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# **The Military Balance in the Middle East**

## **An Analytic Overview**

**Military Expenditures and Arms Transfers, Major Arms by  
Country and Zone, and Qualitative Trends**

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# **Part One**

## **What Is the Middle East Military Balance?**

## **Defining the Middle East Military Balance**

- **Data summarizing the trends in 23 different countries explain virtually nothing.**
- **There are several key regional sub-balances:**
  - **The individual trends in North Africa, where there is no meaningful balance.**
  - **The trends affecting the Arab-Israeli conflict, dominated by Israel versus Syria.**
  - **The Gulf military balance, now divided into states that view their primary threat as Iran and those who see the threat as Iraq.**
- **Two sub-balances are particularly critical:**
  - **Israel versus Syria**
  - **Kuwait and Saudi Arabia versus Iraq.**
  - **Iran versus Iraq?**
- **Internal civil conflicts increasingly dominate regional tensions:**
  - **Mauritania, Algeria, Libya, Egypt, Sudan, Bahrain, Saudi Arabia, Iraq, Yemen.**
  - **Morocco's war with Polisario?**
- **Low level border conflicts and tensions affect other areas of the military balance:**
  - **Mauritania versus Senegal, Israel versus Hezbollah, Bahrain versus Qatar, Saudi Arabia versus Yemen.**
  - **Every state has some complaint about its neighbor(s): "My neighbor is my enemy."**
- **The "greater Middle East" is more a matter of rhetoric than military reality.**

## The “Perceptual Balance”: Military Demographics of the Greater Middle East

Country	Total Population	Males Reaching Military Age Each Year	Males Between the Ages of			Males Between 15 and 49	
			13 and 17	18 and 22	23 and 32	Total	Medically Fit
Egypt	61,703,000	694,000	3,560,000	3,122,000	4,984,000	17,757,000	11,507,000
Israel	6,007,000	50,700	278,000	269,000	516,000	1,474,000	1,206,000
Jordan	5,020,000	50,000	269,000	2420,000	439,000	1,114,000	793,000
Lebanon	4,277,000	-	210,000	196,000	385,000	926,000	573,000
Palestinian	2,900,000	-	163,000	140,000	233,000	-	-
Syria	16,404,000	189,000	1,007,000	823,000	1,208,000	4,061,000	2,272,000
Iran	72,644,000	767,000	4,438,000	3,694,000	5,582,000	17,203,000	10,217,000
Iraq	23,846,000	260,000	1,457,000	1,237,000	1,828,000	5,460,000	3,058,000
Bahrain	636,000	4,346	32,000	25,000	40,000	221,000	121,000
Kuwait	2,200,000	20,900	117,000	98,000	146,000	718,000	425,000
Oman	2,213,000	-	126,000	101,000	149,000	753,000	420,000
Qatar	681,000	6,125	25,000	20,000	35,000	301,000	158,000
Saudi Arabia	18,000,000	197,000	1,304,000	1,088,000	1,615,000	5,697,000	3,172,000
UAE	2,650,000	19,266	86,000	82,000	142,000	1,072,300	584,000
Algeria	29,600,000	360,000	1,923,000	1,740,000	2,780,000	8,238,000	5,047,000
Libya	6,203,000	62,000	362,000	301,000	458,000	1,327,000	816,000
Morocco	29,829,000	320,000	1,720,000	1,555,000	2,589,000	7,736,000	4,889,000
Tunisia	9,811,000	100,000	519,000	487,000	842,000	2,602,000	1,487,000
Chad	7,712,000	70,464	383,000	316,000	497,000	1,689,000	876,000
Mauritania	2,538,000	-	140,000	117,000	184,000	572,000	278,000
Djibouti	733,000	-	40,000	33,000	53,000	105,000	62,000
Eritrea	3,994,000	-	238,000	199,000	303,000	-	-
Ethiopia	57,000,000	655,000	3,706,000	2,993,000	4,513,000	13,520,000	7,053,000
Somalia	6,300,000	-	587,000	477,000	687,000	1,730,000	963,000
Sudan	32,194,000	379,000	1,888,000	1,596,000	2,399,000	7,942,000	4,890,000
Turkey	65,161,000	659,000	3,267,000	3,257,000	5,953,000	18,169,000	11,024,000
Yemen	18,000,000	212,000	939,000	772,000	1,259,000	3,776,000	2,119,000

Source: Adapted by Anthony H. Cordesman, CIA World Factbook, 1999 and IISS, Military Balance, 1998-1999 and 1999-2000.

## The “Perceptual Balance”: Military Forces of the Greater Middle East

<u>Country</u>	<u>Total Active Manning</u>	<u>Total Active Army Manning</u>	<u>Tanks</u>	<u>OAFVs</u>	<u>Artillery</u>	<u>Combat Aircraft</u>	<u>Armed Helicopters</u>	
Egypt	450,000	320,000	3,855	4,187	1,378	583	129	
Israel	173,500	130,000	3,800	6,300	1,630+	459	133	
Jordan	98,650	90,000	1,204	1,454	521	93	16	
Lebanon	67,900	65,000	304	1,348	174	(3)	0	
Palestinian	(35,000)	(35,000)	-	45	-	-	-	
Syria	316,000	215,000	3,450	4,805	2,410	589	72	
Iran	513,000	450,000	1,440	1,065	2,948	295	100	
Iraq	382,500	350,000	2,900	4,400	1,980	353	120	
Bahrain	10,700	8,500	106	281	58	24	10	
Kuwait	16,600	10,000	220	329	40	76	16	
Oman	43,500	25,000	117(24)	103	109	40	0	
Qatar	11,800	8,500	44	397	44	18	18	
Saudi Arabia	105,500	70,000	1,307	4,285	520	432	12	
UAE	54,500	59,000	232	927	289	99	49	
Algeria	124,000	107,000	890	1,680	727	181	63	
Libya	65,000	35,000	985	2,620	1,870	420	65	
Morocco	196,300	175,000	524	1,344	396	89	24	
Tunisia	35,000	27,000	84	382	117	44	7	
Chad	30,350	25,000	60	63+	5	4	0	
Mauritania	15,650	15,000	35	105	75	7	0	
Djibouti	9,600	8,000	0	31	6	0	0	
Eritrea	182,100	180,000	-	-	-	19	0	
Ethiopia	352,500	350,000	500	200	300	71	24	
Somalia	12,900	12,900	-	-	-	-	-	
Sudan	94,700	90,000	230	608	856	51	9	
Turkey	639,000	525,000	4,205	2,515	4,453	440	0	
Yemen	39,500	37,000	1,125	1,140	727	69	8	

Note: Totals count all equipment, much of which is not operational. They should not be confused with estimates of operational equipment holdings. Light tanks are counted as OAFVs. Artillery counts towed and self-propelled tube weapons and multiple rocket launchers, but not mortars. Only combat aircraft in combat, COIN, or OCU units are counted, not other trainers or aircraft.

Source: Adapted by Anthony H. Cordesman, CIA World Factbook, 1998 and IISS, Military Balance, 1998-1999 and 1999-2000.

## **The “Qualitative Paradigm Shift” in the Middle East Military Balance**

- **No Middle Eastern state is currently spending the resources necessary to full sustain the modernization of its existing force structure.**
- **Numbers still count, but:**
  - **The “revolution in military affairs” often makes quality far more important than quantity.**
  - **Maintenance, manpower quality, and sustainability are often more critical than force size.**
- **The qualitative shifts in equipment exacerbate long-standing manpower quality problems:**
  - **The value of conscripts in operating advanced military equipment is uncertain.**
  - **Joint and combined arms training become far more important.**
  - **Technical cadres, NCOs, “hands on” officers, and leadership also become critical.**
- **Proliferation is changing the balance and the potential nature of war.**
  - **Iran, Iraq, Israel and Syria are major proliferators.**
  - **Algeria, Egypt, and Libya show indications of being proliferators.**
- **Political and internal struggles often present more of an immediate security threat than outside invasion: Algeria, Egypt, Israel, Bahrain, Saudi Arabia, Iraq, etc.**

## **Key Analytic Issues Affecting the Middle East Military Balance**

- **Arms control and the Arab-Israeli peace process are, and will remain, an extension of war by other means.**
- **The differences between North African, Arab-Israeli, and Gulf forces preclude a common approach.**
- **Only the Arab-Israeli balance lends itself to a CFE-like approach, and time-distance problems and qualitative differences may preclude such solutions.**
- **Manpower and equipment numbers are no longer dominant issues, and even equipment quality has secondary importance relative to the creation of balanced, sustainable, well-trained forces with advanced C<sup>4</sup>I/battle management capabilities.**
- **The recapitalization problem does create an incentive for some forms of force reduction, but reductions eliminating older and lower-quality forces will have little impact on warfighting capability.**
- **Recapitalization is also an incentive to proliferate.**
- **At the same time, most countries have historically spent twice their present percentages of GNP on military forces. Middle East states have tremendous “surge” capability to make major, unpredictable new equipment purchases.**
- **Proliferation cannot be seen in terms of one type of weapon -- i.e. nuclear. In fact, the inability to acquire nuclear weapons creates an incentive to acquire biological and chemical weapons.**
- **Delivery systems for proliferation are not ballistic missile driven: They may involve terrorism, unconventional, and proxy systems as well as cruise missiles and aircraft.**

# **Part Two**

## **Assessing the Changing Face of the Middle East Military Balance**

## **Assessing the Middle East Military Balance**

- **The most important questions and the most important answers are scenario and contingency dependent.**
  - **Time, motive, the specific forces engaged, and factors like geography, mobilization and preparation are critical.**
  - **“Intangibles” like training, readiness, and sustainment are critical.**
  - **Efforts to guess at doctrine, war plans, the details of intentions, escalation management, and conflict termination are critical, but guesses are guesses.**
- **Like all regions in the world, the Middle East is being affected by radical changes in warfighting:**
  - **Proliferation.**
  - **Asymmetric warfare.**
  - **Local versions of the revolution in military affairs.**
    - **Joint warfare versus stove piping.**
    - **C4I/BM/ISR**
    - **New cadre human factors capabilities.**
  - **Proxy warfare and no-state actors.**
  - **External and regional coalitions.**
  - **New forms of warfare like information warfare.**
- **There are no reliable methods of analysis:**
  - **Static analysis tends to be order of battle and assumption driven.**
  - **Effectiveness measures cannot handle complex forms of warfare, and are probably inherently wrong.**
  - **Games are bound by the model, assumptions, and the “black box” problem.**
- **Ethnocentrism, bureaucratic compartmentation, and warming over the word processor are “killers”**
- **When in doubt, consult the field and history – lessons studies.**

## 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.
- *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<sup>4</sup>I/BM/T/BDA:* New C<sup>4</sup>I/BM/T/BDA organization, technology, and software systems make it possible to integrate various aspects of command, control, communications, computers, and intelligence (C<sup>4</sup>I); 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<sup>4</sup>I/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<sup>4</sup>I/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<sup>4</sup>I/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<sup>4</sup>I/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 handling 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<sup>4</sup>I/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<sup>4</sup>I/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.

## **Critical Issues for Analysis**

- **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?**

## **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<sup>4</sup>I/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.

## **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?

<u>Country</u>	<u>Type of Weapon of Mass Destruction</u>			
	<u>Chemical</u>	<u>Biological</u>	<u>Nuclear</u>	
			<b>East-West</b>	
Britain		Breakout	Breakout	Deployed
France		Breakout	Breakout	Deployed
Germany		Breakout	Breakout	Technology
Sweden		-	-	Technology
Russia		Residual	Residual	Deployed
US		Residual	Breakout	Deployed
			<b>Middle East</b>	
Egypt		Residual	Breakout	-
Israel		Breakout	Breakout	Deployed
Iran		Deployed?	Breakout	Technology
Iraq		Deployed	Deployed	Technology
Libya		Deployed	Research	-
Syria		Deployed	Technology?	-
Yemen		Residual	-	-
			<b>Asia and South Asia</b>	
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	-	-
			<b>Other</b>	
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 Delivered Against a Typical Urban Target in the Middle East

Using missile warheads: 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.

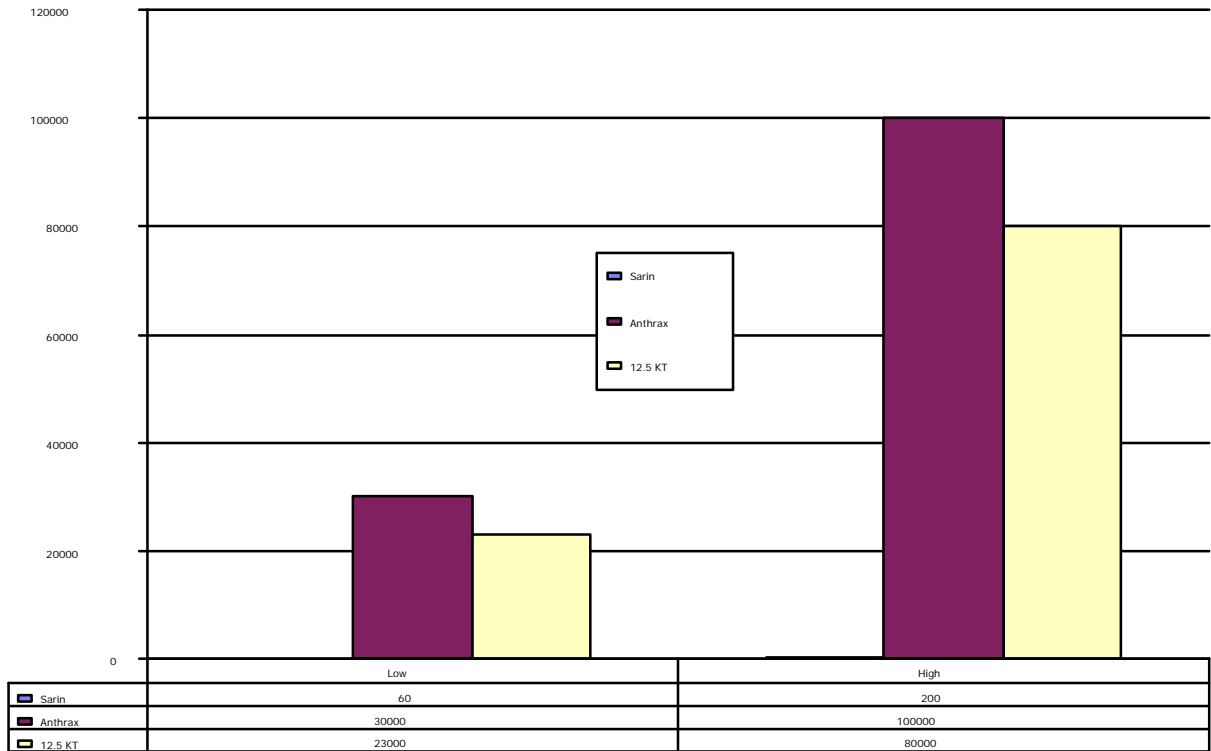
	<u>Area Covered in Square Kilometers</u>	<u>Deaths Assuming 3,000-10,000 people Per Square Kilometer</u>
<u>Chemical:</u> 300 kilograms of Sarin nerve gas with a density of 70 milligrams per cubic meter	0.22	60-200
<u>Biological</u> 30 kilograms of Anthrax spores with a density of 0.1 milligram per cubic 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

Using one aircraft delivering 1,000 kilograms of Sarin nerve gas or 100 kilograms of anthrax spores: 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.

	<u>Area Covered in Square Kilometers</u>	<u>Deaths Assuming 3,000-10,000 people Per Square Kilometer</u>
<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, Proliferation of Weapons of Mass Destruction: Assessing the Risks, 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



### 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 ensues, 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.**

# **Part Three**

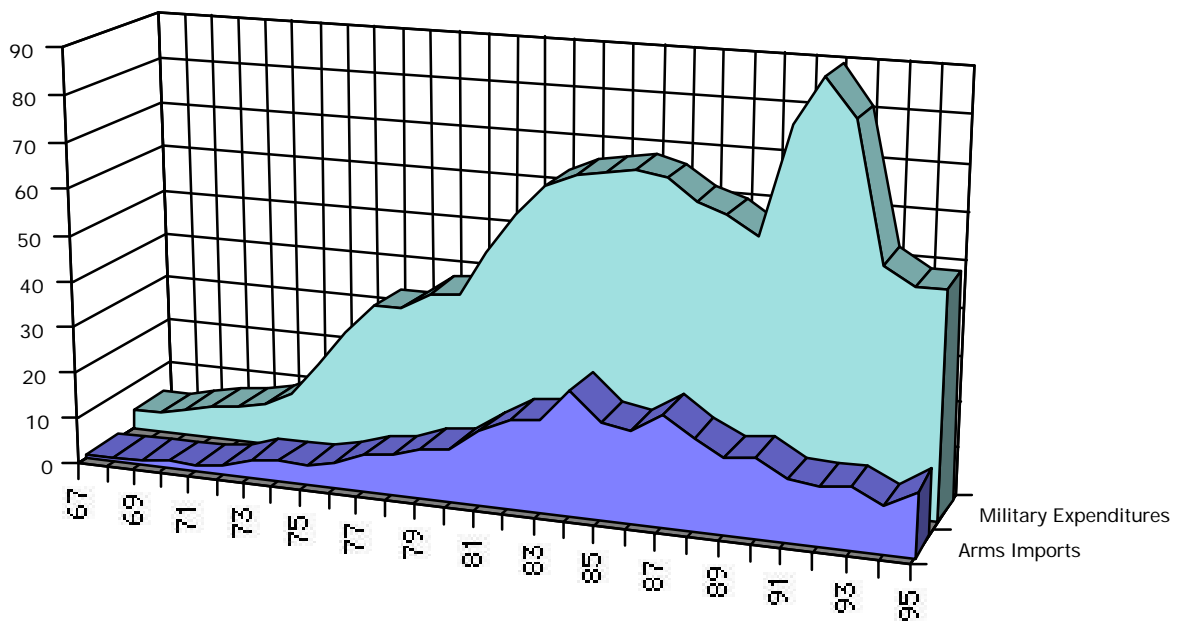
## **“The Most Militarized Area in the World”**

## **The Global Context: Military Efforts “The Most Militarized Region in the World”**

- **The Middle East Remains the Most Militarized Region in the World by Virtually Every Measure of Effort.**
- **This statement, however, disguises important downward trends in regional military spending and the burden of military expenditures and arms efforts.**
- **Military expenditures only place about half the burden on the GNP they did during the Cold War-Gulf War era.**
- **Military expenditures have steadily dropped as a percent of total government expenditures since the Gulf War.**
- **Arms imports are way down as a percent of total imports.**
- **Trends, however, are cyclical. Wars lead to major increases and then decreases. Major acquisitions often lead to short-term increases in arms orders followed by cuts as nations pay for previous orders.**
- **A steady drop has taken place in the percent of the total population under arms.**
- **“Statism”:** Government domination of regional economies and the massive mismanagement of civil spending is the key problem.

## The Trend in Middle Eastern Military Expenditures and Arms Transfers Since the October War

(1967-1995 in \$Current Billions)

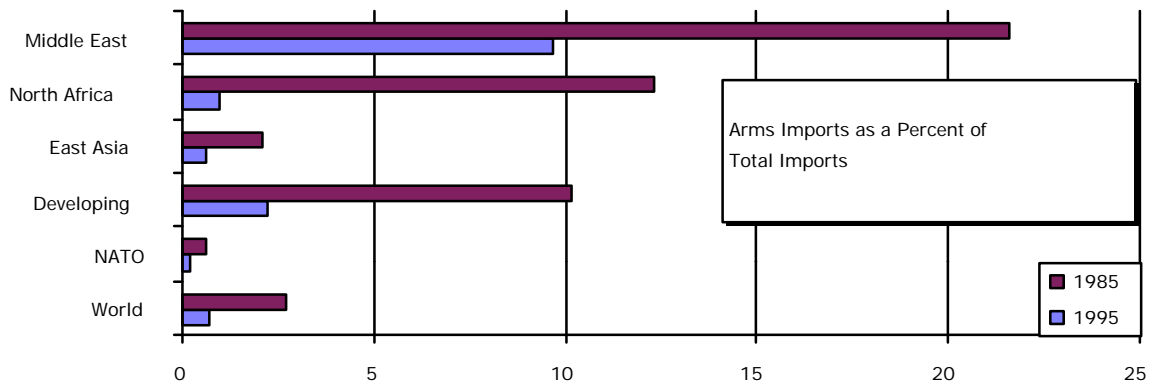
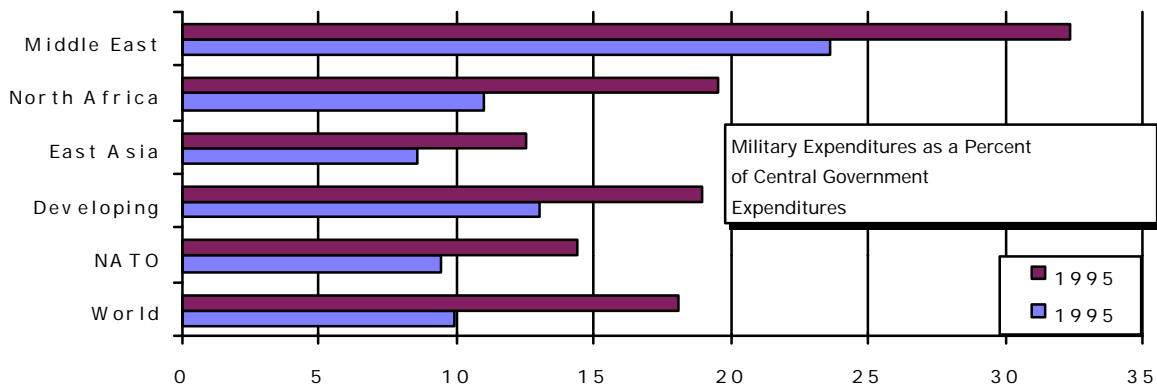
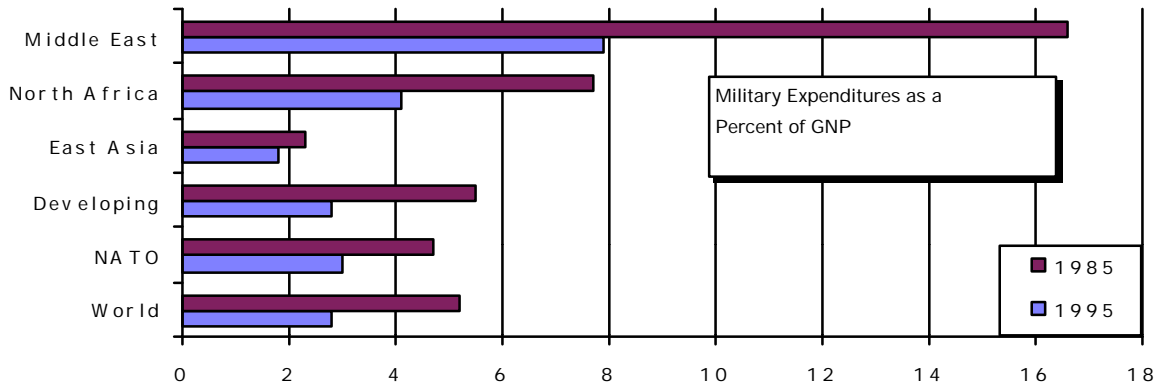


Adapted by Anthony H. Cordesman from ACDA, World Military Expenditures and Arms Transfers, various editions. Middle East does not include North African states other than Egypt.

