development of Agents by the Major Powers Before the BWC

Agent	Canada	France	Germany	Japan	UK	USA	Russia	
Bacteria								
Anthrax	+	+	+	+	+	+	+	
Brucella		+				+	+	
Chlamydia psittaci					+			
Dysenteria		+			+	+	+	
Gas gangrene		+			+			
Leperosy					+		+	
Tuberculosis							+	
Pseudomonas mallei		+	+		+	+	+	
Pseudomonas Pseudomallei		+			+	+		
Tetanus		+			+	+	+	
Typhoid		+			+	+	+	
Typhus		+			+	+		
Vibro Cholera				+	+	+	+	
Yersinia Pestis				+	+	+	+	
Viruses								
Eboloa		+				+	+	
Encephalitis		+				+	+	
FMD				+			+	
Fowl plague		+				+		
Influenza		+			+	+	+	
Newcastle disease								
Rinderpest	+	+	+			+		
Korean haemorrhagic Fever					+			
Toxins								
Botulin	+	+			+	+	+	+
Ricin		+			+	+	+	
Saxitoxin						+	+	
Staphylococcus						+	+	
Enterotoxin B						+		
Snake Toxins				+				
Tetrodotoxin (fish poison)				+				
Arthropods								
Potato beatles		+	+					
Fungi								
Coccidioides immitis						+		
Other								
Malaria				+				
Weeds			+					
Phytopathogens						+	+	
Fish pathogens							+	

Source: SIPRI and IDA

CWC: Chemical Weapons Convention

- **Opened for signature on January 1993, after 25 years of negotiation. Entered into force on April 29, 1997.**

- **Prohibits development, production, stockpiling, transfer, and use of chemical weapons.**

  - **Restricts sale and transfer of precursors, and lists them for control by OPCW.**

  - **Destruction of arsenals within 10 years.**

  - **Signatories must declare all facilities and stockpiles of weapons.**

  - **Scheduled chemicals are categorized as I, II, and III:**

    - **Schedule I exported only to CWC signatories.**

    - **Schedule II controlled as of 2000.**

    - **Schedule III: Controls to be considered as of 2002.**

- **Organization for the Prohibition of Chemical Weapons (OPCW) headquartered in the Hague**

  - **Conference of States Parties includes all signatories and meets annually**

  - **Executive Council includes 41 parties on two-year rotation.**

  - **Technical Secretariat.**

  - **Scientific Control Board.**

Chemical Weapons

- **<u>Chemical Weapons Convention: Preventing the Wrong war?</u>**

  - **Inspection regime adequate -- if aggressively enforced -- to prevent large scale stockpiling for WW I or Iran-Iraq War-like ground war.**

  - **Cannot prevent development of breakout capability.**

  - **Cannot reliably detect stockpile of several hundred weapons needed for strategic-countervalue threat purposes.**

- **<u>The Technology</u>**

  - **Real world lethality so far roughly equal to artillery at best – no chemical weapons use has yet equaled artillery casualties at the Somme in WW I.**

  - **Should not focus on killing, however, Mustard and persistent nerve gas have major impact in inhibiting many types of combat operations/terror effect.**

  - **No superweapons in spite of rumors.**

  - **Weaponization, targeting, and weather models critical.**

  - **CWC may accelerate "liar's contest. Can only get technology if deny development.**

Australia Group: Biological and Chemical Weapons

- **Meets since June 1985.**

- **Set up in reaction to use of chemical weapons in Iran-Iraq War.**

- **Informal supplier control groups with 30 members.**

- **Has developed list of chemical and equipment needing control.**

- **Expanded list to include biological weapons supplies in 1990.**

- **Does not prohibit sale of listed items, only establishes monitoring and licensing arrangements.**

- **Export denial only if reason to suspect use for chemical or biological weapons program.**

INF Treaty: Intermediate Range Nuclear Forces Treaty

- **Signed in 1987.**

- **Affects all land-based ballistic missiles and cruise missiles with ranges of 300-3,400 miles.**

- **Exempts UK and France.**

- **Exempts land and sea-based aircraft and sea-based missiles.**

- **Physical destruction of missiles with joint teams. No physical destruction of warheads.**

- **START III calls for first serious effort to reexamine theater nuclear forces since signing of INF Treaty and end of Cold War.**

Missile Technology Control Regime (MTCR)

- **US, Canada, France, FRG, Italy, Japan, and UK sign in April 1987.**

- **Now 25 countries have signed.**

- **China, Israel, Romania, and Ukraine have agreed to observe guidelines.**

- **Restraint on all sales of Category I equipment includes complete rocket, missile, and UAV systems capable of delivering 500 kilograms (1,100 pounds) payloads for 300 kilometers (186 miles) or more.**

- **Controls on components, equipment, material and technologies useful for missiles and UAVs, plus rocket systems and UAVs with shorter ranges and smaller payloads.**

- **Supported by wide range of US sanctions.**

- **Proposals for buyer's regimes – Zero Ballistic Missile (ZBM) treaties.**

- **Questions on what is a conventional arm: E.g. US ATACMS has a range of 250 kilometers. Russia has similar systems.**

- **Growing range of dual-use parts; problems with new suppliers, questions about relation to civilian space-launch vehicles.**

Part Six

Can Mixing Arms Control and Counterproliferation and Power Projection Limit The Most Dangerous Forms of Asymmetric Warfare?

Unpleasant Truths: Remembering The "Iron Laws" Limiting Arms Control

- **The world is already heavily armed and high technology weapons are not necessary for mass killing.**

- **Nations that want to go to war will always be able to do so.**

- **Squeezing the balloon: Any effective set of limitations drives nations to develop war fighting systems in those areas exempt from control and to exploit gray areas.**

- **Technology is not static: Technology will always evolve in ways that forces the constant revision of any agreement or which creates alternative approaches to competition or warfare.**

- **Verification and inspection: No matter how intrusive, no agreement is ever reliable or perfect.**

- **Some of the bloodiest forms of violence have never been covered by arms control: E.g. state violence against its own citizenry.**

- **Jurassic Park: Over-complex systems always fail, and the cost of failure is proportionate to the risk inherent in what is being controlled.**

- **Ignorance: There are many things we simply do not know enough to accomplish: E.g. START I, peace-making and nation-building, BWC?**

- **The "Good Guys" Paradox: Agreements are most binding on the least threatening states.**

Unpleasant Truths: Remembering the Unholy Partnership between Arms Control, On-going Competition and Warfighting

- **Arms control works best when it creates a stable balance of warfighting capability that minimizes the incentive to initiate and/or escalate a conflict.**

- **The threat of extended deterrence and punitive action is often necessary to support enforcement.**

- **Hostile and intrusive intelligence action is usually necessary to support agreed enforcement.**

- **Coalitions involved in enforcement will rarely be fully agreed, composed of equals, and easily accommodated in a large international forum where a veto can block effective action.**

What Is the Future of Arms Control?

- **The idea that global agreements can bring stability or end future conflict is an illusion: "The Jurassic Park Syndrome."**

- **Arms control agreements can, however, help improve global stability as part of a broad regime of security arrangements.**

  - **Global agreements must accept their real-world limitations and be seen as constantly evolving efforts.**

  - **New thinking is needed about regional agreements that focusing on conflict prevention and limitation structured around key risks of war, not illusory regional security arrangements.**

  - **More focus is needed on national and local agreements tailored to limit the risk of local conflicts.**

- **In most cases, arms control will only be successful in reinforcing successful mutual deterrence. Arms control and war fighting capability are natural partners, not enemies.**

- **Proliferation creates the need to rethink both arms control and deterrence. To define "counterproliferation" in a broader sense.**

- **Peace-making and peace-keeping must be seen as forms of arms control tailored to limit or prevent state killing.**

- **Confidence building measures remain as important a tool as efforts to constrain, limit, or prevent arms.**

Beyond Arms Control?