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## “The Most Militarized Region in the World”

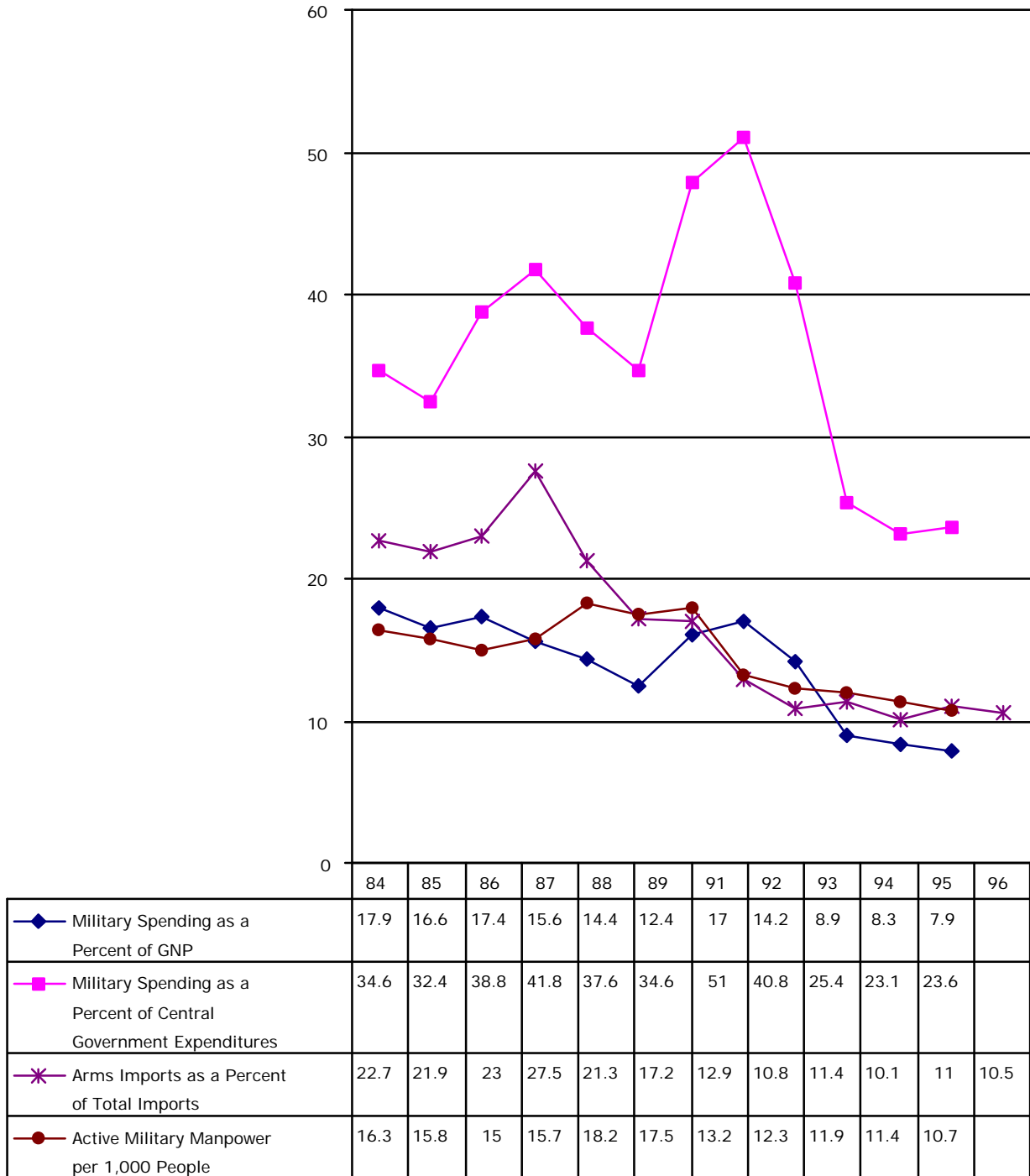
(Military Expenditures and Arms Imports as an Economic Burden in the Middle East Relative to Other Regions)



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

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## Middle Eastern Military Efforts Have Also Dropped Sharply as a Percent of GNP, Government Expenditures, Total Population, and Arms Imports: 1984-1996

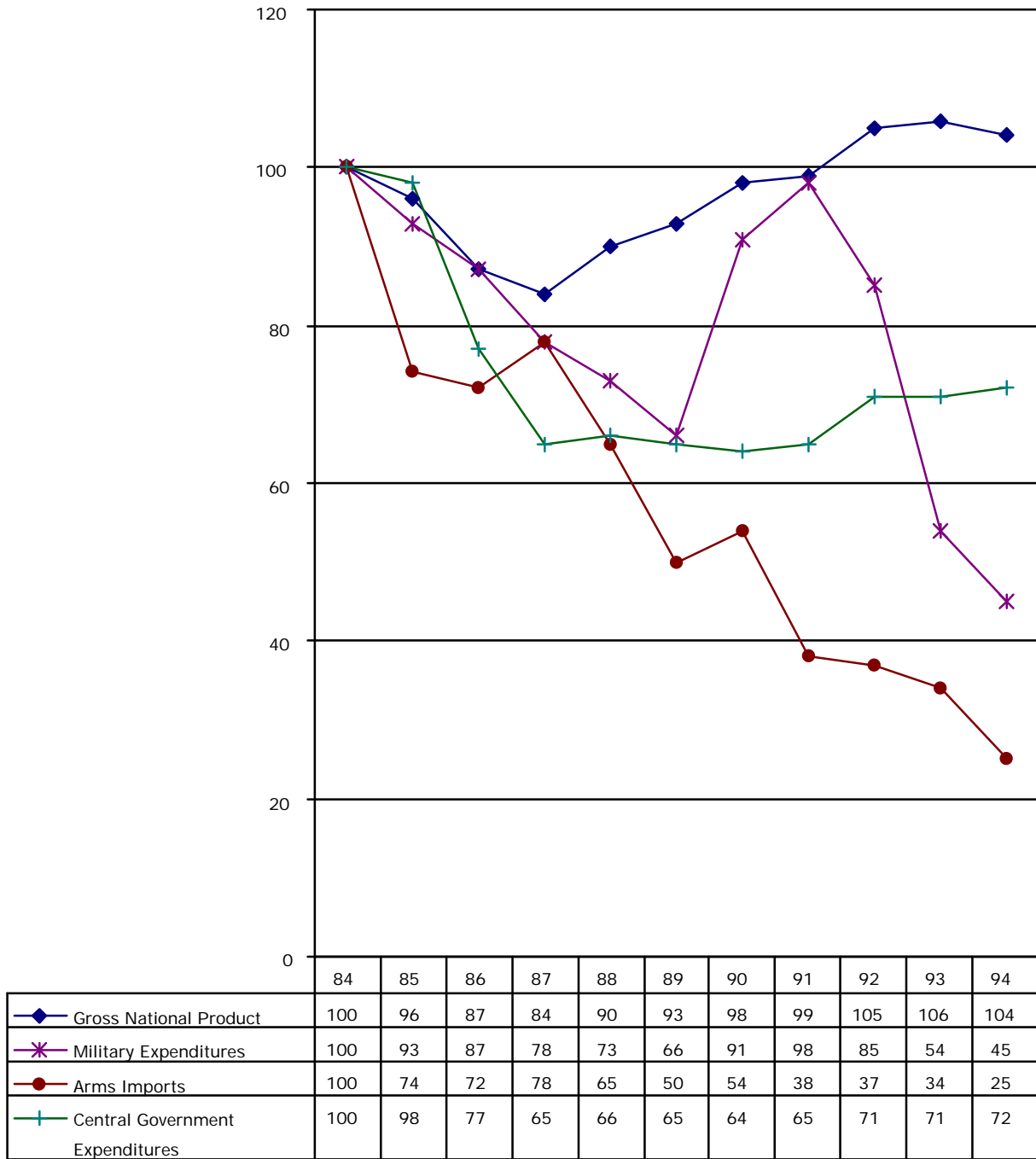


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## Middle Eastern Military Expenditures and Arms Imports Dropped Sharply Relative to Economic Growth and Government Spending During 1984-1994

(1984=100, and all following years are percentages of 1984 as base year. All expenditure totals are measured in constant 1984 US dollars.)

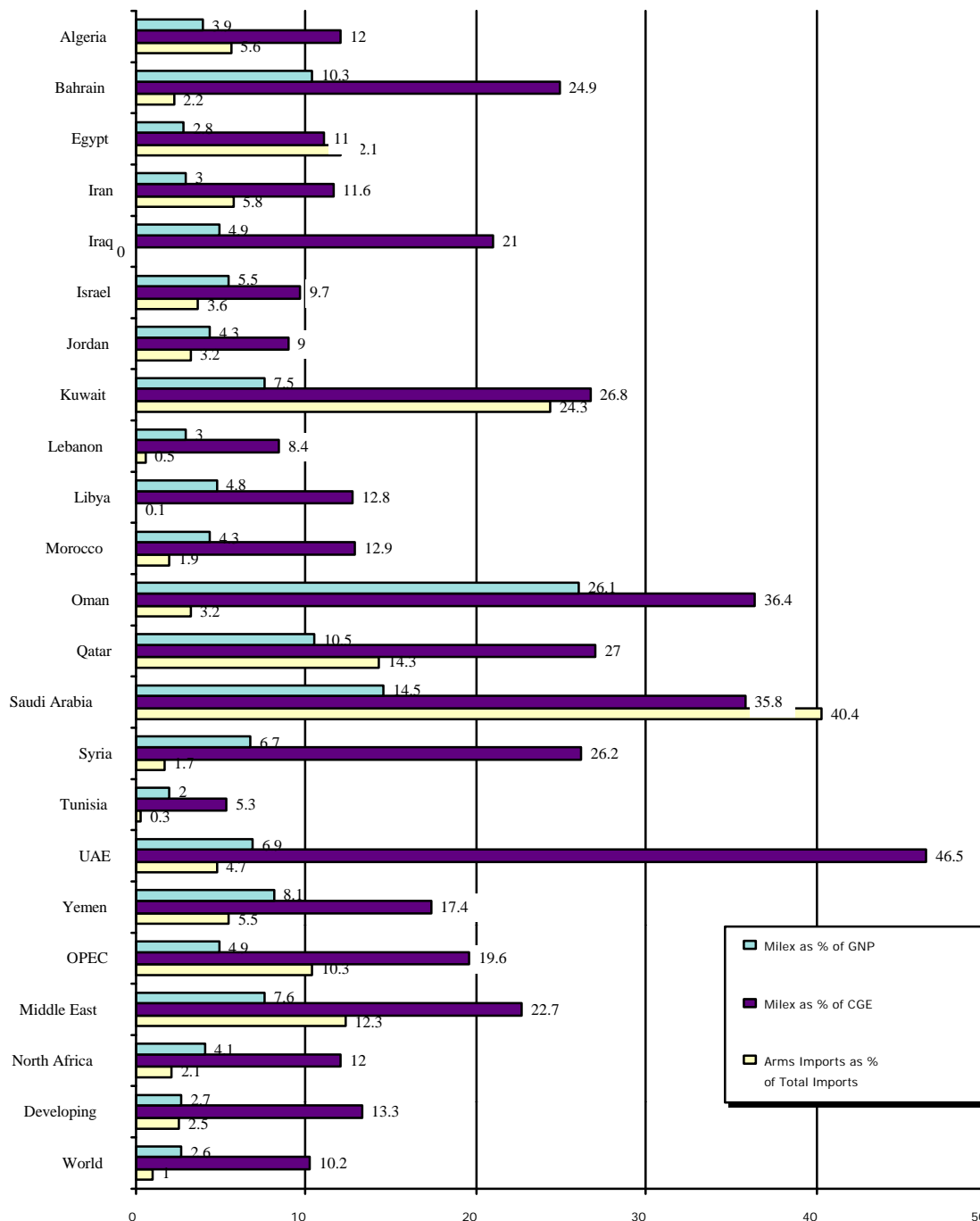


Adapted by Anthony H. Cordesman from ACDA, *World Military Expenditures and Arms Transfers*, various editions. Middle East does not include North African states other than Egypt.

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## Military Expenditures and Arms Transfers as an Aspect of “Statism” in Individual Middle Eastern Countries

(Military spending as a percent of Central Government Expenditures (CGE) and Gross National Product (GNP), and Arms Imports as a Percent of Total)

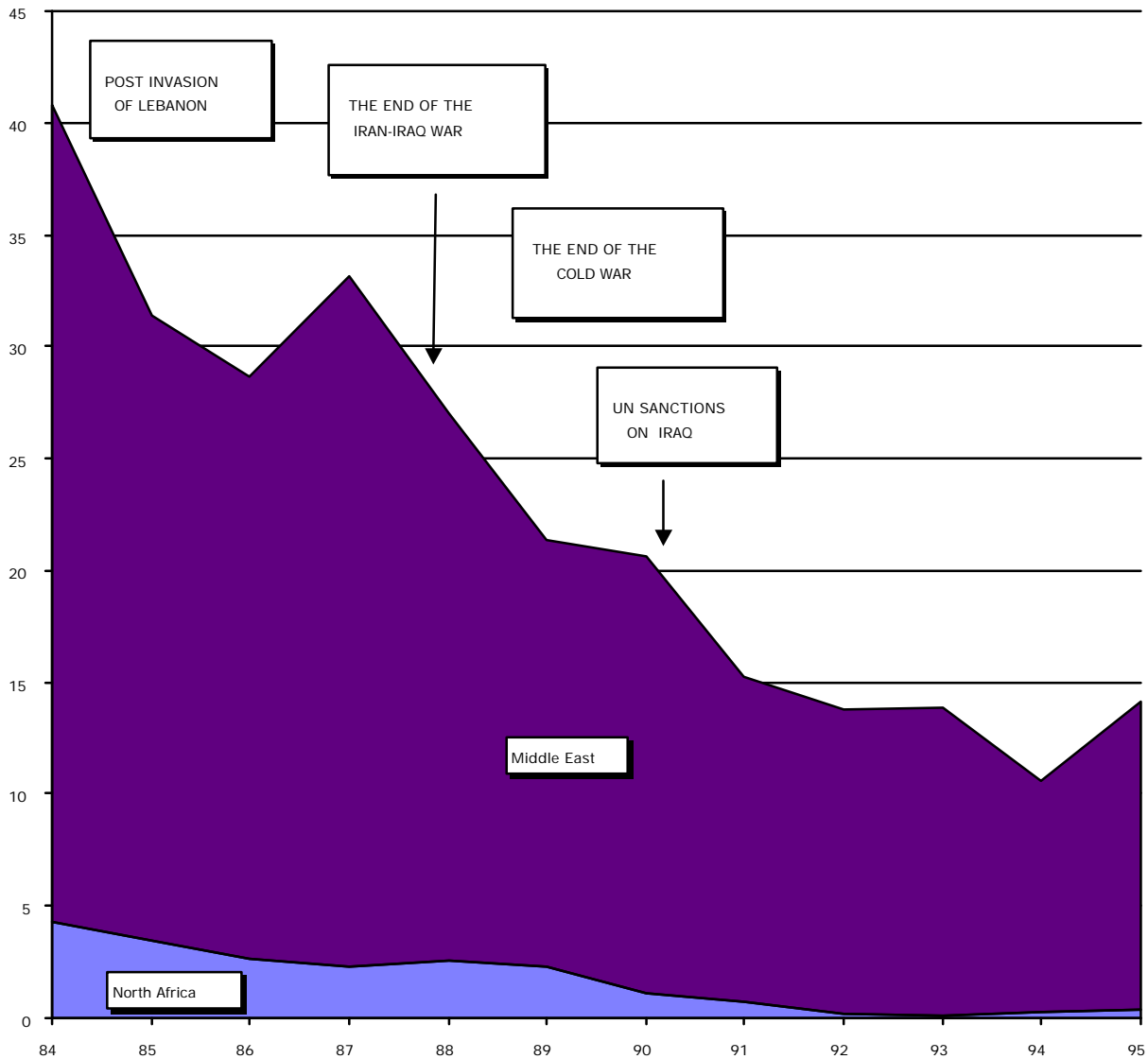


Source: Adapted by Anthony H. Cordesman from US State Department, World Military Expenditures and Arms Transfers, 1998, Bureau of Arms Control, Washington, 1999.

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## The Cumulative Impact of the Arab-Israeli Peace Accords, Sanctioning of Libya, End of the Iran-Iraq War, End of the Cold War, Gulf War, and Economic Recession

(Arms Deliveries in Constant \$95 Billions)



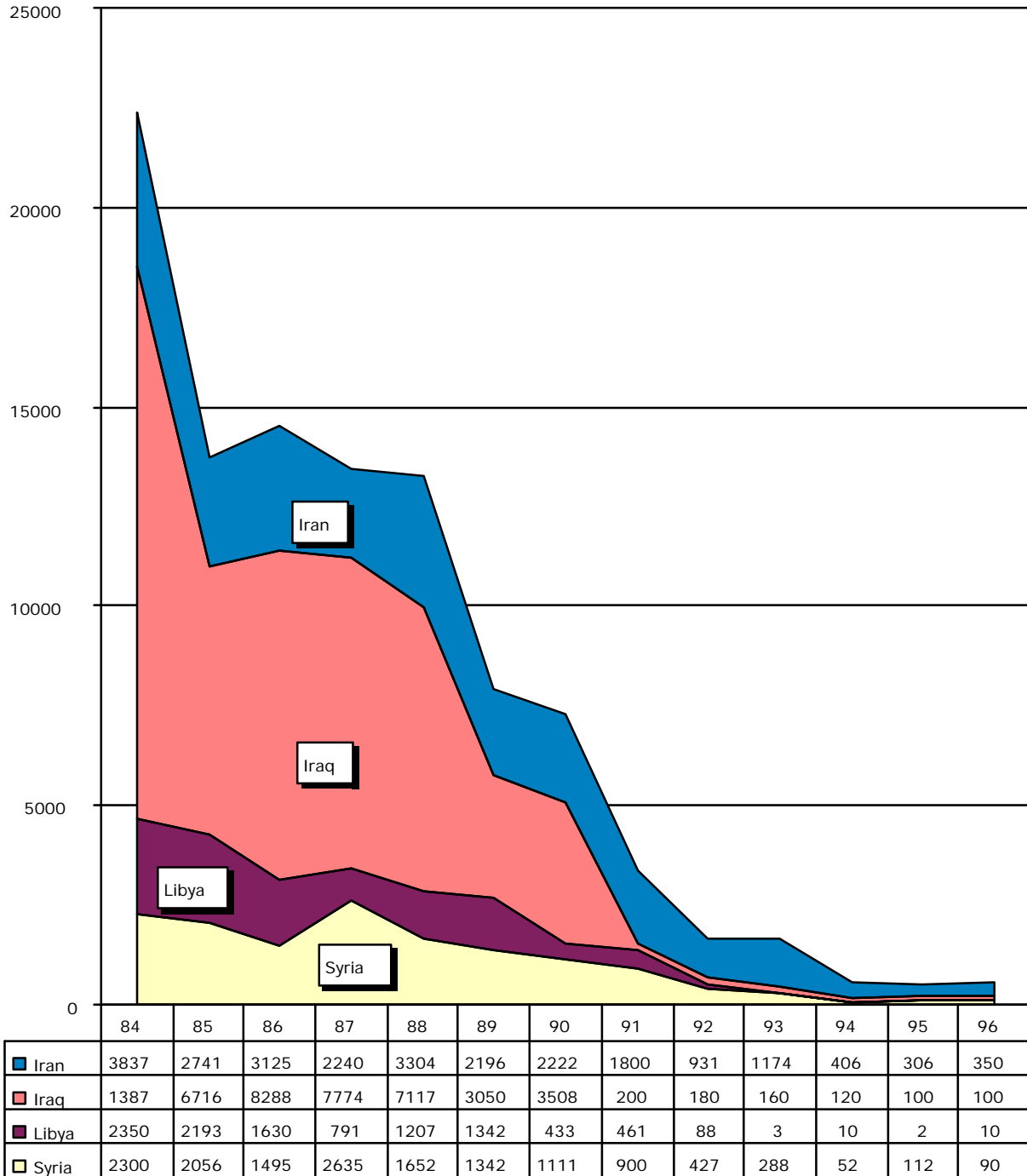
	84	85	86	87	88	89	90	91	92	93	94	95
Oceania	0.99	1.39	1.021	1.236	1.623	1.33	1.034	0.845	0.409	0.771	0.431	0.96
South America	3.2	1.398	1.295	1.534	1.592	1.354	0.724	0.851	0.559	0.467	0.472	1.295
North Africa	4.3	3.467	2.669	2.278	2.559	2.247	1.08	0.696	0.21	0.115	0.318	0.32
Central America	2.8	4.002	3.27	3.275	3.19	2.085	1.862	0.801	0.237	0.189	0.072	0.045
Sub-Saharan Africa	6.4	3.981	3.917	6.511	5.331	3.301	1.931	0.696	0.575	0.592	1.04	0.27
South Asia	3.8	5.229	6.567	6.265	7.803	8.962	7.223	3.519	1.232	0.917	0.697	1.13
East Asia	7.9	6.14	6.02	7.635	7.31	6.59	5.42	5.265	4.9	4.125	5.34	6.425
Developed World	20.2	20.76	19.82	25.4	23.86	22.46	16.98	15	12.2	14.35	10.96	10.55
Middle East	36.5	27.95	25.96	30.88	24.5	19.15	19.53	14.52	13.53	13.79	10.23	13.8

Adapted by Anthony H. Cordesman from ACDA, World Military Expenditures and Arms Transfers, various editions. Middle East does not include North African states other than Egypt.

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## The Cumulative Decline in Military Spending by Selected Major Buyers in Constant Dollars: 1984-1996

(\$96 Constant Millions)



Source: Adapted by Anthony H. Cordesman from US Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers*, GPO, Washington, various editions.