- **There are several approaches to reducing conflict which may or may not be called arms control:**

- **Peace-making and peace-keeping: E.g. Kosovo, Bosnia, Somalia, etc.**

- **Conflict prevention or limitation: E.g. Liberia, Congo.**

- **Supplier regimes: E.g. MTCR, export controls.**

- **Sanctions: E.g. UN sanctions on arms exports to Libya and Iraq.**

Counterproliferation/Extended Deterrence
Possible Regional Counterproliferation Policy

- **Dissuasion to convince non-weapons of mass destruction states that their security interests are best served through not acquiring weapons of mass destruction.**

- **Denial to curtail access to technology and materials for weapons of mass destruction through export controls and other tools,**

- **Arms control efforts to reinforce the Nuclear Non-Proliferation Treaty, Biological and Chemical Weapons Conventions, nuclear free zones, conventional arms treaties that stabilize arms races, confidence and security building measures, and Anti-Ballistic Missile Treaty clarification efforts to allow US deployment of advanced theater ballistic missile defenses.**

- **Region-wide arms control agreements backed by intelligence sharing and ruthless, intrusive challenge inspection without regard for the niceties of sovereignty.**

- **International pressure to punish violators with trade sanctions to publicize and expose companies and countries that assist proliferators, and to share intelligence to heighten awareness of the proliferation problem.**

- **Defusing potentially dangerous situations by undertaking actions to reduce the threat from weapons of mass destruction already in the hands of selected countries -- such as agreements to destroy, inspect, convert, monitor, or even reverse their capabilities.**

- **Military capabilities to be prepared to seize, disable, or destroy weapons of mass destruction in time of conflict.**

- **Improve tracking and detection of sales, technology transfer, research efforts, extremist groups.**

- **Defensive capabilities, both active (theater missile defenses) and passive (protective gear and vaccines) that will mitigate or neutralize the effects of weapons of mass destruction and enable US forces to fight effectively even on a contaminated battlefield.**

- **Declared and convincing counterstrike options ranging from conventional strikes devastating a user nation's economy, political structure and military forces to the use of nuclear weapons against the population centers of user nations and groups.**

Key Technological Improvements Affecting Counterproliferation Policy

- *Detection and characterization of biological and chemical agents.* **This initiative is intended to accelerate the fielding of stand-off and point detection and characterization systems by up to six years. It also addresses the integration of sensors into existing and planned carrier platforms, emphasizing man-portability and compatibility with UAVs.**

- *Detection, characterization, and defeat of hard, underground targets.* **The US is seeking new sensors, enhanced lethality, and penetrating weapons to increase the probability of defeating the target while minimizing the risk of collateral damage.**

- *Detection, localization and neutralization of weapons of mass destruction inside and outside the US.* **The US is seeking to identify and evaluate systems, force structures, and operational plans to protect key military facilities and logistic nodes, and conduct joint exercises to improve the capability to respond to potential biological and chemical threats.**

- *Development and deployment of addition passive defense capabilities for US forces, including development and production of biological agent vaccines.* **This program will develop and field improved protective suits, shelters, filter systems, and equipment two to five years faster than previously planned. It also restores funding to the development of improved decontamination methods.**

- *Support for weapons of mass destruction related armed control measures include strengthening the NNPT, CTB, and BWC.* **They include establishing a COCOM successor regime, and improving controls on exports and technology by strengthening the MTCR, Nuclear Suppliers Group and Australia Group.**

- *Missile defense capabilities, with primary emphasis on theater ballistic missile defenses.* **This activity involves improvements in active and passive defenses, attack operations, and improvements in BM/C4I as well as the deployment of theater missile defenses. The primary focus, however, is on anti-ballistic missile defenses, and in the near term, this involves the development of the Patriot Advanced Capability Level-3 (PAC-3/ERINT), Navy area theater missile defense (Aegis), and theater high altitude area defense (THAAD).**

- *Publicized counterstrike options.* **Options ranging from a convincing declared capability to conduct precision mass air and missile strikes with conventional weapons that can devastate user states to use of nuclear weapons escalating to the destruction of population centers.**

- *New force tailored to dealing with terrorist and unconventional threats.* **New intelligence and tracking systems dedicated to the prevention of mass terrorism, and tailored special**

forces to detect and attack terrorist groups and deal with unconventional uses of weapons of mass destruction.