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## **The De-Radicalization of Middle East Arms Transfers**

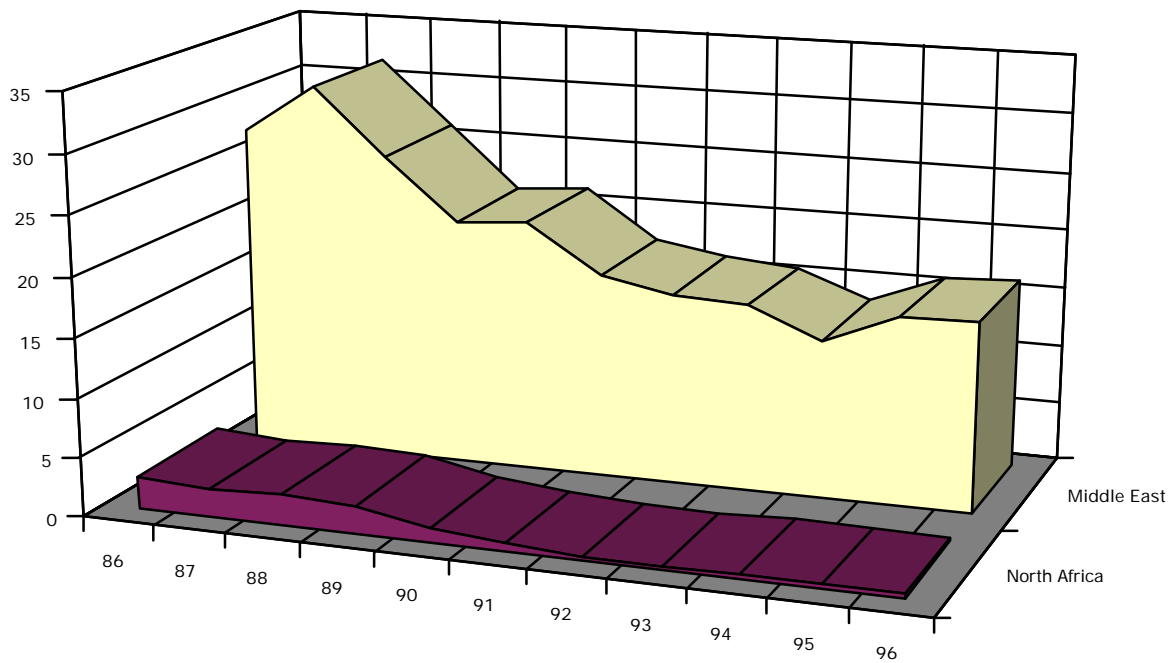
- **The Arab-Israeli peace process, end of the Iran-Iraq War, end of the Cold War, and Gulf War have reduced the threat far more than orders of battle would indicate.**
- **Mismanagement of the economy, lower oil prices, and regional recession have also affected sales.**
- **New agreements states with recent conflicts, or which are outside the peace process, are down to token share of past levels.**
- **States committed to peace have signed 93% of all recent new arms import agreements versus 67% before Gulf War.**
- **Southern Gulf states have recently signed 96% of all new arms import agreements versus 53% before Gulf War.**
- **The most dangerous single threat country -- Iraq -- has had only token imports since 1990.**
- **Iran did not choose to renew the arms race after its defeat in 1988, and made major further cuts in 1992, after the Coalition weakened Iraq.**
- **Syria has no sponsor.**
- **Libya faces economic problems and is sanctioned.**
- ***Warning: Data Do Not Take Proliferation Into Account***

## **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<sup>4</sup>I/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.**

## Technology Transfer to MENA is Declining But Is Still An Issue

(In constant \$US1996 Billions)



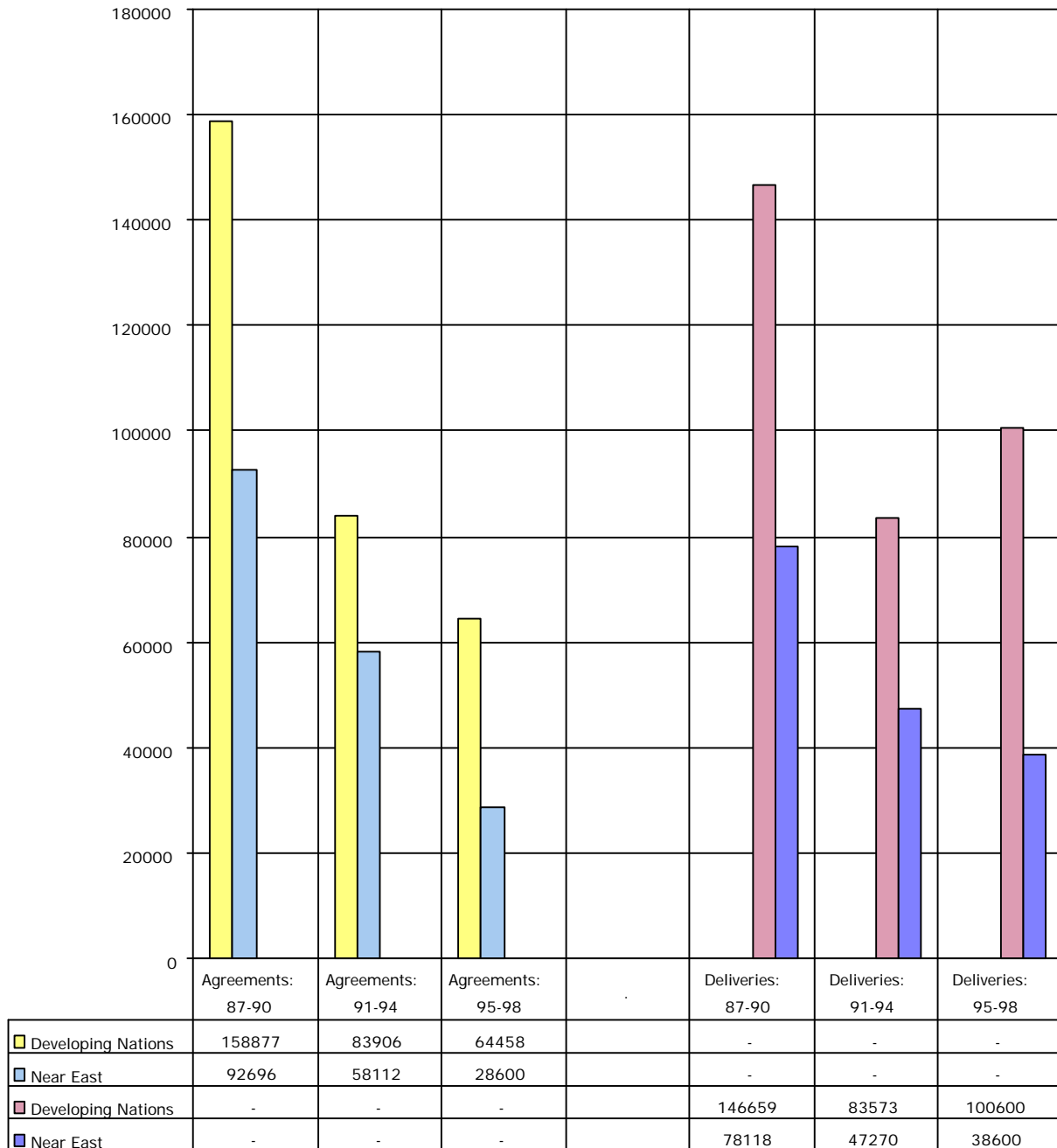
	86	87	88	89	90	91	92	93	94	95	96
North Africa	2.7	2.3	2.6	2.3	1.1	0.64	0.23	0.13	0.37	0.35	0.25
Middle East	27.4	31.6	26.1	20.8	21.3	17.3	16.2	15.8	13.4	15.9	16.2

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## 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)



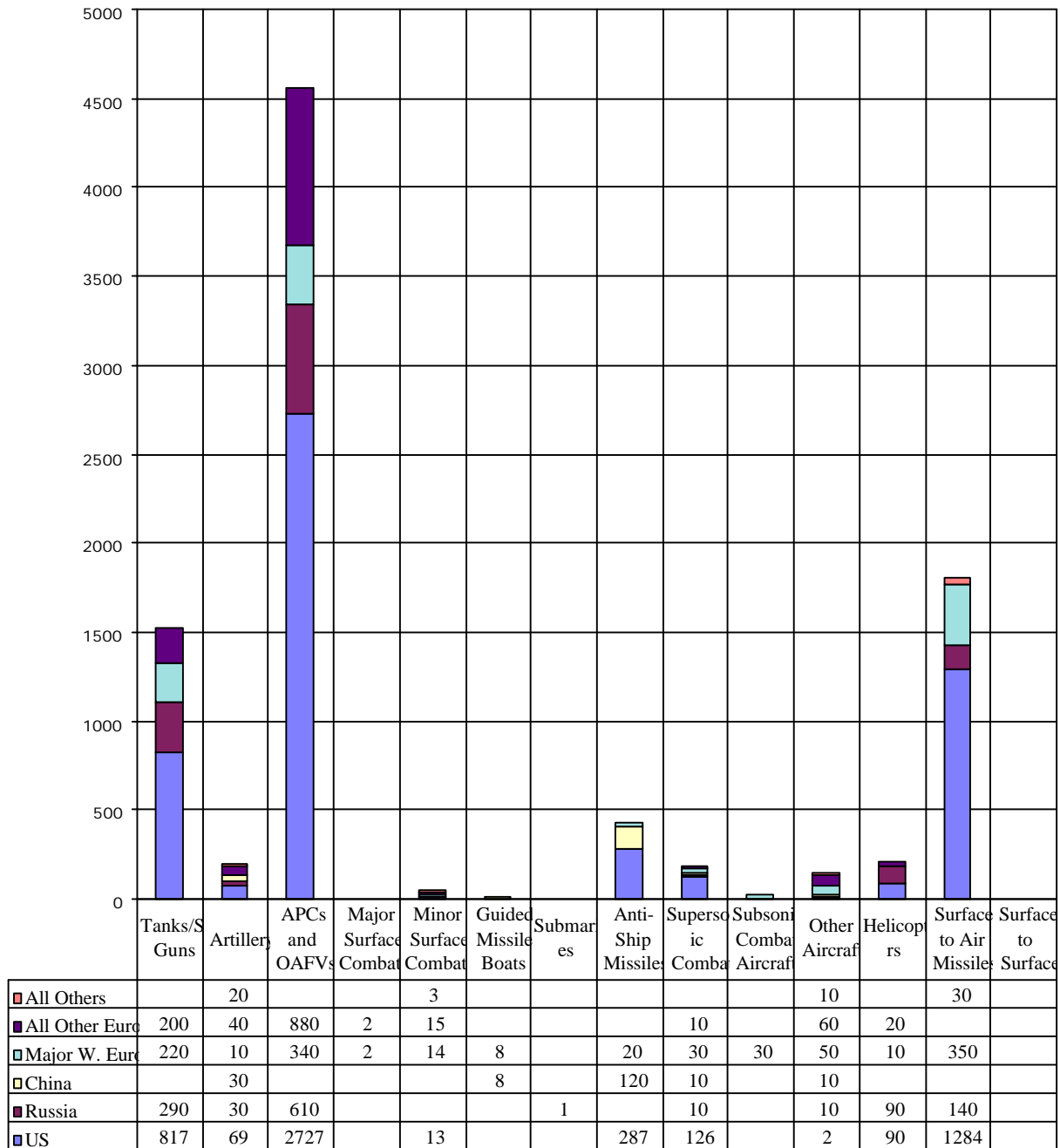
Includes Gulf states, Arab-Israeli states, North Africa, and Yemen

0 = less than \$50 million or nil, and all data rounded to the nearest \$100 million

Source: Richard F. Grimmitt, Conventional Arms Transfers to the Developing Nations, 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)



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, Conventional Arms Transfers to the Developing Nations, Congressional Research Service, various editions.

## **Key States Affecting the Regional Balance**

- **Iraq: More than enough arms for self-defense, aggressor state, proliferator**
- **Iran: Regime moderating, but still possible threat to lower Gulf, still a revolutionary state, proliferator**
- **Libya: Radical and unstable regime, already world's largest military parking lot, sometime aggressor and sponsor of terrorism, proliferator.**
- **Syria: Uncertain commitment to peace process, occupier of Lebanon, threat to Israel and Turkey, proliferator**

## **Arms Transfers versus Transfers of Technology**

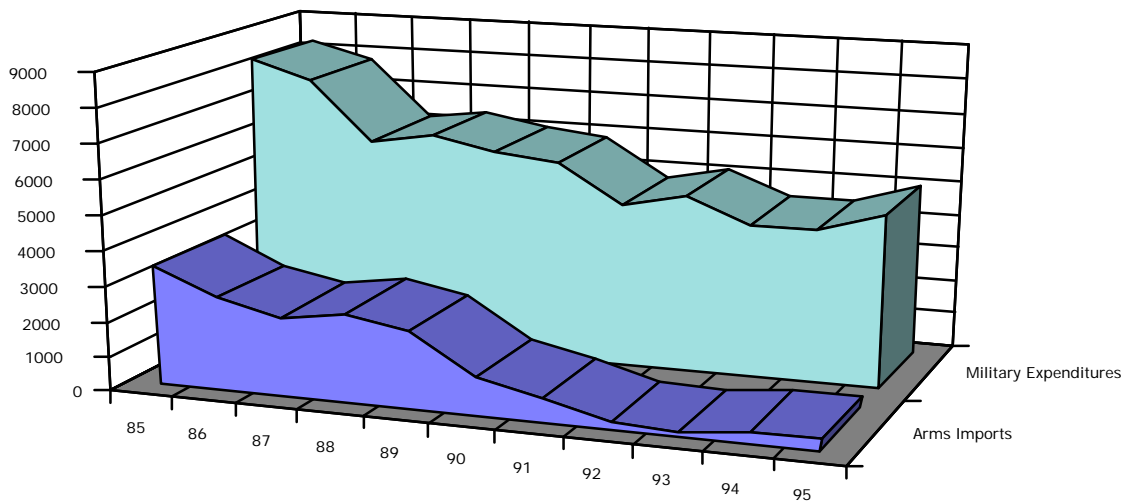
- **Proliferation is driven by dual-use exports, black market transfers and violations of agreements.**
- **Many forms of asymmetric warfare are not affected.**
- **Modifying the platform is increasingly as important as obtaining new platforms.**
- **Countries differ sharply in indigenous technology base and production capabilities.**
- **“Dual use” technologies aid in proliferation and the C<sup>4</sup>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 Mahgreb**

## North African Military Expenditures and Arms Transfers in Constant Dollars Have Dropped to Low Levels by Global Standards

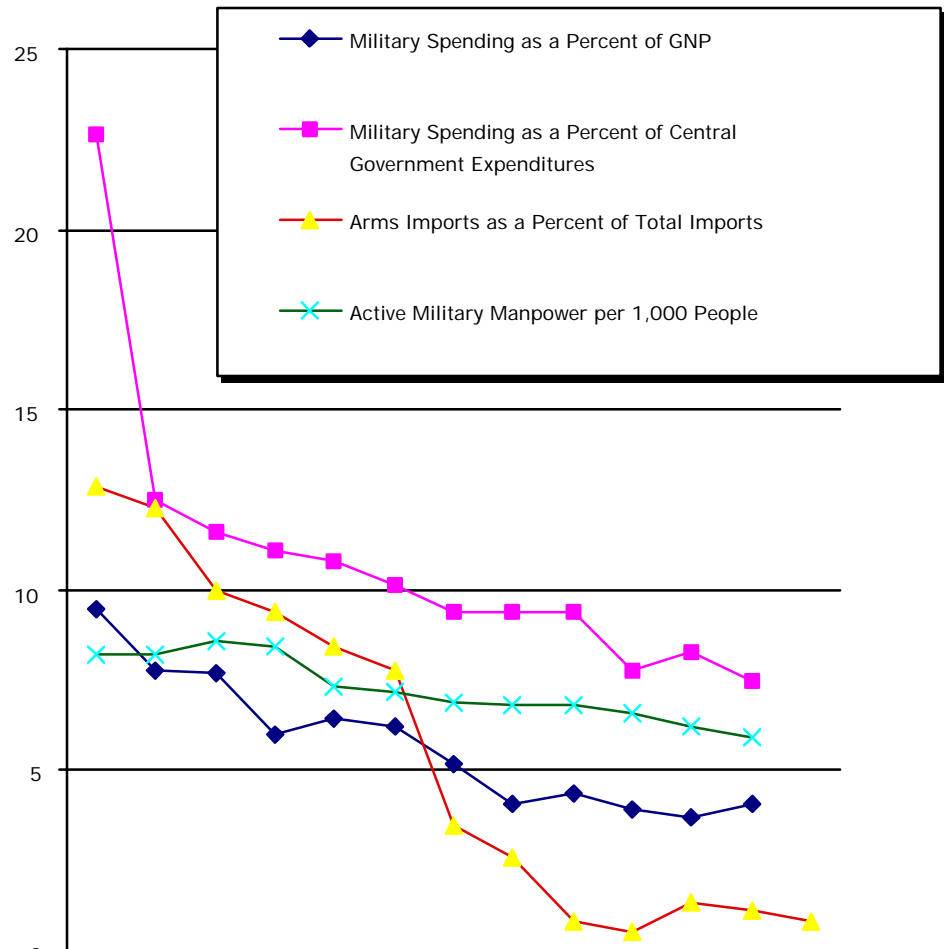
(Algerian, Libyan, Moroccan, and Tunisian spending in \$1995 Billions)



	85	86	87	88	89	90	91	92	93	94	95
Arms Imports	3467	2669	2278	2559	2247	1080	696	210	115	318	320
Military Expenditures	8300	7800	6100	6400	6000	5800	4700	5100	4400	4400	5000

Adapted by Anthony H. Cordesman from Bureau of Arms Control in the US State Department (formerly ACDA), World Military Expenditures and Arms Transfers, various editions.

## North African Military Efforts Declined Sharply as a Percent of GNP, Government Expenditures, Imports, and Total Population: 1984-1995



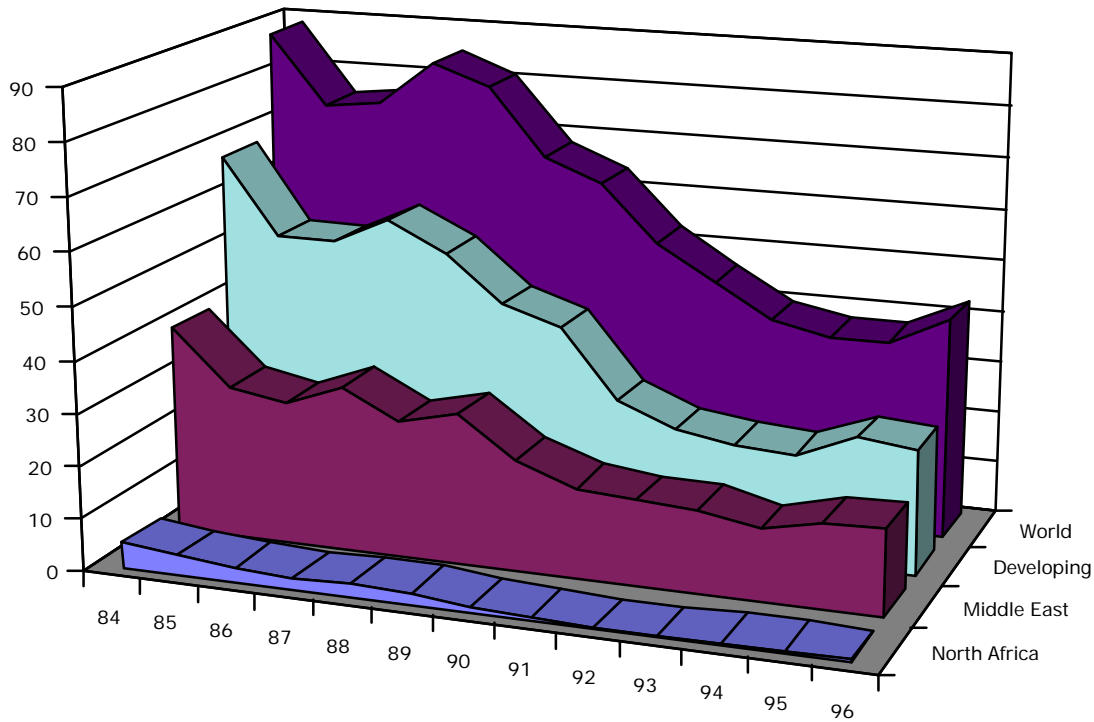
	84	85	86	87	88	89	90	91	92	93	94	95	96
◆ Military Spending as a Percent of GNP	9.5	7.8	7.7	6	6.4	6.2	5.2	4.1	4.4	3.9	3.7	4.1	
■ Military Spending as a Percent of Central Government Expenditures	23	13	12	11	11	10	9.4	9.4	9.4	7.8	8.3	7.5	
▲ Arms Imports as a Percent of Total Imports	13	12	10	9.4	8.4	7.8	3.5	2.6	0.8	0.5	1.3	1.1	0.8
✕ Active Military Manpower per 1,000 People	8.2	8.2	8.6	8.4	7.3	7.2	6.9	6.8	6.8	6.6	6.2	5.9	

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## North African Arms Deliveries Are Declining, and Are a Minor Portion of the World Market: 1984-1996

(Arms Deliveries in Constant \$96 Billions)

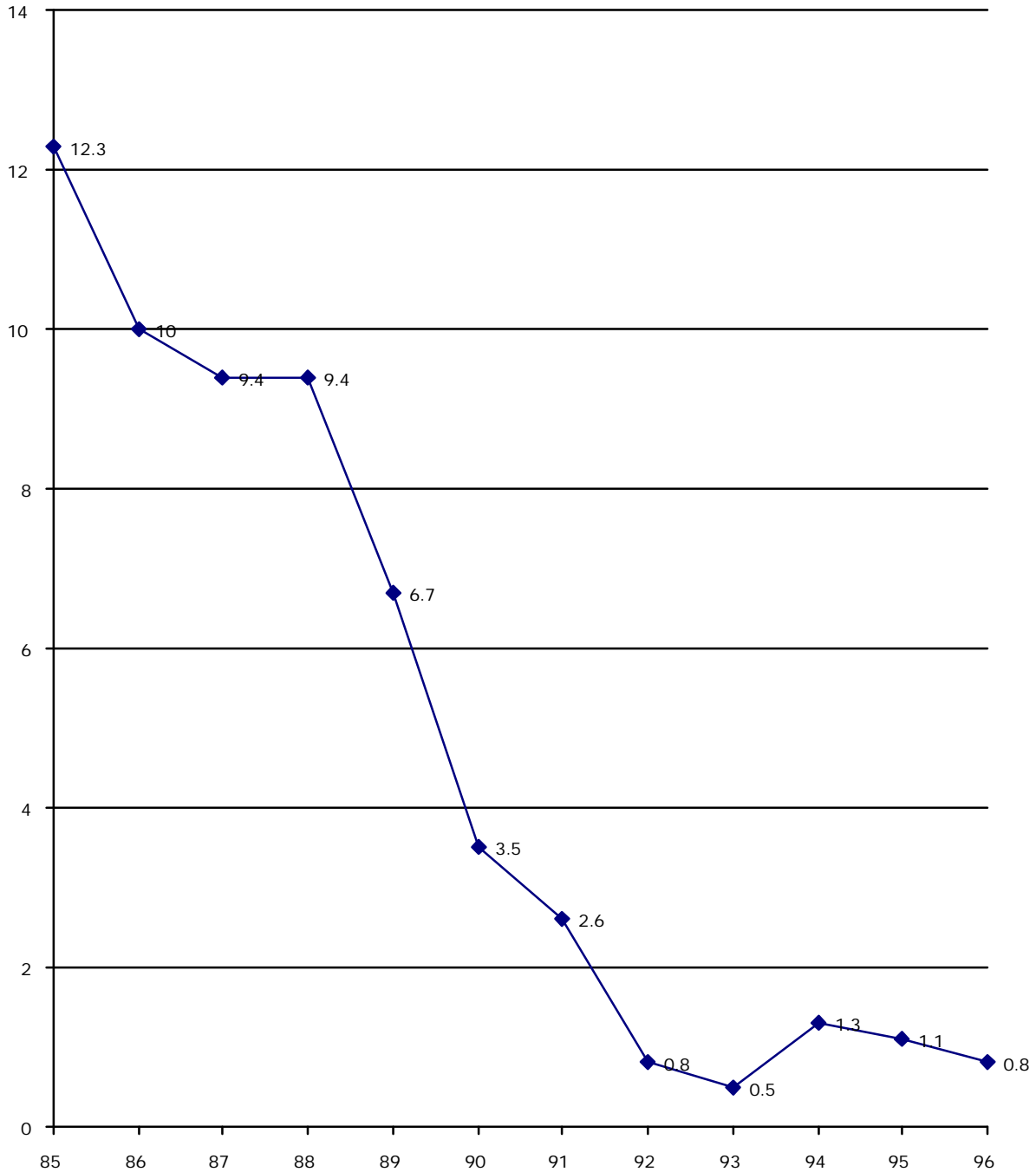


	84	85	86	88	89	90	91	92	93	95	96
■ North Africa	4.9	3.7	2.7	2.6	2.2	1.1	0.72	0.23	0.128	0.346	0.25
■ Middle East	39.9	29.4	27.4	26.1	28.8	21.3	17.3	16.2	15.8	15.9	16.2
■ Developing	68	53.2	53.1	52.7	44.1	40.5	27.4	23	21.2	24.9	23.7
■ World	88.1	74.5	75.9	80.6	67.7	63.4	52.5	45.5	39.5	37	42.6

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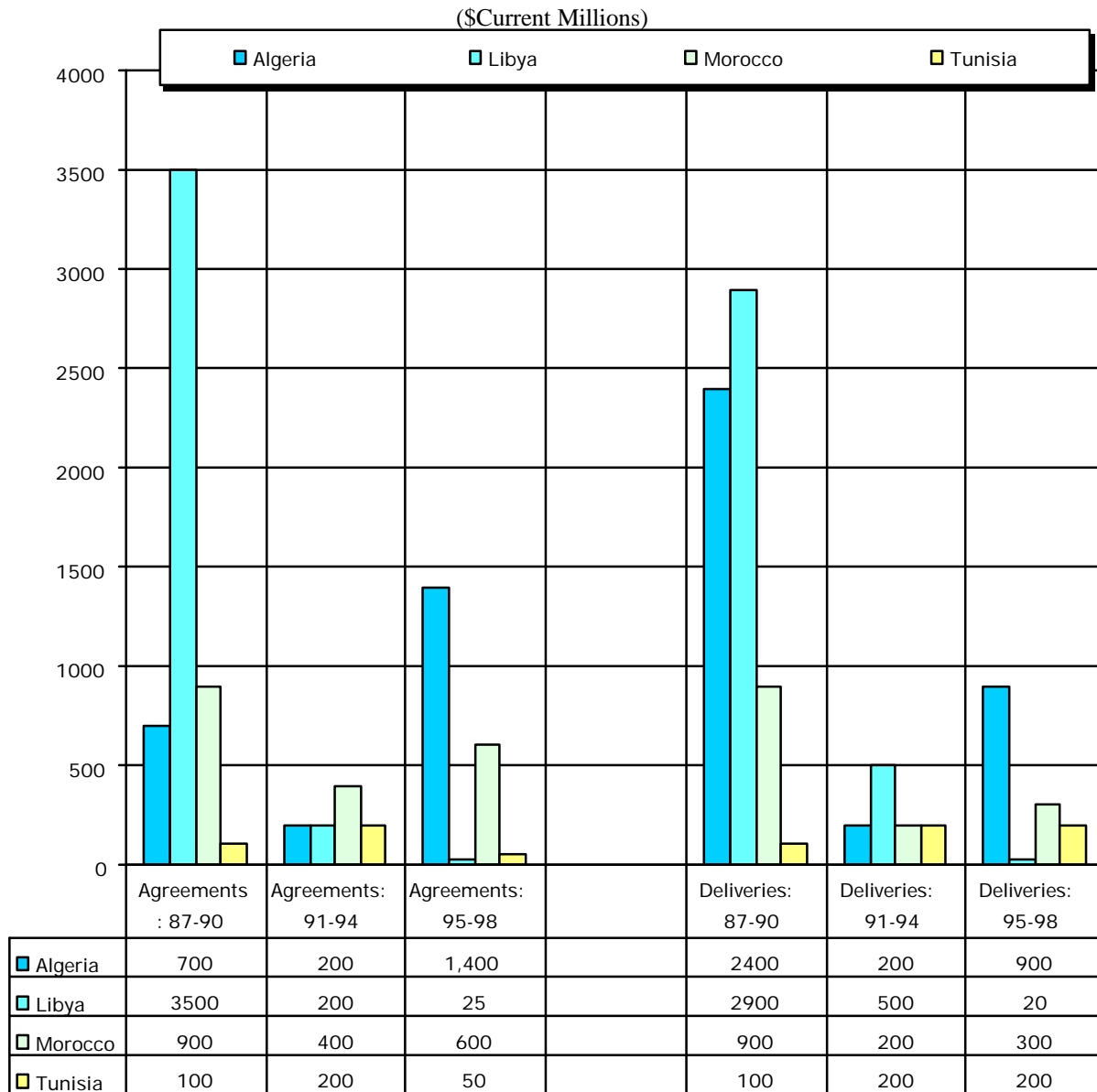
## North African Arms Imports as a Percent of Total Imports: 1985-1996



Adapted by Anthony H. Cordesman from Bureau of Arms Control in the US State Department (formerly ACDA), World Military Expenditures & Arms Transfers, various editions. North Africa does not include Egypt.

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## Trend in North African Agreements and Deliveries by Country: 1987-1998

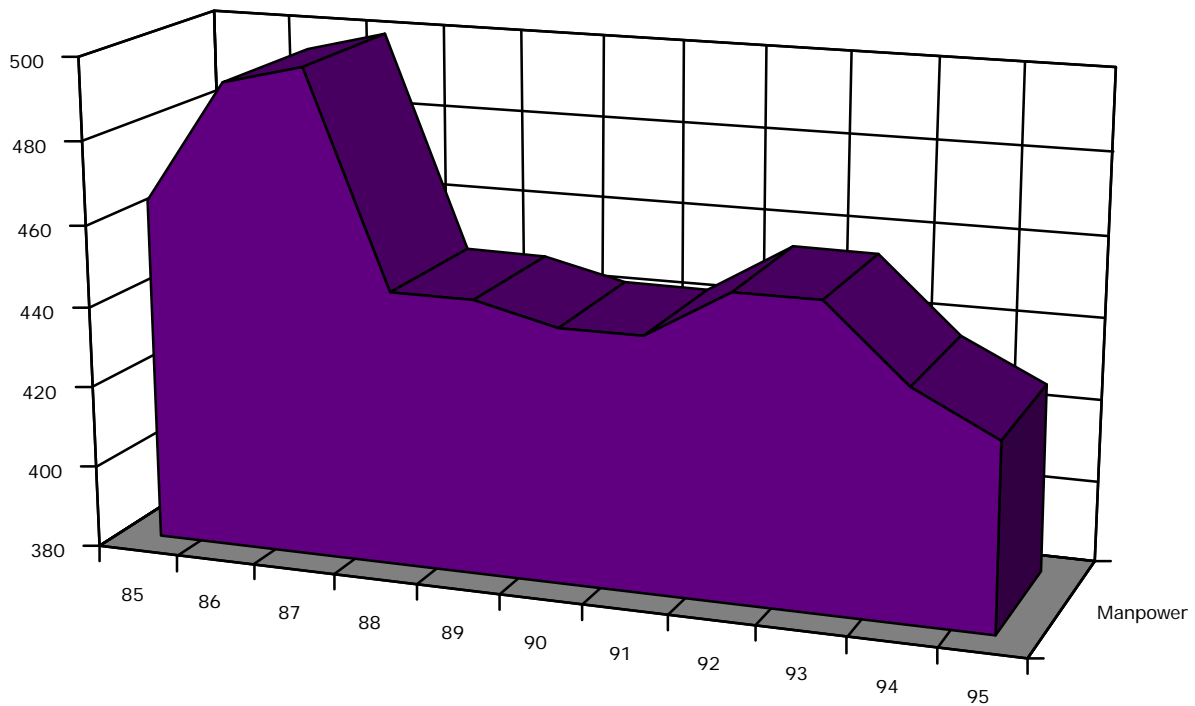


<sup>0</sup> = Data less than \$50 million or nil. All data rounded to the nearest \$100 million.

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

## Trends in North African Military Manpower

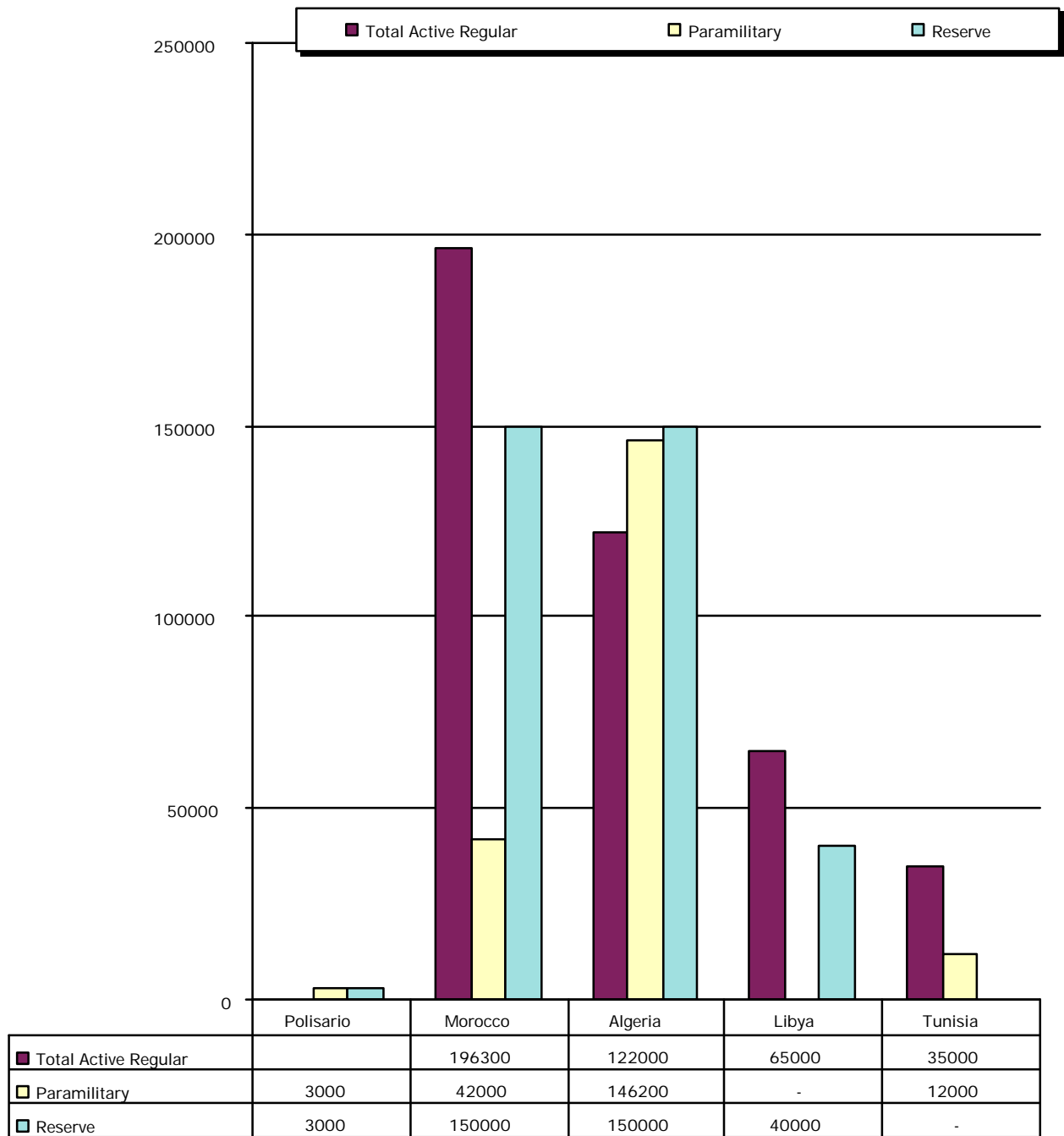
(Algerian, Libyan, Moroccan, and Tunisian Military Manpower in Thousands)



	85	86	87	88	89	90	91	92	93	94	95
■ Manpower	464	494	499	447	447	442	442	454	454	436	426

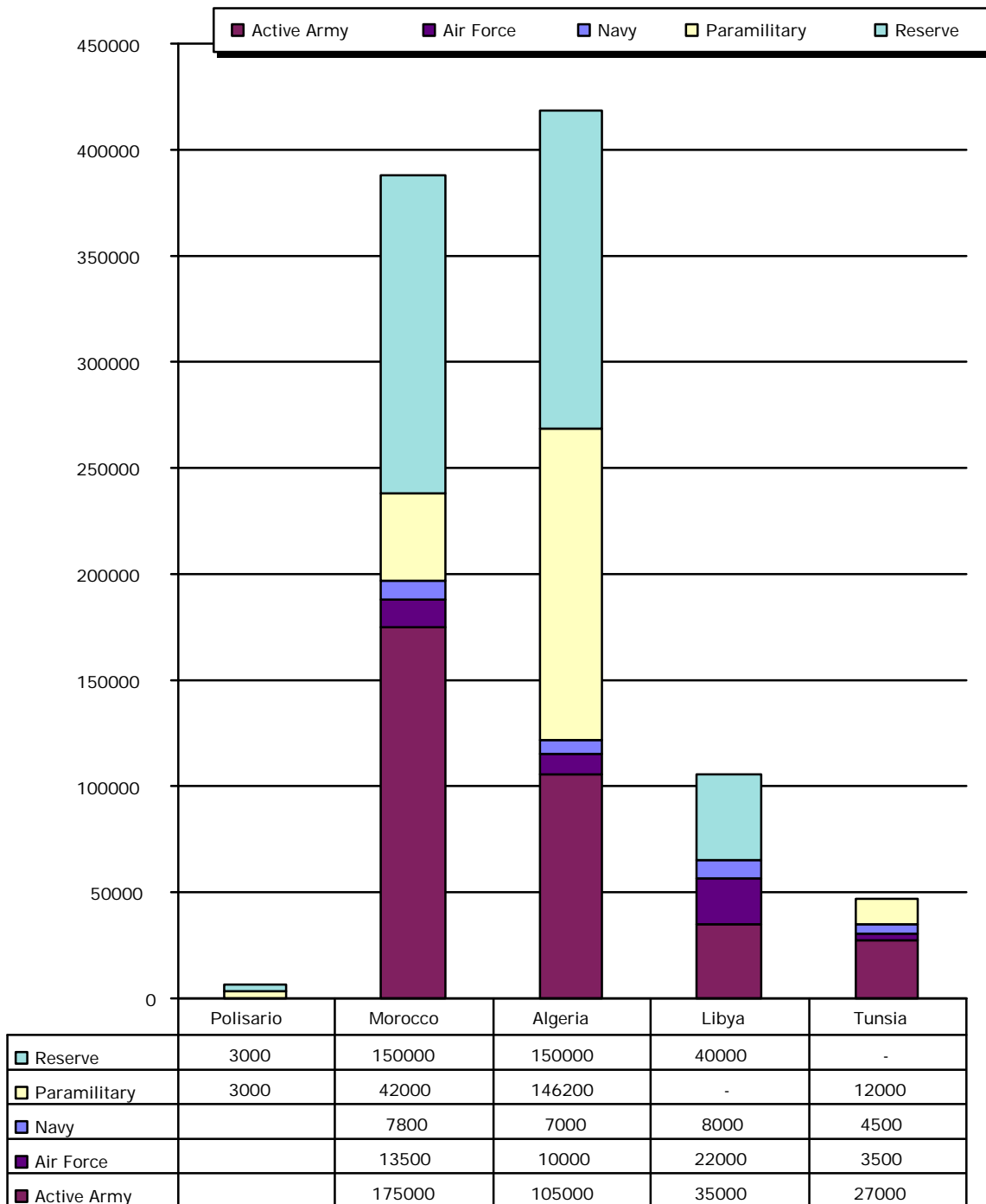
Adapted by Anthony H. Cordesman from Bureau of Arms Control in the US State Department (formerly ACDA), World Military Expenditures and Arms Transfers, various editions. Middle East does not include North African states other than Egypt.

### Total Manpower in North African Military Forces in 1999-2000



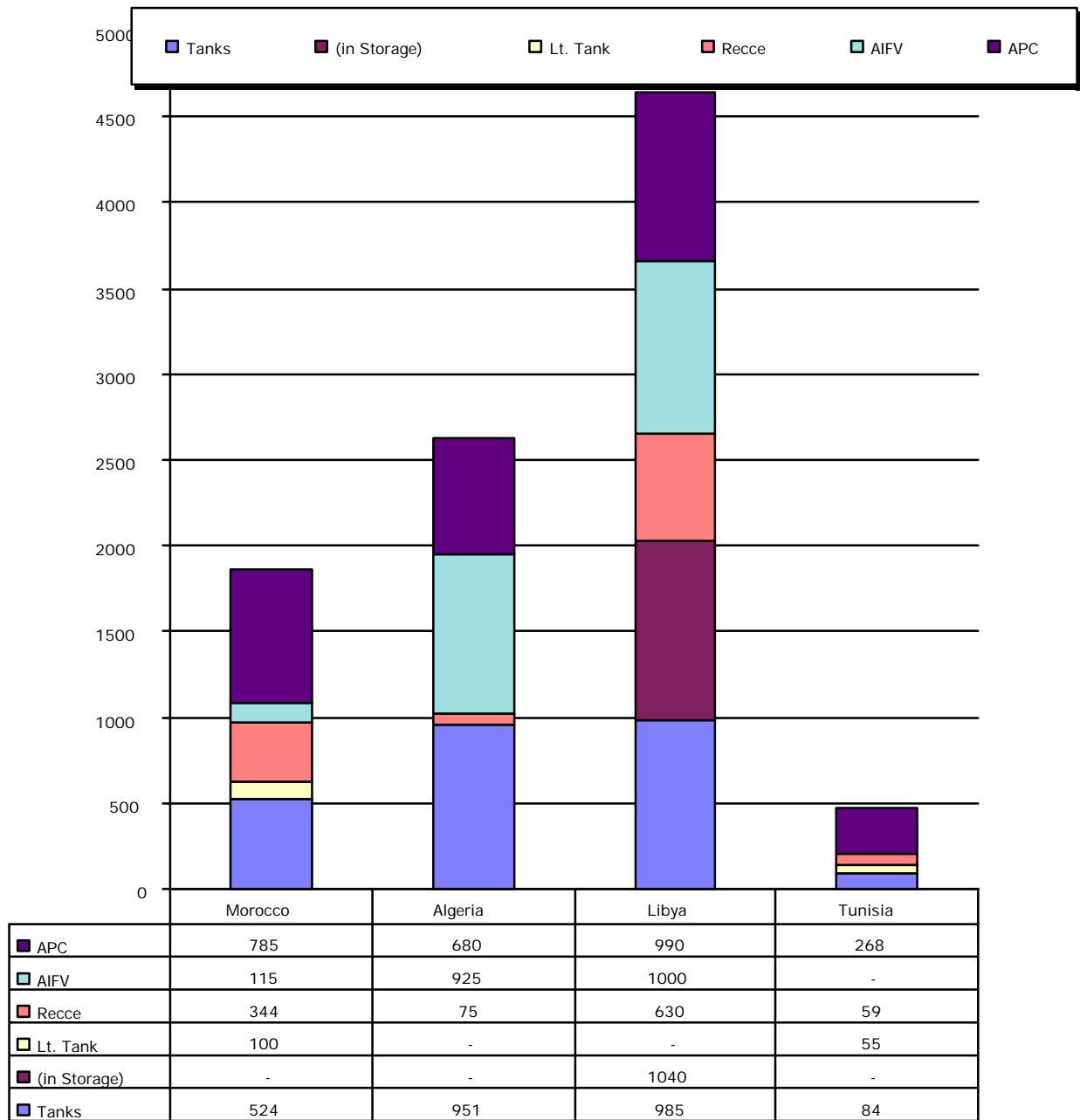
Adapted by Anthony H. Cordesman from IISS, The Military Balance, various editions.

## Total Regular Military Manpower in North African Forces by Service in 1999-2000



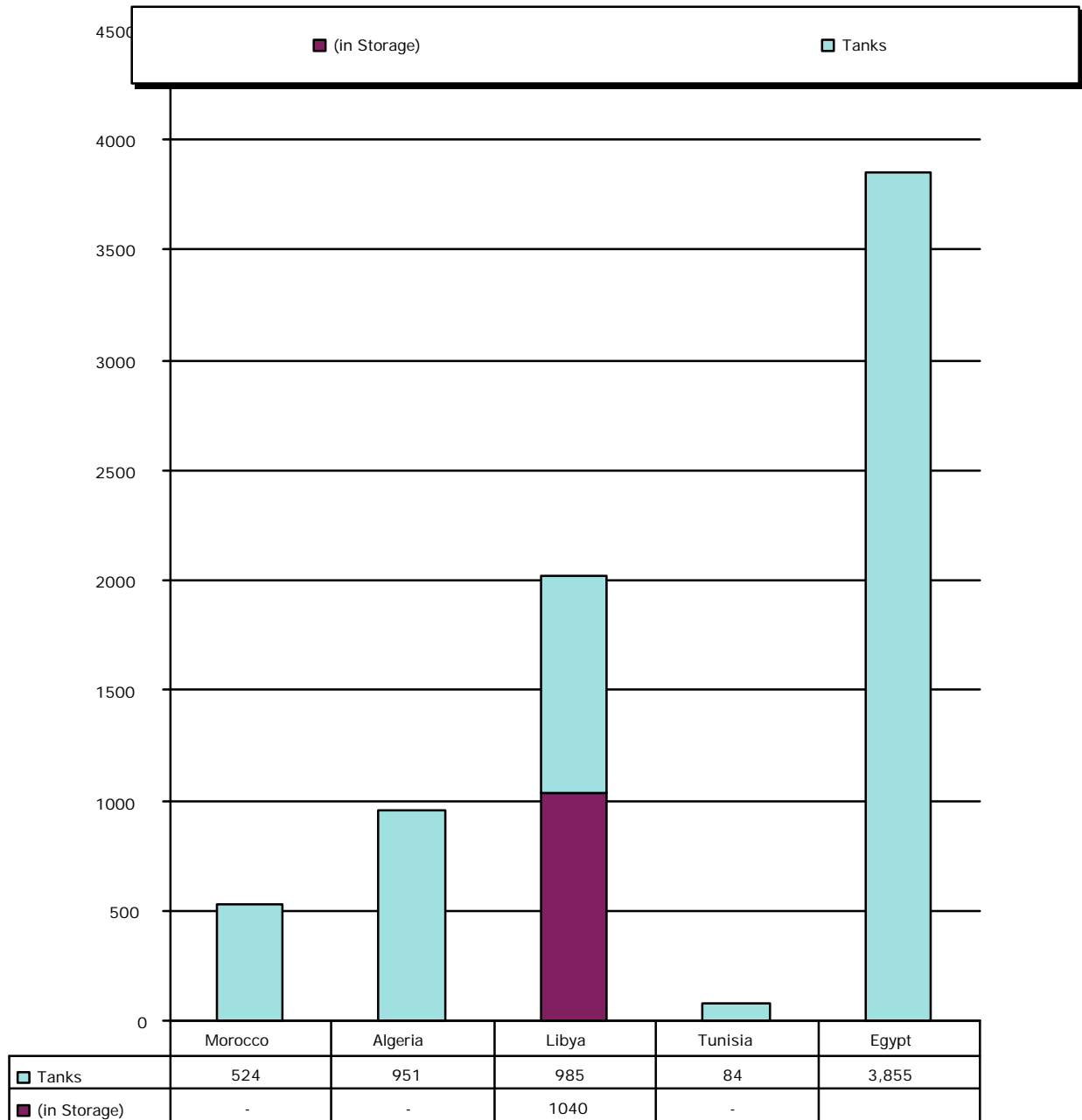
Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, and JCSS, Military Balance in the Middle East, various editions.