Technology and Power Projection

- **The US as the World's Only Remaining "Superpower:"**
  - **Technology-based**
  - **Global information and intelligence systems.**
  - **Strategic lift. Force assembly, allocation, supply management.**
  - **Independent sea-based power.**
  - **Expeditionary forces.**
  - **Monopoly on counterproliferation/WMD?**
  - **Stealth.**
  - **Deep strike/Stand-off attack.**
  - **Decisive coalition.**
- **Peer Allies and Challenges:**
  - **UN in peace making/keeping**
  - **Europe in region**
  - **Russia?**
  - **China and/or Japan in Asia?**

Part Seven

"Out of the Box:" New Forms of Warfare

Information Warfare

- **New dimension of warfare only partly understand.**

- **Global threat to global systems, regional threat to any interconnected systems.**

- **Attack military systems, political leadership, and/or economy.**

- **Evolving race between offensive and defensive technology.**

- **Uncertain balance between sophistication, vulnerability, and war-waging capability.**

- **Growth in computing power and interconnectivity both necessary and uncontrollable.**

- **The legal argument: Indiscriminate warfare?**

- **What is arms control?**

  - **New form of Interpol?**

  - **Global monitoring and tracking systems?**

  - **What are national and corporate self-defense requirements?**

Forms of Information Warfare

- **Military Side includes:**
  - **EMP and HERF weapons.**
  - **Electronic warfare.**
  - **C4/BM/SR Entry and deception.**
  - **C4/BM/SR Entry and destruction.**
  - **Telecommunications jamming.**
  - **Intelligence deception and destruction**

- **Civil side includes:**
  - **Air traffic systems.**
  - **Telecommunications .**
  - **Utilities.**
  - **Internet and dedicated nets.**
  - **Hospitals.**
  - **Research base and technology centers.**

The Jargon of Information Warfare

- **ARM: Anti-radiation missiles.**

- **Back Door: Software designed so that it can be covertly entered by the designer.**

- **Chipping: Hidden circuit built into a chip for sabotage, self-location, or hardware back door.**

- **EW: Electronic warfare.**

- **ECM/ECCM: Electronic counter and counter counter measures.**

- **EMP: Electro-magnetic pulse.**

- **ESM: Electronic support measures.**

- **HERF: High energy radio frequency (emitter/radiation)**

- **Jammer: Interferes with signal.**

- **Killer E-Mail: Floods enemy computer system halting outside access., or takes the form of a Trojan Horse communicated via E-Mail.**

- **Logic Bomb: Type of Trojan Horse designed to release a virus or worm, or other attack and built into a larger piece of software.**

- **Nano Machines: Micro robots which destroy electronic hardware.**

- **Trojan Horse: Hides in a program, and functions without the user's knowledge. Often disguised as a security tool.**

- **Virus: Software the spreads through a network or data base, destroying or modifying data and, using up resources, and self-replicates and spreads.**

- **Worm: Spreads through a network, deleting or modifying data, eventually jamming the system.**

Global Economic Interdependence

- *Major new risks of Economic, trade, and information warfare!*

- **Trade is 39% of PPP GNP in high income states, 19% in middle income, and 8% in low income.**

  - **Regional trade blocs show a sharp growth in intraregional exports, relative to global markets. EU exports within bloc rose from $76.5 billion in 1970 to $1,867.8 billion in 1997. NAFTA from $22 billion to $496 billion.**

- **Global capital flows aren't truly global:**

  - **Foreign direct investment in 1997 totaled $10.6 billion in low income countries, $160.6 billion in middle income countries, and $233.9 billion in high income countries.**

  - **Private capital flows in 1997 totaled $17 billion in low income countries, and $268.9 billion in middle income countries.**

- **Technology diffusion is a major challenge:**

  - **Richest 20% controls 74% of all telephone lines, 91% of all Internet users.**

  - **Top 10 telecommunications firms control 86% of the $262 billion global telecommunications market.**

Total Per 1,000 People	Low Income	Middle Income	High Income
Television sets	56	256	647
Telephone mainlines	16	87	506
Mobile phones	1	15	189
Fax machines	0.2	0.9	49.7
Personal computers	2.2	15.8	264.4
Internet hosts (per 10,000)	0.10	3.96	374.89

Technology, Economic Integration, and Information Warfare: Shifts in Maritime Traffic and Power