### Total North African Armor in 1999-2000



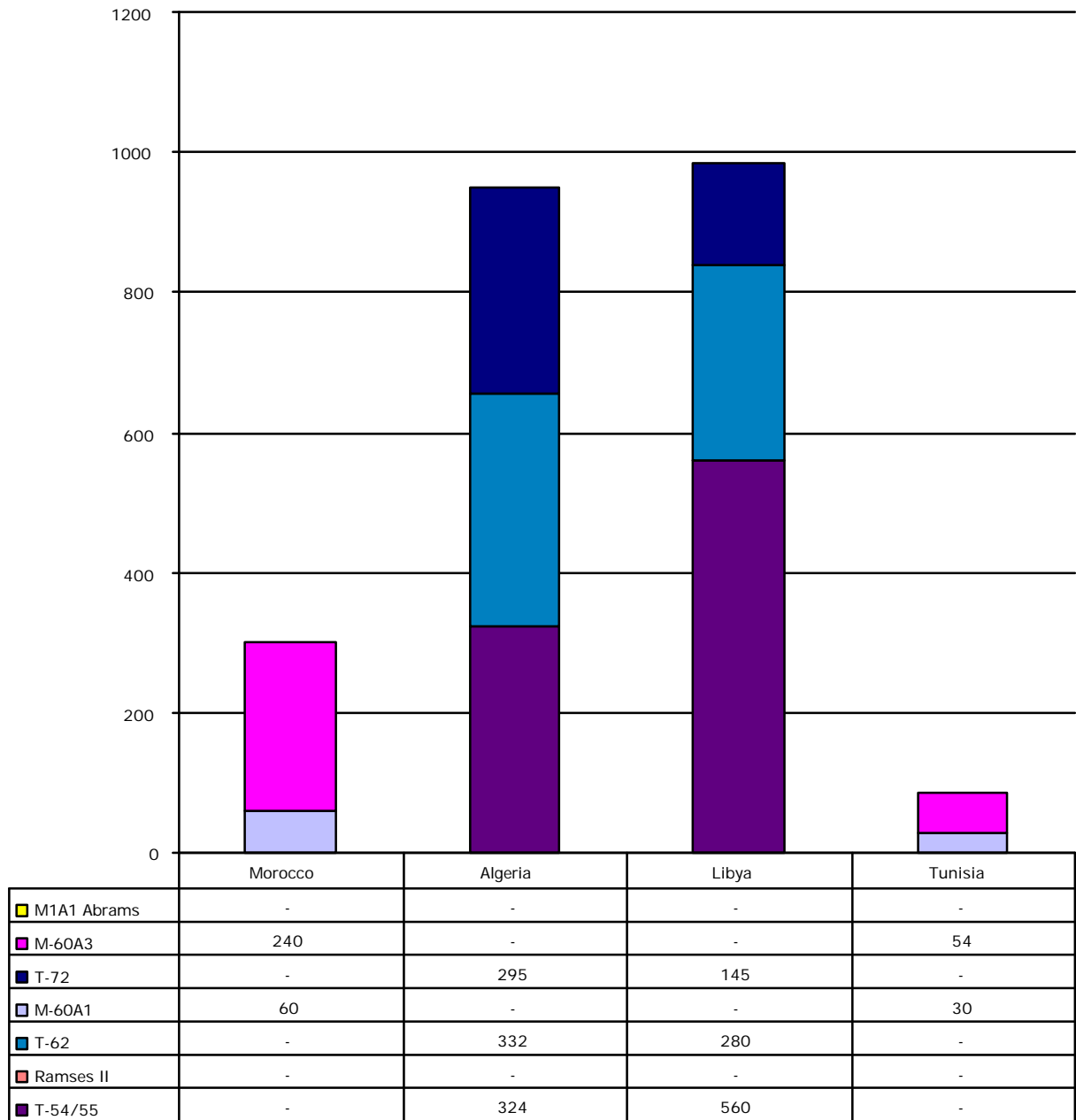
Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, and JCSS, Military Balance in the Middle East, various editions.

### Total North African Main Battle Tanks in 1999-2000



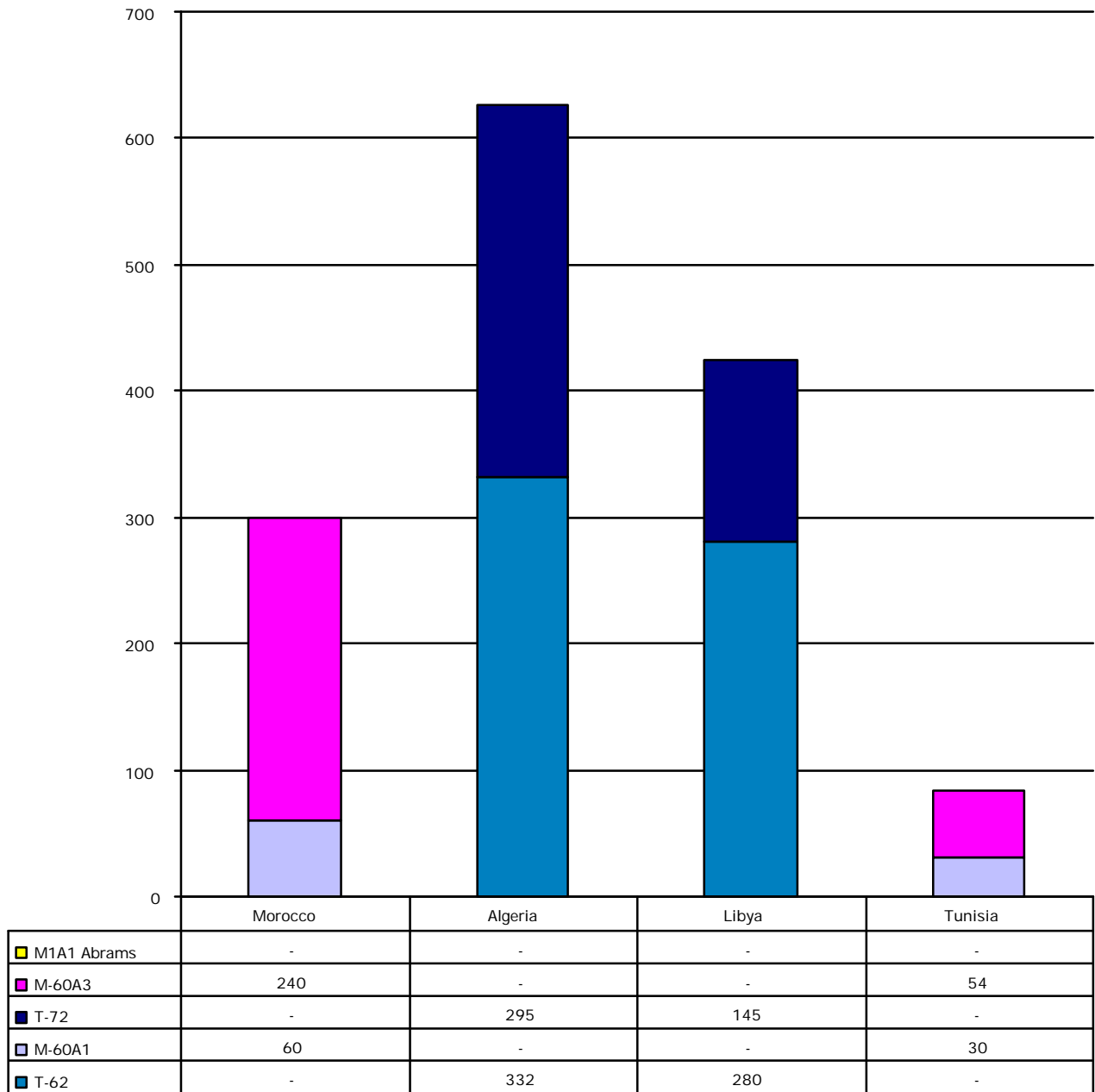
Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various editions.

## Total North African Medium Active Main Battle Tanks by Type in 1999-2000



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various editions.

## Total North African Medium Quality and Modern Active Main Battle Tanks in 1999-2000



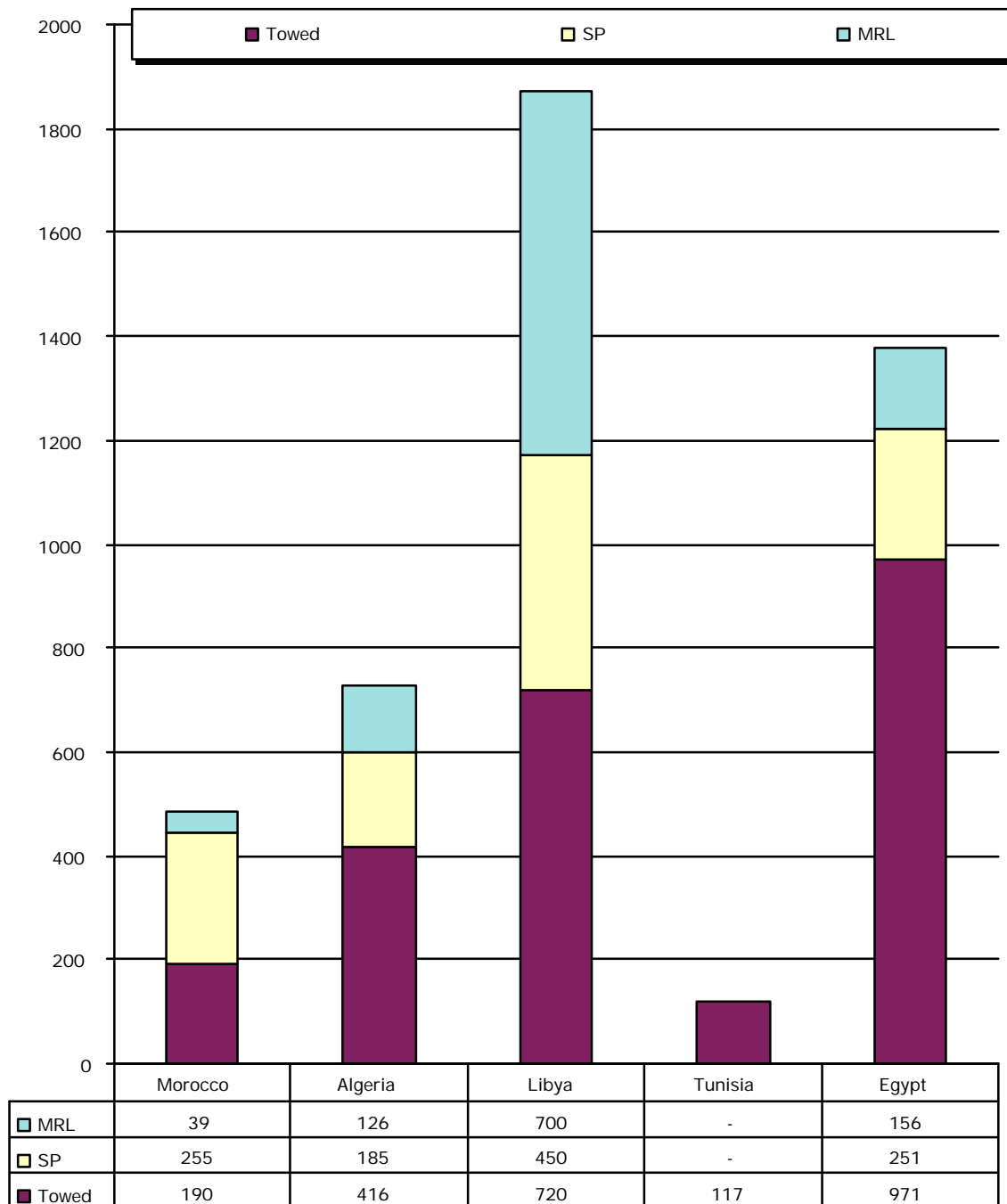
Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various editions.

## Total North African Medium Quality and Modern Other Armored Fighting Vehicles in 1999-2000 (Less APCs)



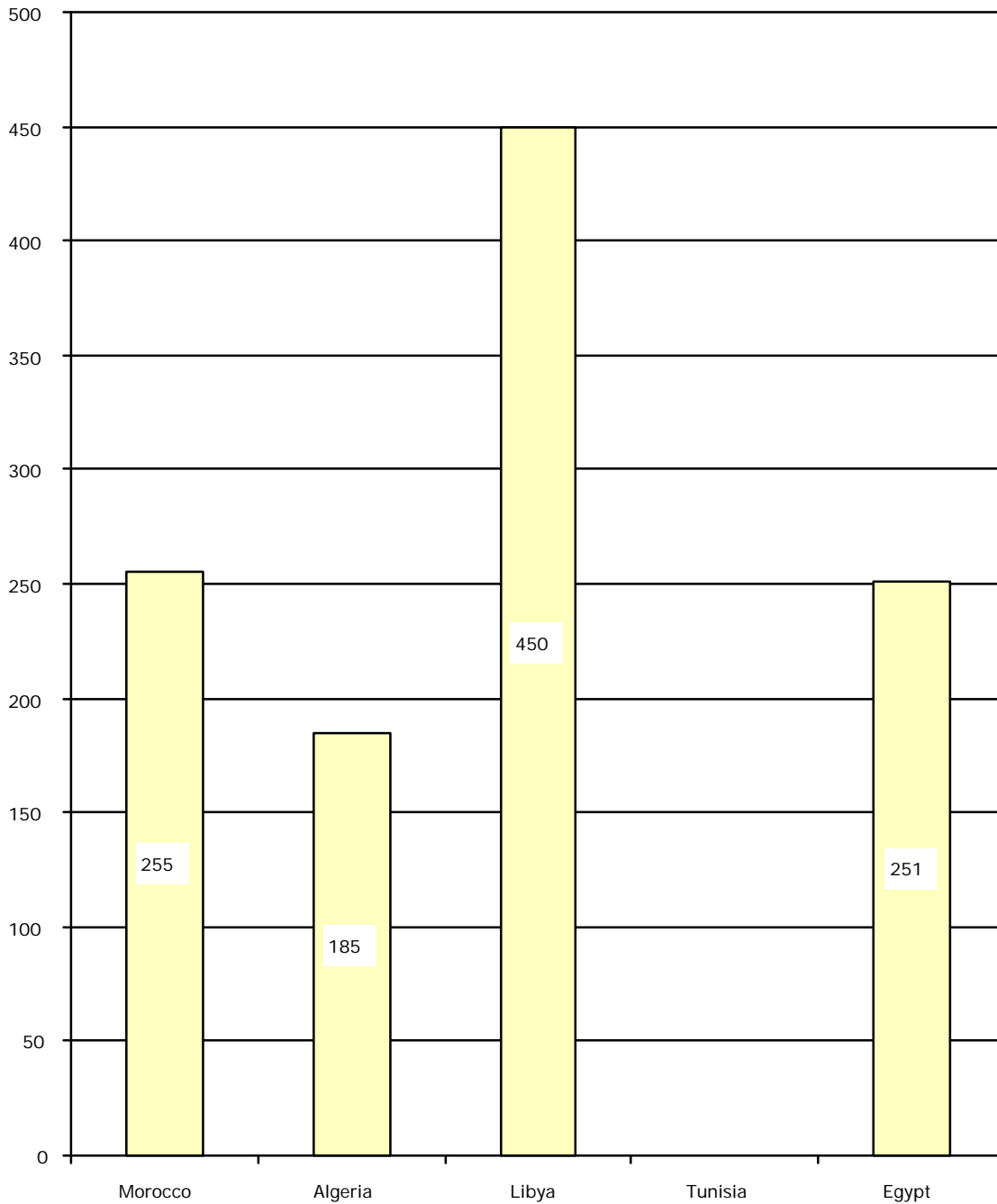
Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various editions.

### Total North African Artillery in 1999-2000



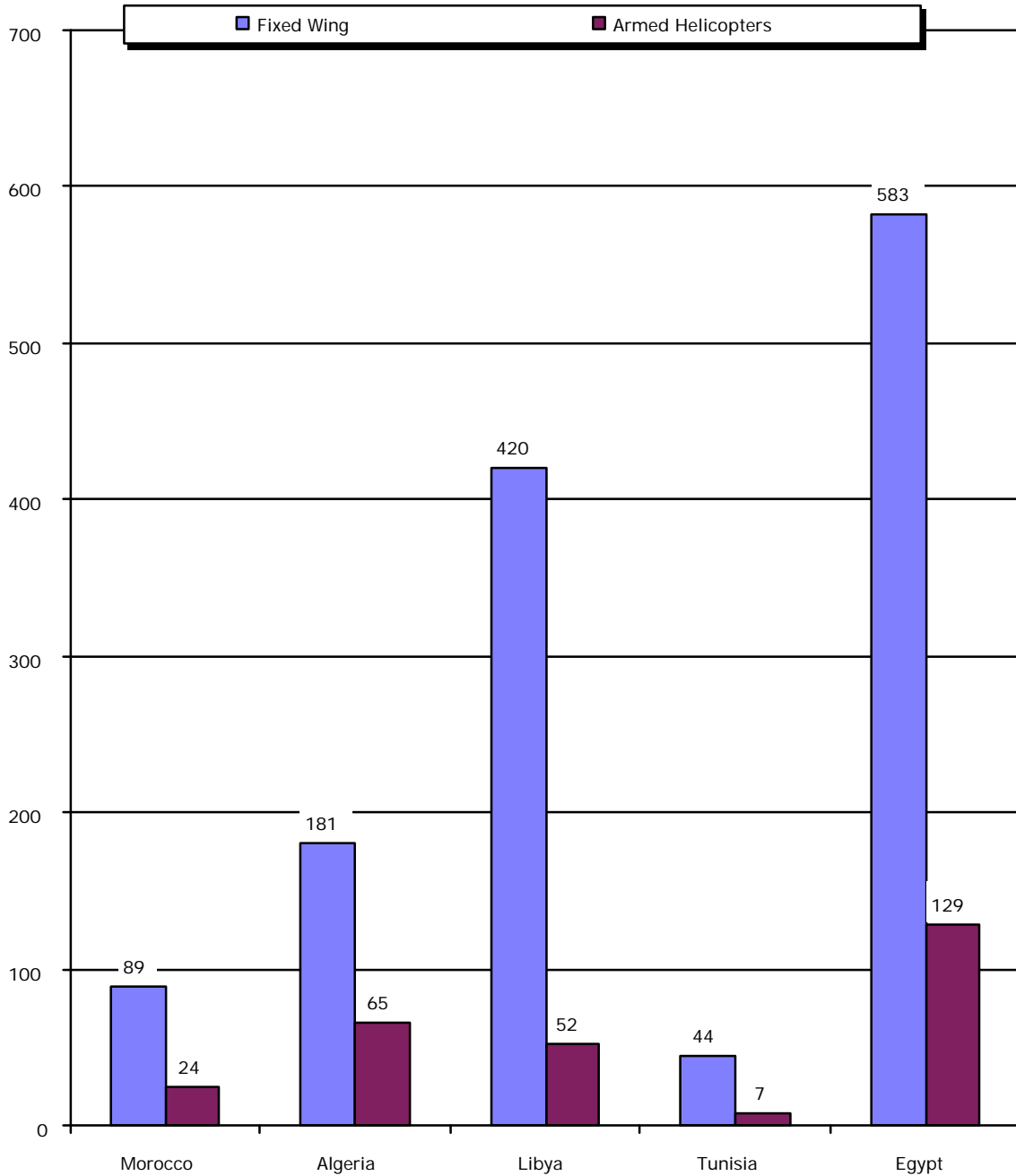
Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various editions.

### North African Self-Propelled Artillery in 1999-2000



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various editions.

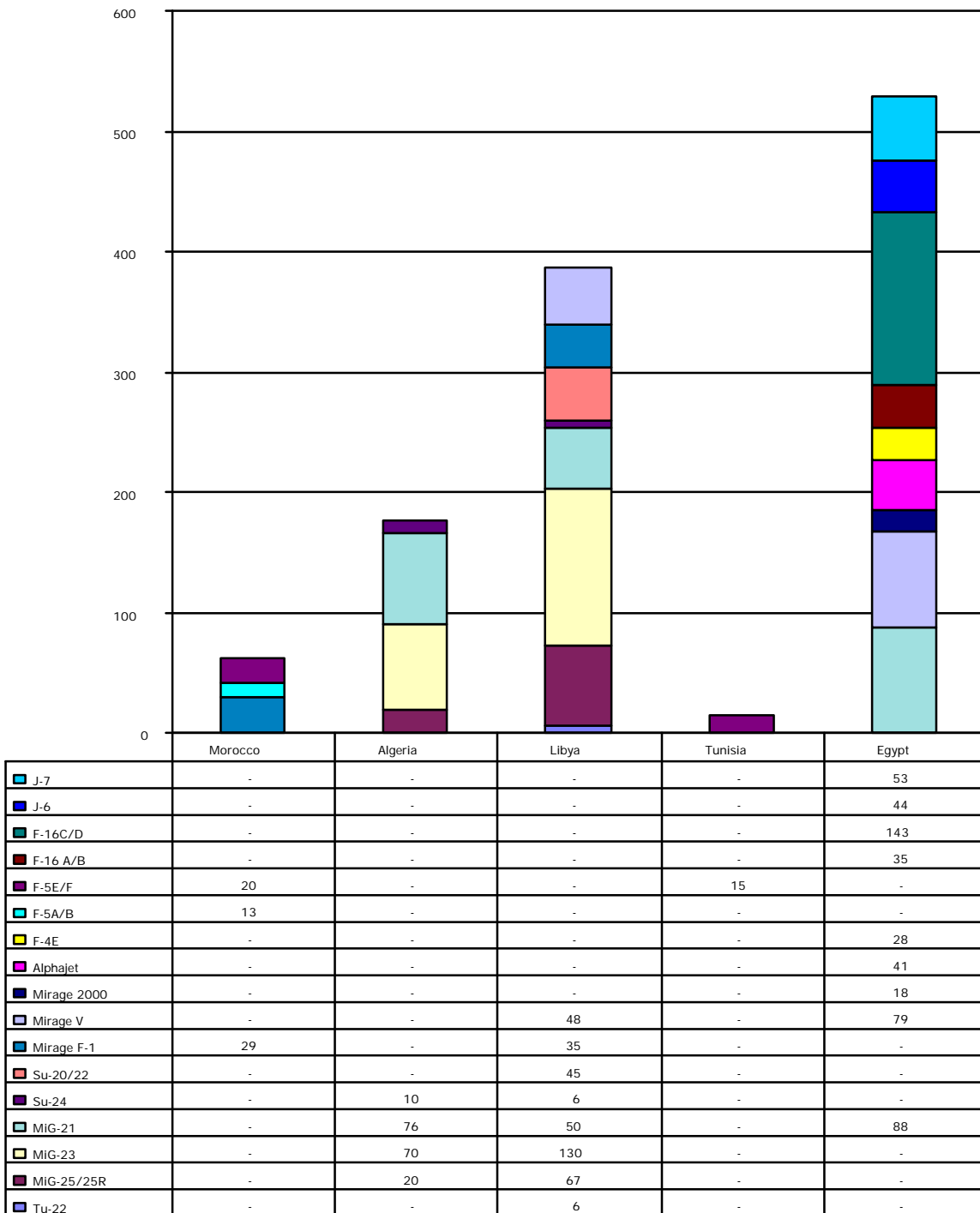
## North Africa: Total Fixed Combat Aircraft and Armed Helicopters in 1999-2000



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various editions.

## North African Active Bomber, Fighter, FGA, and Strike Combat Aircraft by Type in 1999-2000

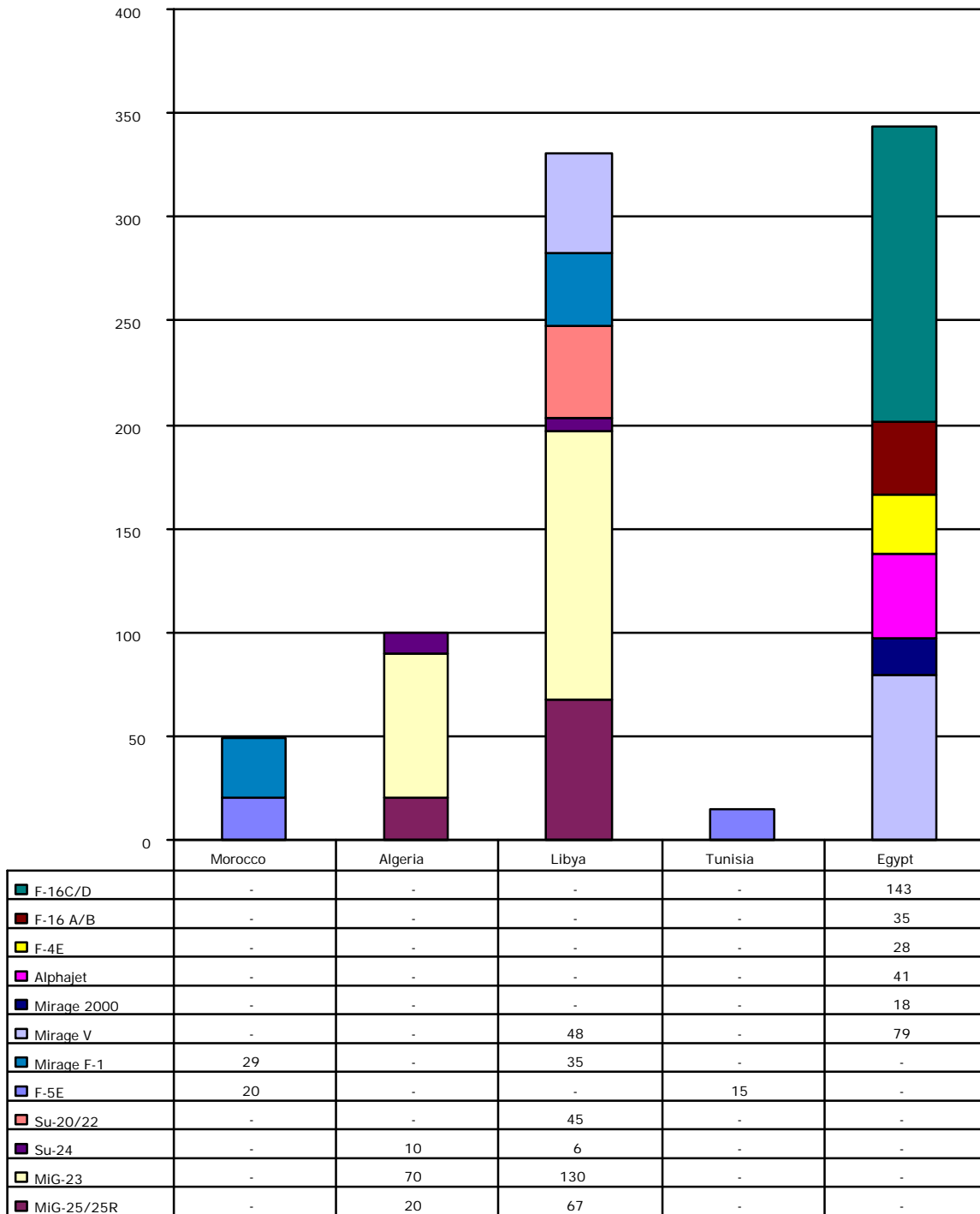
(Does not include Light Attack and COIN, Combat Capable Trainers, or Aircraft in Storage)



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various editions.

## North African Medium and High Quality Combat Aircraft by Type in 1999-2000

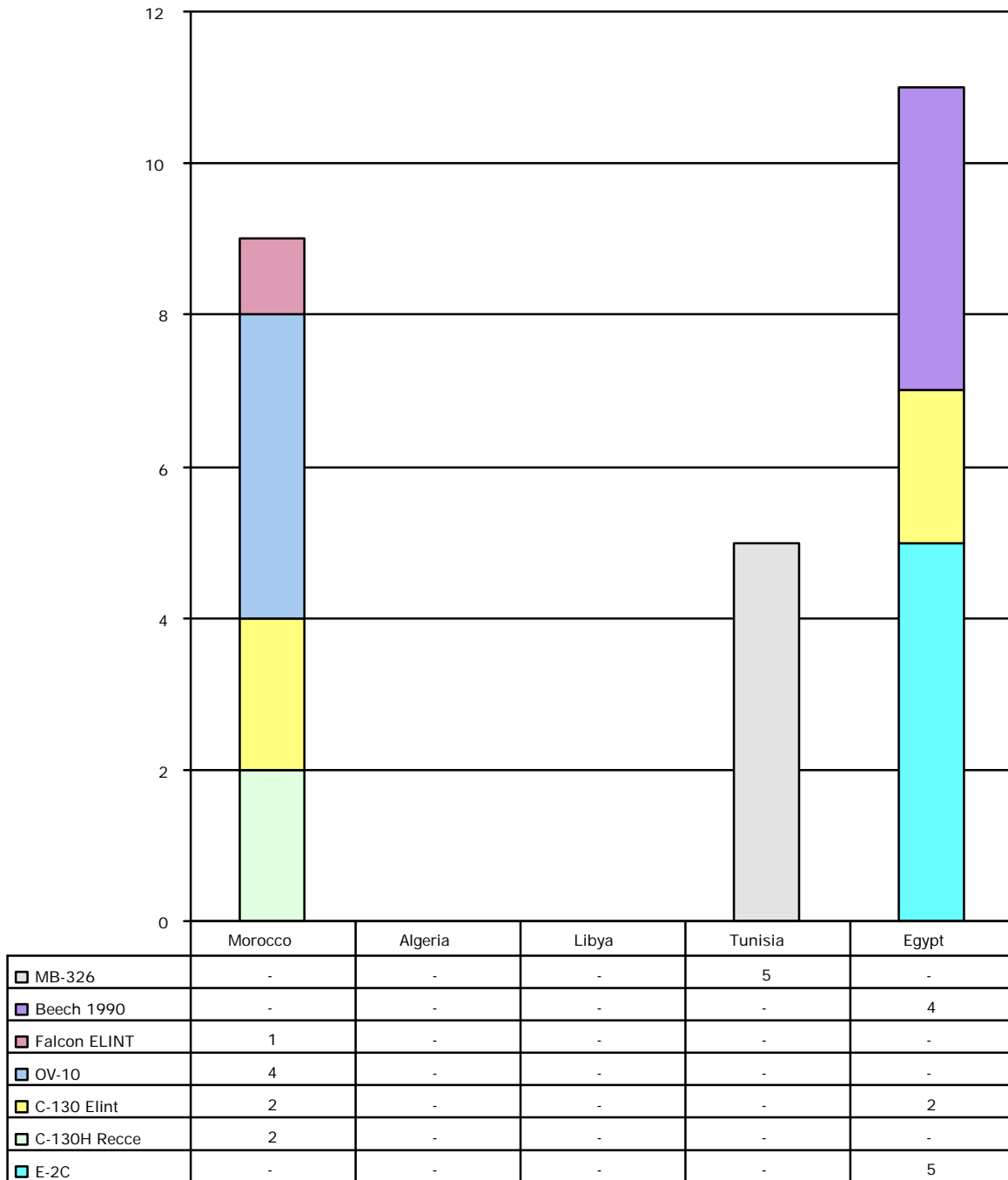
(Does not include Light Attack and COIN, Combat Capable Trainers, or Aircraft in Storage)



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various editions.

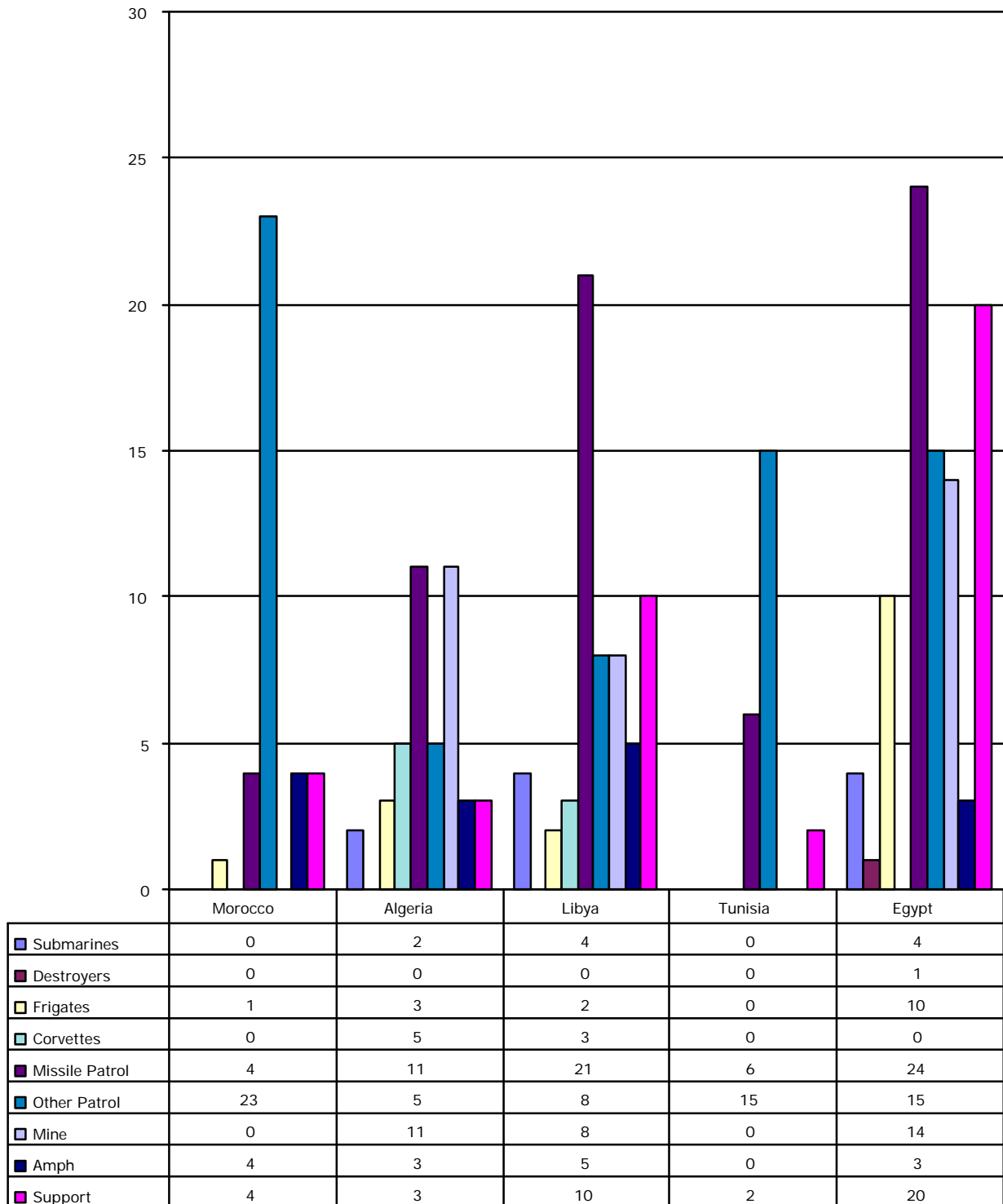
## North African Active AEW, ELINT and Electronic Warfare Aircraft by Type in 1999-2000

(Does not include Combat Capable Trainers or Aircraft in Storage)



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various editions.

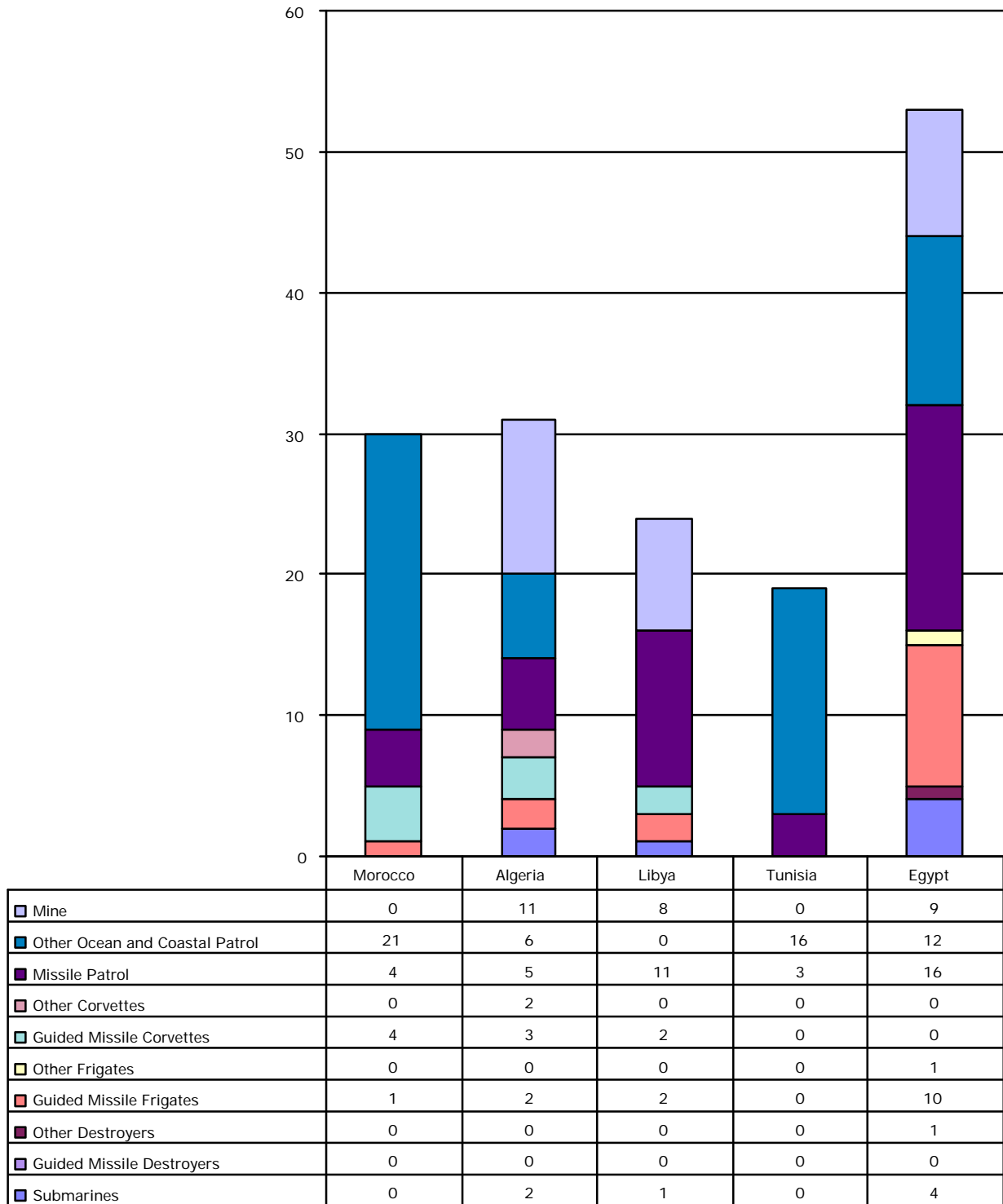
## North African Naval Ships in Active Inventory by Category in 1999-2000



Adapted by Anthony H. Cordesman from the IISS, Military Balance and Jane's Fighting Ships, various editions.

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## North African Major Active Combat Ships in 1999-2000

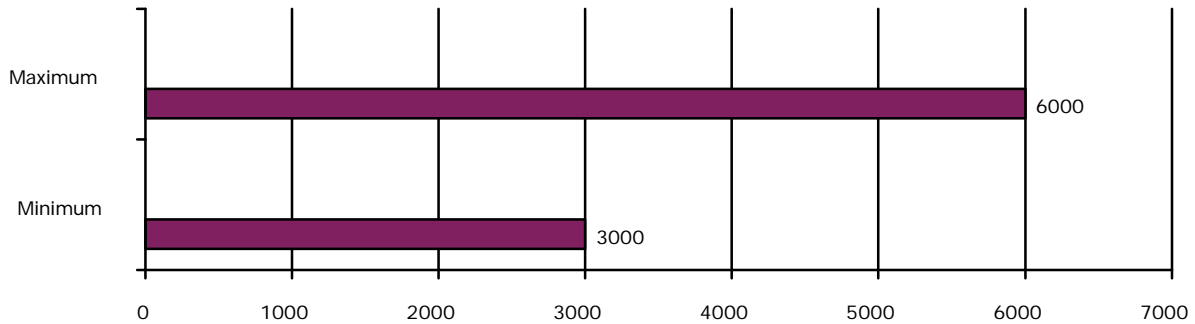


Adapted by Anthony H. Cordesman from the IISS, Military Balance, 1999-2000 and Jane's Fighting Ships, 1999-2000.

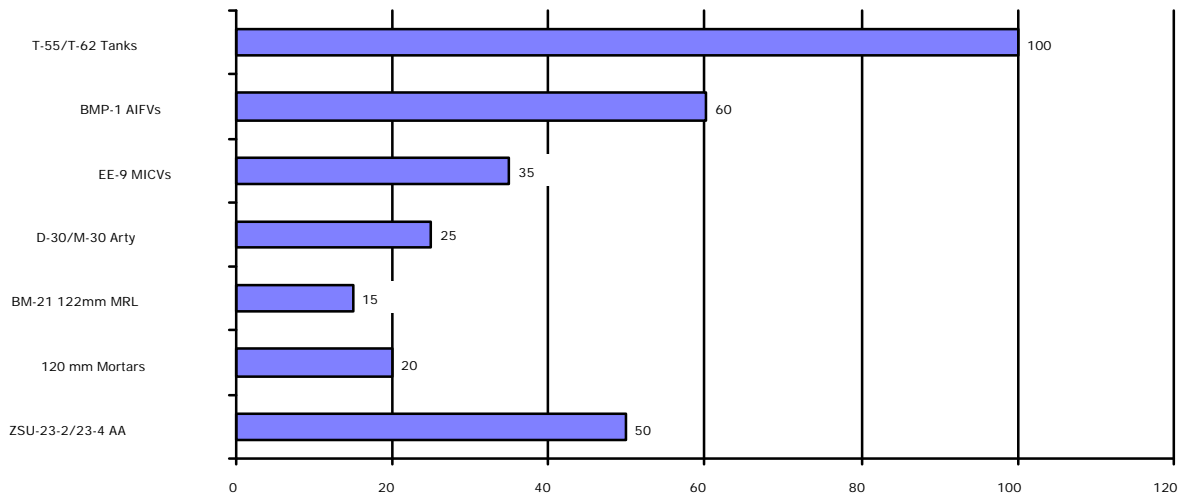
## Polisario Forces in 2000

(Sahrawi People's Liberation Army)

### Manpower



### Weapons



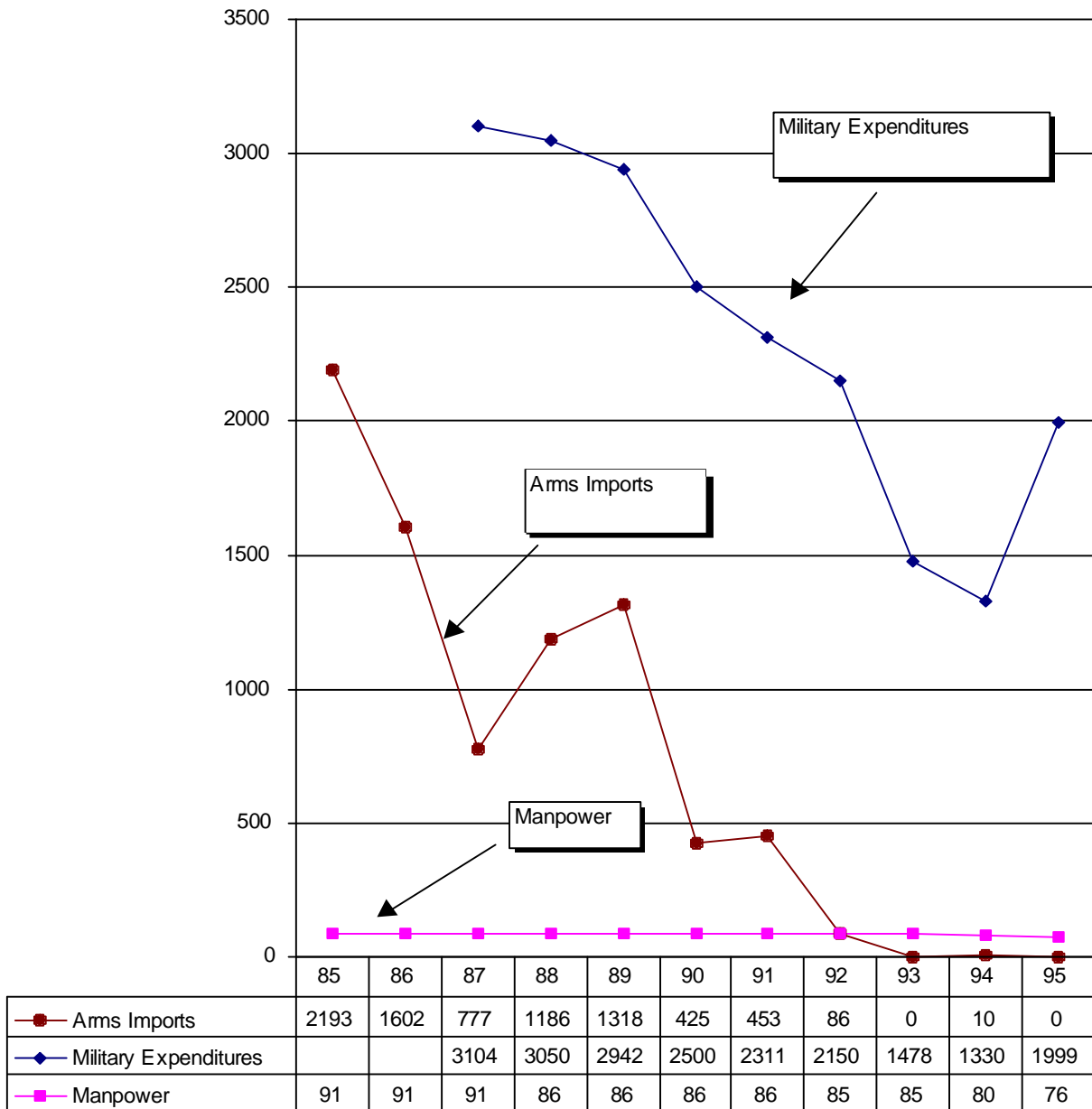
### Other Equipment: Numbers Unknown

- Steyr SK-105 Light. Tanks
- Panhard APCs
- Ratel 20 AFVs
- Eland armored reconnaissance vehicles
- AML-90
- AT-3 Sagger anti-tank guided missiles
- SA-6, SA-7, SA-8, SA-9 surface-to-air missiles

Source: Adapted by Anthony H. Cordesman from data provided by US experts, the IISS, [Military Balance](#), and Jane's [Sentinel](#).