- **Decline in British, French, and European seapower.**

- **Rising regional powers: Japan, China.**

- **Globalization of:**

  - **Longer-range sensors.**

  - **Strike aircraft.**

  - **Anti-ship missiles, mine warfare (& submarines?)**

- **Steadily growing volumes of trade and economic interdependence.**

  - **US trade volumes steadily up. $822 billion in 1996 versus $352 billion in 1985.**

  - **World increasingly dependent on time-sensitive deliveries, and certain heavy industrial activities.**

  - **All trading partners also need other trading partners.**

- **Massive projected growth in oil flows: 37.1 MMBD in 1995 to 66 MMBD in 2020.**

  - **Flows shift from 60% to West to 60%+ to Asia.**

  - **Western/Asian energy imports include the energy supplied to other states to make imported goods and services.**

- **Sea lanes change radically in traffic density; strike systems extend range and number of choke points.**

- **Water supply systems,**

- **Utility systems.**

Part Eight

What "Arms" Can Now Be Controlled?

Is It Possible to Redefine Arms Control in View of the Technology Shifts?

- **Who gives up what, or limits what, in such an asymmetric environment?**

  - **North-South problem is obvious.**

- **Many critical technologies are already dual use and the value of dual use technology will grow:**

  - **Proliferation.**

  - **Battle management systems.**

- **If controlling force numbers is losing its value, how can force quality be controlled?**

- **Does the emphasis shift to regional and local tailored agreements that allow for regular change and evolution?**

- **What role can supplier regimes play?**

- **How do sanctions regimes change?**

- **What happens to peace making/keeping?**

- **Who, if anyone, is the "policeman"?**

  - **UN?**

  - **Pax Americana?**

  - **Pax Regional? EC? ASEAN?**

- **Biotechnology and Information Warfare are the great technological unknowns.**

Yes, But the Rules Change

- **Must take account of asymmetry and quality.**

- **Technology freezes?**

- **Full disclosure of technology?**

- **Inspection. CBMs, transparency takes on new importance.**

- **Must localize and tailor agreements to specific risks of conflict.**

- **Exercises and simulation critical tools.**

- **Ability to monitor Electronic Order of Battle, agreement not to encrypt is critical.**

- **Localize stable patterns of deterrence: Control risk of warfighting, not arms per se.**

- **May have to reinforce with extended deterrence, international role.**

- **Use commercial or dedicated satellites.**

- **Extend UAV, other new inspection technology.**

The Changing Technology of Detection

- **Near advanced satellite imaging.**

- **Use of UAVs. Micro UAVs.**

- **New unattended sensors: soil and water.**

- **Non-encryption agreements.**

- **Challenge inspection.**

- **Sensors that can see through shelters, inspect underground facilities.**

Potential Value in Transparency and Peacekeeping Forces

- **Global transparency, declarations, confidence building measures can precede freezes, limits, and reductions.**

- **Transparency can be enforced from the outside: UN Registry, IISS-like reporting.**

- **Transparency can go much further than arms numbers:**

  - **Commercial satellites offer global transparency on exercises and movements.**

  - **Possible US/Soviet/Europe intelligence regimes that provide global transparency in detail – data on new tests, missile firings, electronic orders of battle.**

- **Sinai-like mixes of peace keeping and transparency can combine two important tools.**

- **Transparency in power projection?**

Potential Value in CFE Treaty-Like Models

- **Going on with CFE/OSCE has great value for Europe, Russia, and US.**

- **Are key regional areas where similar regimes may eventually be possible after reduction of tensions and with conflict resolution:**

  - **Northeast Asia: PRC, Koreas, Japan, Russia, US deployments**

  - **PRC-Taiwan-US deployments**

  - **Persian/Arab Gulf.**

  - **Arab-Israeli.**

  - **"Mini-Regions like the Balkans and North Africa.**

- **Supplier regimes imply some form of sharing or parity in sales, parity in interests.**

Potential Value in Micro-Agreements as Aid to Conflict Resolution

- **War and crises are rarely truly regional.**

- **Often more important to find mixes of limits, transparency, confidence building and peacemaking to deal with key issues:**

  - **Israel and Syria**

  - **North and South Gulf**

  - **North Africa**

- **Need to avoid over-emphasis on both generic global and regional efforts:**

  - **Globalism and regionalism may end in being feel good efforts that only affect nations not caught up in crises.**