## The Decline in Libyan Spending and Arms Imports: 1984-1995

(\$95 Constant Millions)



Source: Adapted by Anthony H. Cordesman from US Arms Control and Disarmament Agency, World Military Expenditures and Arms Transfers, GPO, Washington, various editions.

# **Part Five**

## **The Arab-Israel States**

## The Warfighting Capabilities of the Individual “Ring” States Judged By Western Standards: Part One

<u>Capability &amp; Quality</u>	<u>US</u>	<u>Israel</u>	<u>Syria</u>	<u>Jordan</u>	<u>Egypt</u>	<u>Lebanon</u>
<u>Active Manpower</u>						
• Officer quality	VG-E	G-E	P-VG	M-E	P-E	N
• NCO Quality	VG-E	G	P-M	M-E	P-E	N
• Enlisted quality	G-VG	G-VG	VP-M	M-G	P-M	N
<u>Reserve Manpower</u>						
• Officer quality	G	G-VG	P	M	P	N
• NCO Quality	G	G	P	P	P	N
• Enlisted quality	G	G	VP	P	VP	N
<u>Combined operations</u>	VG	VG	VP	P	P	N
<u>Land Forces</u>						
• Combined arms	G-VG	G-VG	P-M	M	P-M	N
• Advanced Maneuver	VG-E	G-VG	P-M	M	P-M	N
• Armored Warfare	VG	VG	P-M	M	P-M	N
• Infantry Warfare	G	G	P-VG	G	P-G	N-M
• Advanced Artillery	E	G	P	P	P-G	N
• Heliborne	VG	VG	P-M	P	P-M	N
• Advanced Night	VG	VG	P	P	P	N
• Unconventional	VG	E	M-E	M	M-E	N
• C4I/BM	E	VG	P	P	P-M	N
• Sustainability	VG	VG	P	M	P-M	N
• Standardization	E	VG	M	P	VP-M	N
• Interoperability	E	VG	P	M	P-M	N
<u>Naval Forces</u>						
• Combined Operations	VG-E	M	VP	N	VP	N
• Anti-Ship Missile	G-E	G	P-M	N	P-M	N
• ASW	G-E	P	VP	N	VP	N
• Offensive Mine	P-M	P	M	N	P	N
• Defensive Mine	P	P	P	N	P	N
• Amphibious	VG	M	P	N	P	N
• C4I/BM	E	M	P	N	P	N
• Sustainability	VG	P-M	P	N	P	N
• Standardization	E	G	G	N	P	G
• Interoperability	VG	P	P	N	P	G

E = Excellent, VG = Very Good, G = Good, M = Moderate, P = Poor, VP = Very Poor, N = Negligible

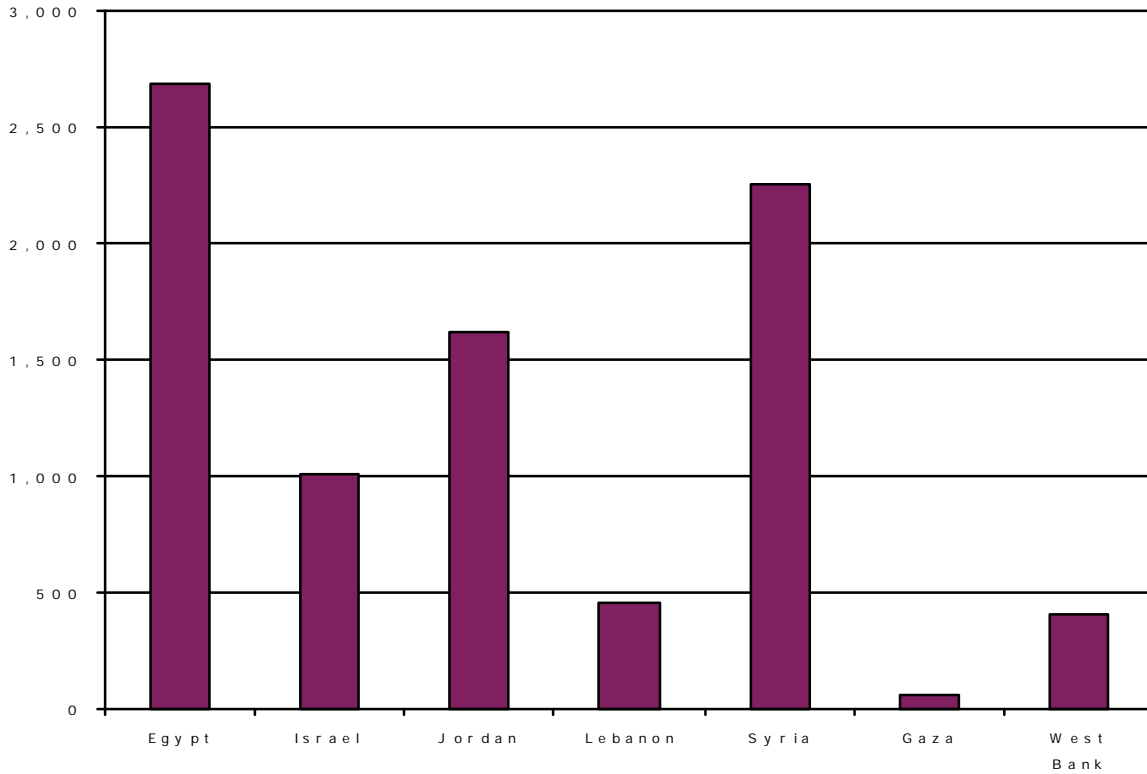
The Warfighting Capabilities of the Individual “Ring” StatesJudged By Western Standards: Part Two

<u>Capability &amp; Quality</u>	<u>US</u>	<u>Israel</u>	<u>Syria</u>	<u>Jordan</u>	<u>Egypt</u>	<u>Lebanon</u>
<u>Air Forces</u>						
• Combined Operations	E	VG	P	P	P-M	N
• Day air defense	E	E	P-G	P-G	P-VG	N
• AWX/BVR air defense	E	E	VP	N	VP-M	N
• Day attack	E	E	P	P	P-M	N
• Close support	E	VG	P	M	P-M	N
• Advanced anti-armor	VG	VG	VP	VP	VP-P	N
• Night/AWX attack	E	VG	VP	P	P-M	N
• Reconnaissance	E	E	P	P	P-M	N
• Electronic warfare	E	G	P	N	P	N
• Attack helicopter	G-E	G	P	P	P	VP
• C4I/BM	VG-E	E	VP	P-M	P-M	N
• Sustainability	VG	E	VP	P	P-M	N
• Standardization	E	E	M	P	VP-M	N
• Interoperability	VG	VG	P	P	VP-M	N
<u>Strategic Mobility</u>						
• Air	VG	M	VP	VP	P-M	N
• Sea	G	P	N	N	N	N
• Prepositioning	M	-	-	-	-	-
<u>Counterproliferation</u>						
• Missile Defense	P-M	P-M	N	N	N	N
• Bio. Offensive	N	N	P	N	P	N
• Bio. Defensive	VP-N	P	P	N	P	N
• Chem. Offensive	VP	P	M	N	P	N
• Chem. Defense	M-G	P-M	P-M	N	P	N
• Nuclear Offensive	E	E	N	N	N	N
• Nuclear Defensive	M-VP	N	N	N	N	N
• Conventional Retaliation	VG	E	P	VP	P	N

E = Excellent, VG = Very Good, G = Good, M = Moderate, P = Poor, VP = Very Poor, N = Negligible

Note: *Interoperability* refers to the Israeli ability to interoperate broadly with other Gulf and Western forces, and Arab country ability to operate flexibly with other Arab forces. *Standardization* refers to whether equipment pool in a given service in given country is standardized enough to permit effective cross-service and resupply. *C4I/BM* refers to overall command, control, communications, intelligence, and battle management capabilities.

## Arab-Israeli Borders (Total Length Kilometers)



Land Boundaries in Kilometers

Egypt	-	255	-	-	-	11	-
Gaza	11	51	-	-	-	-	-
Israel	255	-	238	79	76	51	307
Iraq	-	-	181	-	605	-	-
Jordan	-	238	-	-	375	-	97
Lebanon	-	79	-	-	375	-	-
Libya	1,150	-	-	-	-	-	-
Saudi Arabia	-	-	728	-	-	-	-
Sudan	1,273	-	-	-	-	-	-
Syria	-	76	375	375	-	-	-
Turkey	-	-	-	-	822	-	-
West Bank	-	307	97	-	-	-	-
<b>Total</b>	<b>2,689</b>	<b>1,006</b>	<b>1,619</b>	<b>454</b>	<b>2,253</b>	<b>62</b>	<b>404</b>

Coastline

Egypt	2,450	273	26	225	193	40	-
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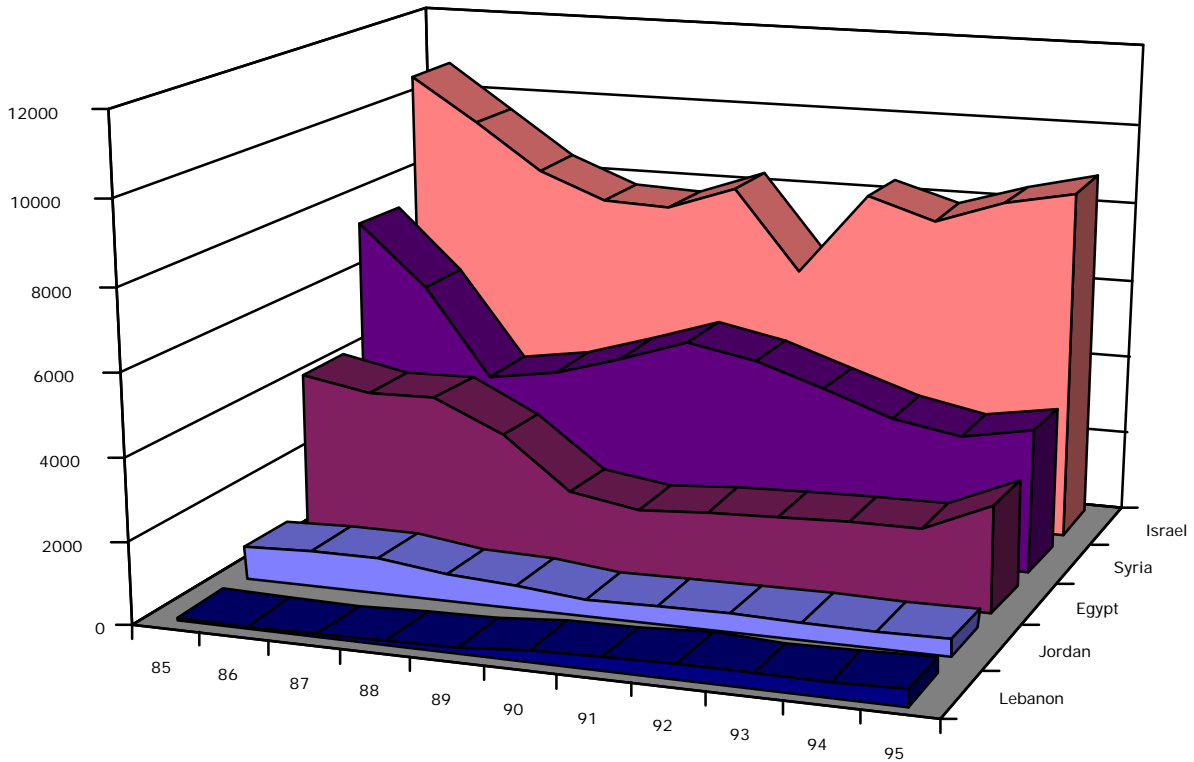
Maritime Claims in Kilometers

Contiguous	38.4	-	-	-	41	-	-
Territorial	15.2	15.2	4.8	15.2	35	-	-

Source: Adapted by Anthony H. Cordesman from CIA, World Factbook, 1996, April, 1997, CD-ROM.

## National Trends in Arab-Israeli Military Spending in Constant Dollars: The Decline in Arab Forces as a Share of Total Spending: 1985-1995

(In \$Constant Millions)



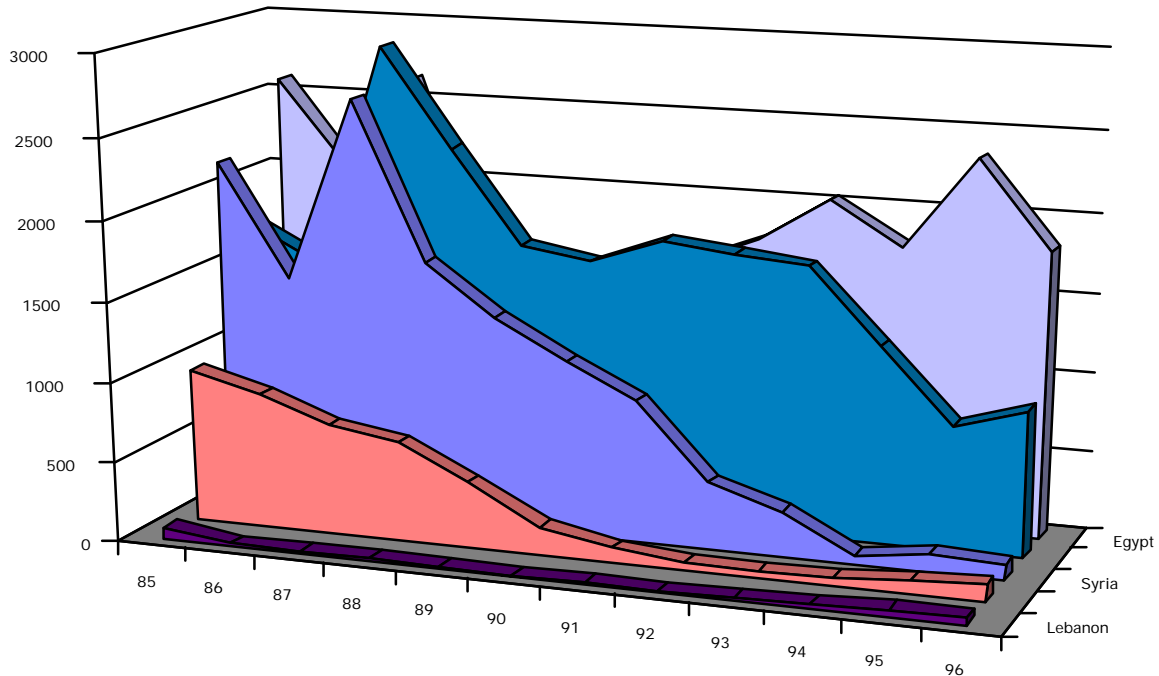
	85	86	87	88	89	90	91	92	93	94	95
■ Lebanon	100	75	75	120	150	301	319	373	344	340	410
■ Jordan	849	899	894	673	597	456	466	461	469	448	481
■ Egypt	4289	3981	3980	3208	1953	1687	1767	1840	1904	1881	2653
■ Syria	7445	5878	3727	4000	4491	5045	4730	4150	3580	3270	3563
■ Israel	10650	9554	8421	7740	7693	8237	6233	8320	7812	8376	8734

Source: Adapted by Anthony H. Cordesman from Arms Control and Disarmament Agency, "World Military Expenditures and Arms Transfers, 1995," Washington, GPO, 1996, Table I.

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## National Trends in Arab-Israeli Arms Deliveries in Constant Dollars

(\$96 Constant Millions)



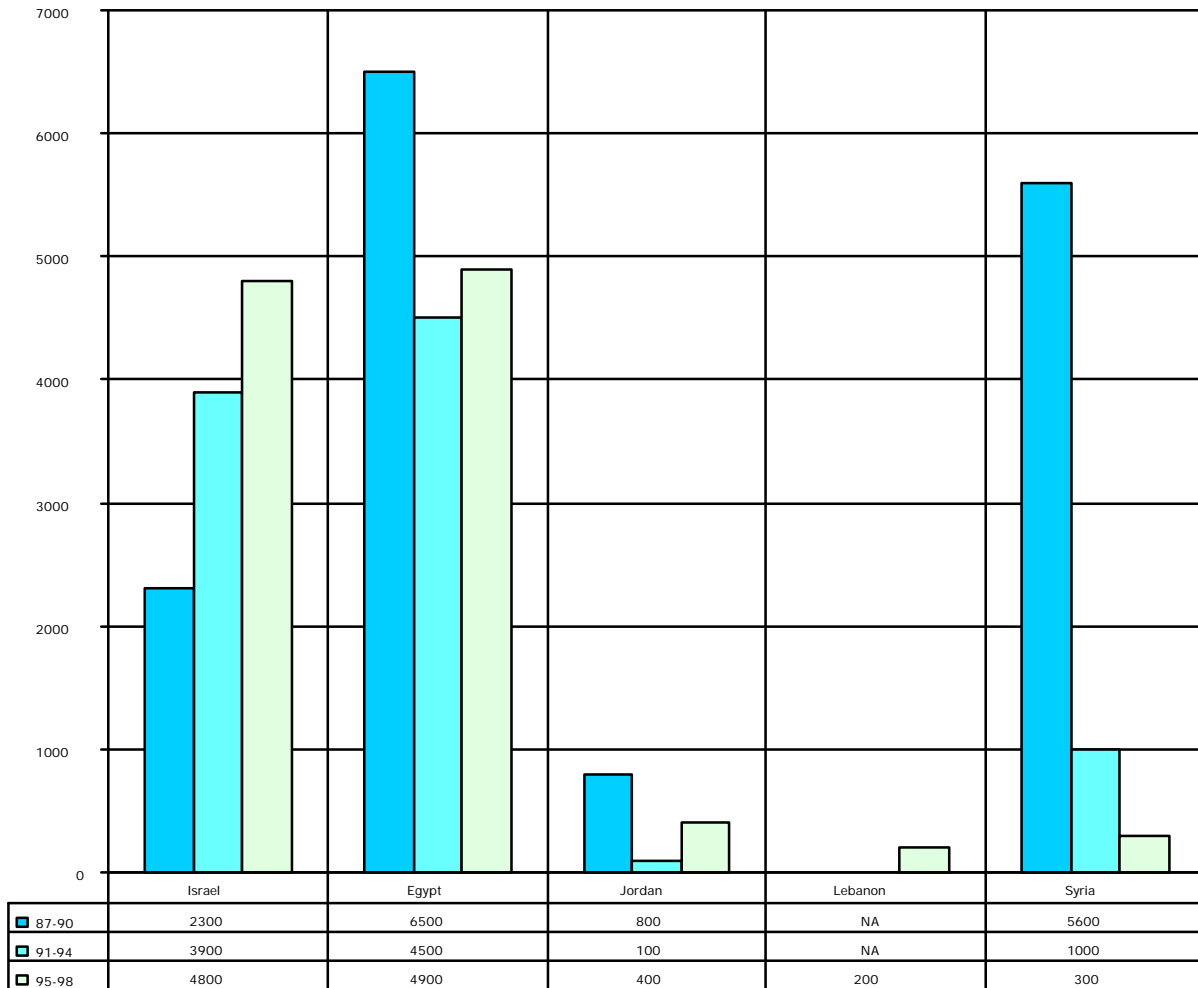
	85	86	87	88	89	90	91	92	93	94	95	96
Lebanon	74	14	13	13	6	2	6	3	11	19	41	49
Jordan	963	849	692	623	415	175	90	44	43	52	81	110
Syria	2196	1495	2635	1652	1342	1111	900	427	288	52	112	90
Israel	1720	1495	2899	2288	1708	1637	1800	1752	1707	1250	789	925
Egypt	2580	2038	2635	1398	1220	1520	1575	1752	2027	1771	2343	1800

Source: Adapted by Anthony H. Cordesman from US Arms Control and Disarmament Agency, World Military Expenditures and Arms Transfers, GPO, Washington, various editions.

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## Total New Agreements By Arab-Israeli Buyer: Before and After Gulf War

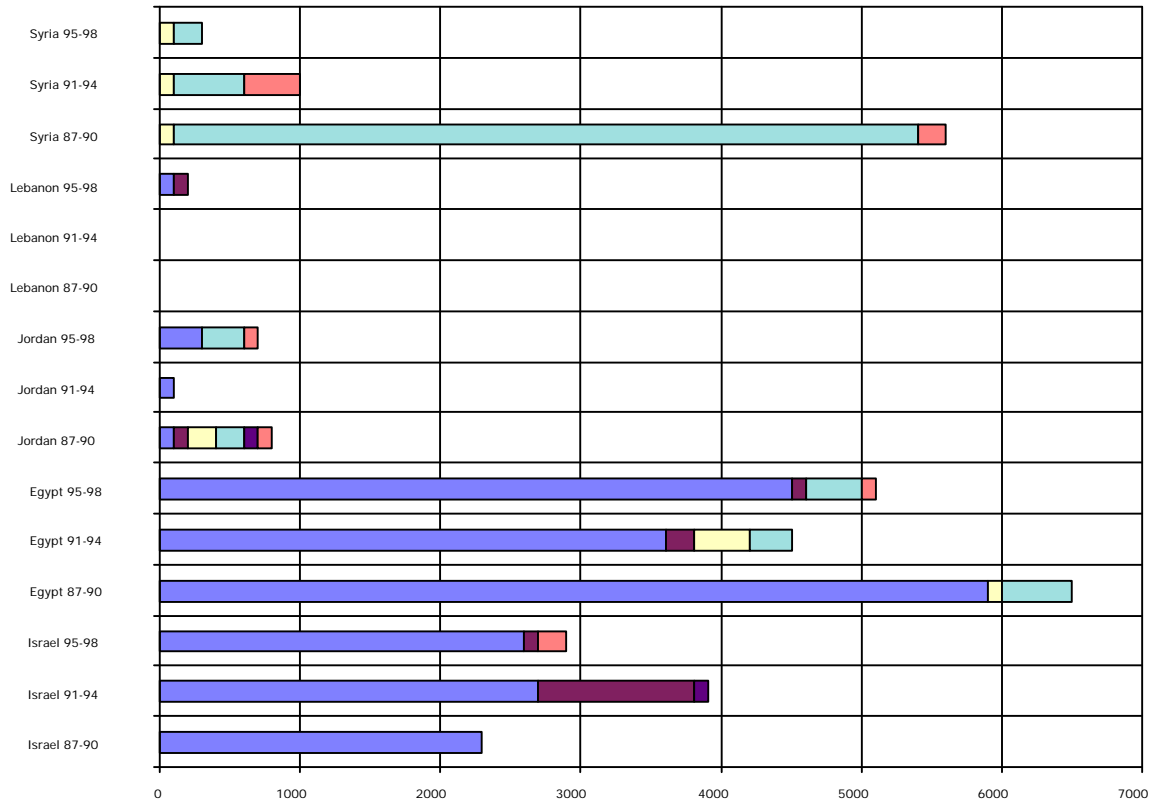
(In \$US Current Millions)



0 = less than \$50 million or nil, and all data rounded to the nearest \$100 million

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

## New Arab-Israeli Arms Orders by Supplier Country: 1987-1998 (Current Millions)



	Israel 87-90	Israel 91-94	Israel 95-98	Egypt 87-90	Egypt 91-94	Egypt 95-98	Jordan 87-90	Jordan 95-98	Lebano n 87-90	Lebano n 91-94	Lebano n 95-98	Syria 87-90	Syria 91-94	Syria 95-98
All Others	0	0	200	0	0	100	100	100	0	0	0	200	400	0
China	0	100	0	0	0	0	100	0	0	0	0	0	0	0
Russia	0	0	0	500	300	400	200	300	0	0	0	5300	500	200
All Other European	0	0	0	100	400	0	200	0	0	0	0	100	100	100
Major West European	0	1100	100	0	200	100	100	0	0	0	100	0	0	0
US	2300	2700	2600	5900	3600	4500	100	300	0	0	100	0	0	0

0 = less than \$50 million or nil, and all data rounded to the nearest \$100 million

Source: Adapted by Anthony H. Cordesman, CSIS, from Richard F. Grimmert, Conventional Arms Transfers to the Developing Nations, Congressional Research Service, various editions.

## The Comparative Size of US Military Assistance and Commercial Arms Sales to the Arab-Israeli Ring States: 1986-1996 - Part One

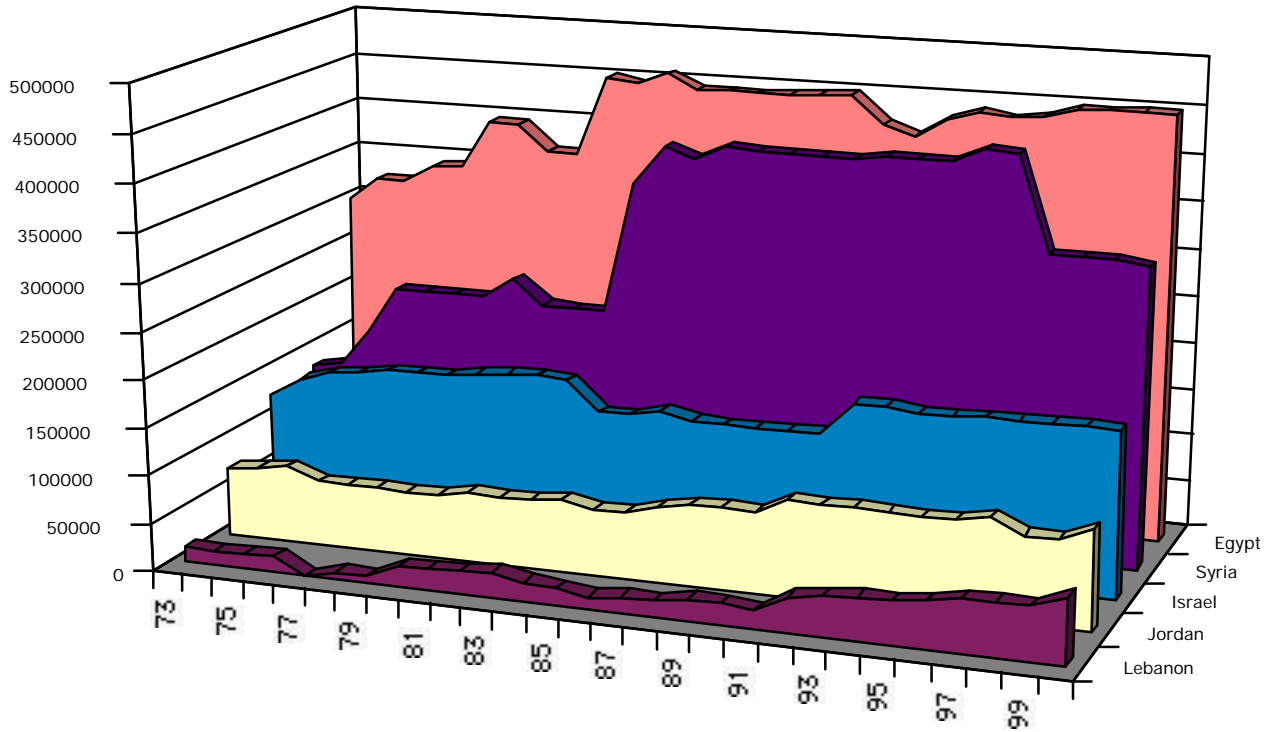
	<u>87</u>	<u>88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>
<u>Israel</u>											
Foreign Military Financing Program	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0
Payment Waived	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0	1,800.0
FMS Agreements	100.5	130.9	327.7	376.7	361.4	98.4	163.3	221.4	664.8	883.3	524.9
Commercial Sales	1,024.8	474.8	997.2	387.3	169.1	27.9	41.8	33.96	14.2	7.7	32.2
FMS Construction Agreements	-	-	-	-	-	-	-	-	-	-	-
FMS Deliveries	1,229.6	754.1	230.3	146.3	239.0	720.6	782.0	446.6	329.1	388.2	504.2
MAP Program	-	-	-	74.0	43.0	47.0	491.1	166.0	80.0	22.0	-
MAP Deliveries	-	-	-	-	114.7	0.6	44.7	-	-	-	2.0
IMET Program/Deliveries	1.9(0)	1.7(0)	1.9(0)	2.1(0)	1.1(0.2)	0.6(0)	0.5(0)	0.8(0)	0.8(0)	-	-
<u>Egypt</u>											
Foreign Military Financing Program	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0
Payment Waived	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0
FMS Agreements	330.9	1306.1	2646.3	969.5	1,631.7	631.5	447.3	443.0	1,051.7	1,397.7	1,065.5
Commercial Sales	55.4	73.1	252.5	206.0	75.6	31.0	18.7	9.6	3.7	1.7	3.2
FMS Construction Agreements	112.4	118.8	65.1	48.2	269.7	107.5	14.0	1.4	15.4	61.6	21.4
FMS Deliveries	955.1	473.0	296.8	368.1	482.3	1,026.7	1,238.6	890.0	1,536.4	1,112.4	1,180.7
MAP Program	-	-	-	-	-	-	-	13.5	-	-	.
MAP Deliveries	-	-	-	-	-	-	-	1.4	-	-	.
IMET Program/Deliveries	1.7	1.5	1.5	1.5	1.8	1.5	1.7	0.8	1.0	1.0	1.0

The Comparative Size of US Military Assistance and Commercial Arms Sales to the Arab-Israeli Ring States: 1986-1996 - Part Two

	<u>87</u>	<u>88</u>	<u>89</u>	<u>90</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>
<u>Jordan</u>											
Foreign Military Financing Program	-	-	10.0	67.8	20.0	20.0	9.0	9.0	7.3	100.3	30.0
Payment Waived	-	-	10.0	67.8	20.0	20.0	9.0	9.0	7.3	100.3	30.0
DoD Guaranty	81.3	-	-	-	-	-	-	-	-	-	-
FMS Agreements	33.9	28.7	9.4	26.7	0.4	6.9	15.6	39.1	15.0	216.6	18.3
Commercial Sales	73.4	18.3	23.5	12.1	0.9	2.0	1.3	1.0	1.4	3.2	3.3
FMS Deliveries	49.7	55.4	59.5	42.1	22.9	19.5	25.0	31.5	47.0	15.7	52.3
MAP Deliveries	1.1	0.8	-	-	0.4	-	0.1	-	-	16.0	20.8
IMET Program/ Deliveries	1.9	1.7	1.9	2.1	1.1	0.6	0.5	0.8	1.0	1.2	1.7
<u>Lebanon</u>											
FMS Agreements	4.9	0.5	-	-	-	-	3.4	29.7	65.0	16.1	22.0
Commercial Sales	0.1	0	0.2	0.1	0.5	0.4	0.9	0.8	0.4	0.1	0.1
FMS Deliveries	12.1	11.9	3.9	2.0	0.3	1.3	4.9	3.6	40.9	31.7	33.0
IMET Program/ Deliveries	-	0.3	0.3	0.1	-	-	0.5	0.3	0.4	0.4	0.5
<u>Syria</u>											
FMS Agreements	-	-	-	-	-	-	-	-	-	-	-
Commercial Sales	-	-	-	-	-	-	-	-	-	-	-
FMS Deliveries	-	-	-	-	-	-	-	-	-	-	-

Source: Adapted from US Defense Security Assistance Agency (DSAA), "Foreign Military Sales, Foreign Military Construction Sales and Military Assistance Facts", Department of Defense, Washington, various editions.

### Total Arab-Israeli Active Military Manpower: 1973-2000

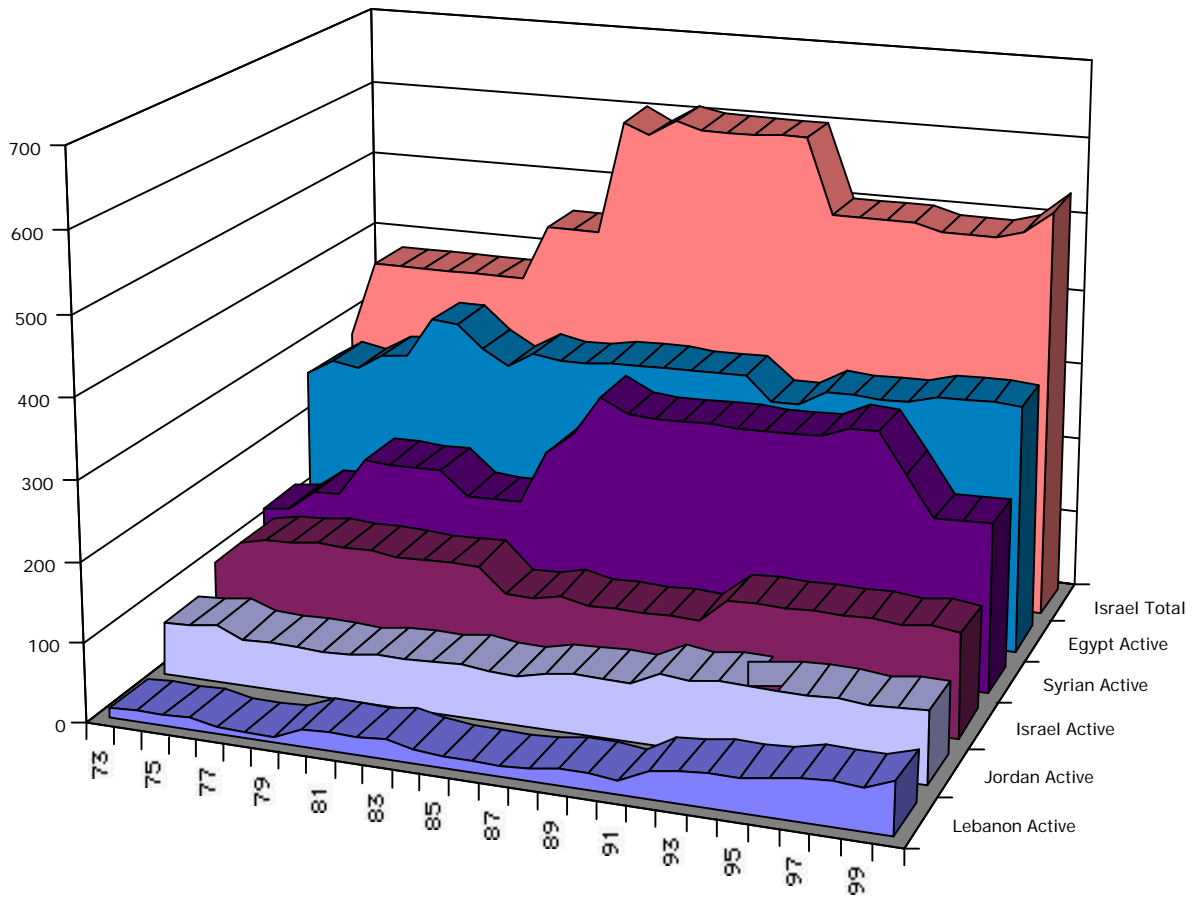


	73	75	78	80	82	85	87	89	92	94	96	99
Lebanon	15250	15300	7800	23000	23750	17400	16700	22300	36800	44300	48900	55,100
Jordan	72,850	80,250	67,200	67,500	72,800	70300	80300	85250	99400	98600	98650	90,000
Israel	125000	156000	164000	169600	174000	142000	141000	141000	175000	172000	175000	175000
Syria	132,00	177,50	227,50	247,50	222,50	402,50	407,50	404,00	408000	408000	421000	320000
Egypt	298000	322500	395000	367000	452000	445000	445000	448000	410000	440000	440000	450000

Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various years. Some data adjusted or estimated by the author.

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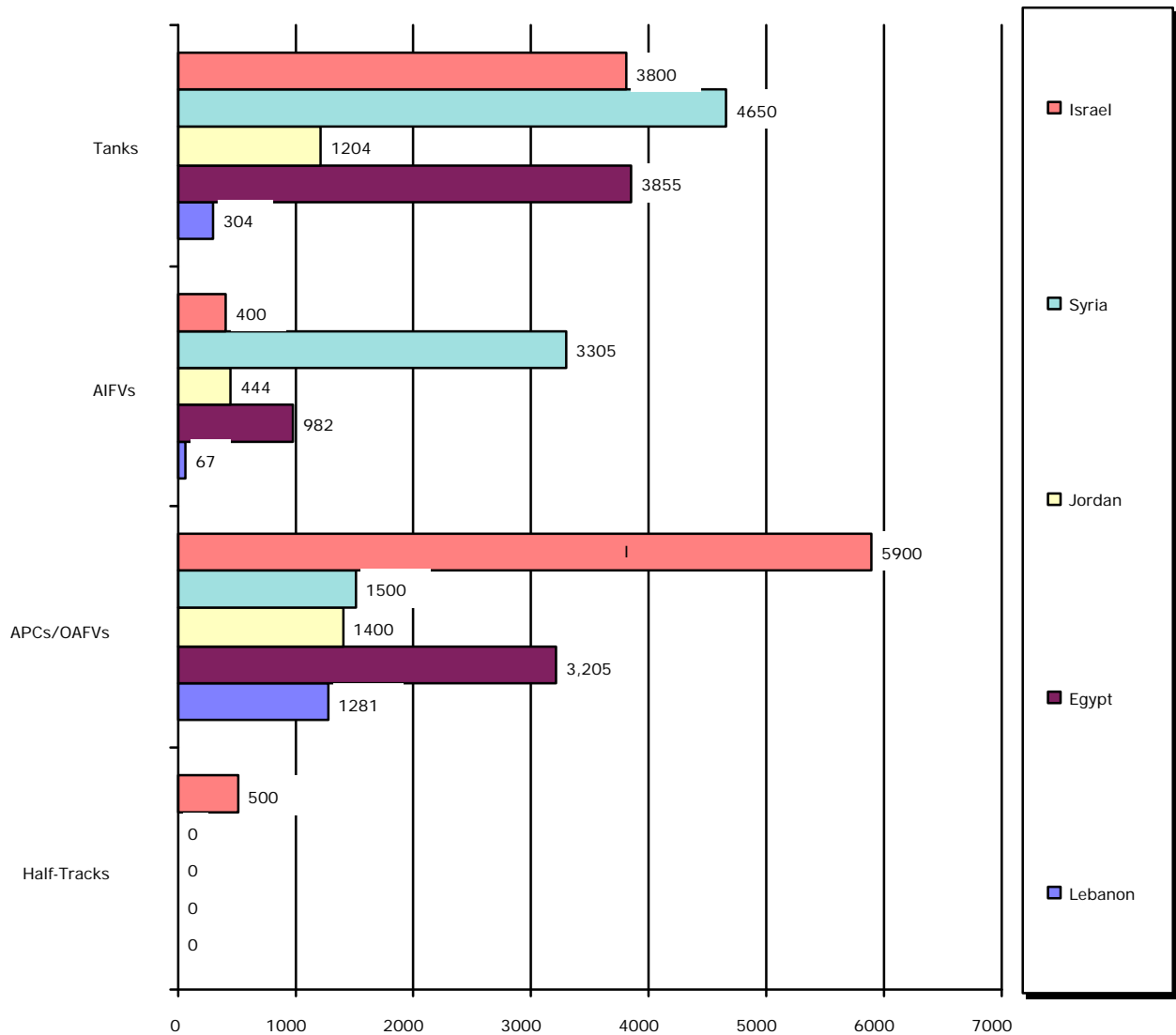
## Arab Active versus Israeli Mobilized Army Manpower: 1973-2000



	73	75	76	78	79	81	82	84	85	87	89	90	92	93	95	96	98	99
Lebanon Active	14	14	17	7	8	22.3	22.3	19	15	15	21	21	35.7	40	43	47.4	54	53.3
Jordan Active	68	75	61	61	60	65	65	68	63.8	70	74	74	85	90	90	90	87	90
Israel Active	94.5	135	135	138	138	135	135	104	104	104	104	104	134	134	134	134	131	134
Syrian Active	120	150	150	200	200	170	170	240	270	300	300	300	300	300	315	315	215	215
Egypt Active	260	275	295	350	350	300	320	315	320	320	320	320	290	310	310	310	320	320
Israel Total	275	375	375	375	375	450	450	600	584	598	598	598	499	499	499	490	490	499

Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various years. Some data adjusted or estimated by the author.

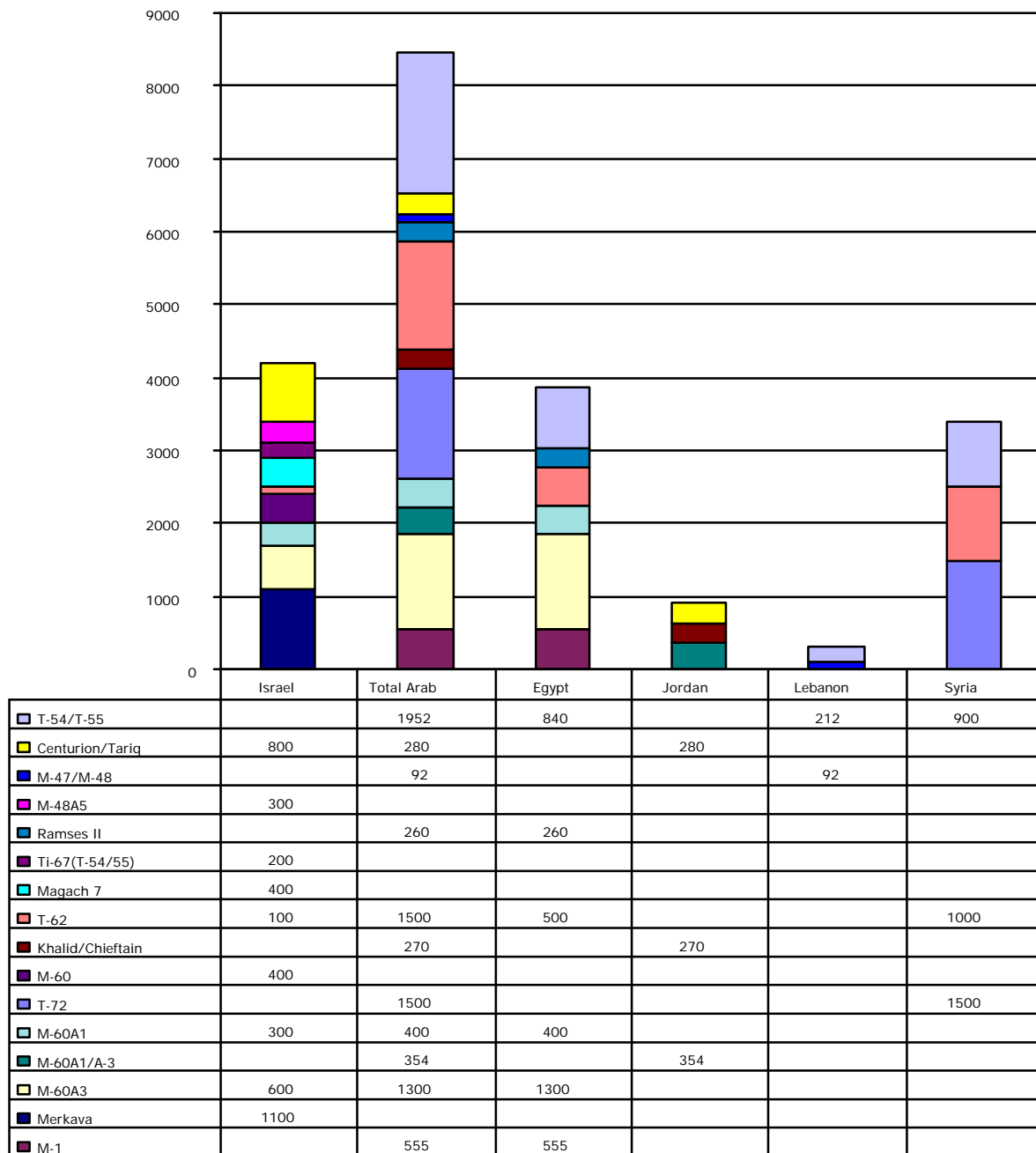
### Arab-Israeli Armored Forces in 2000



	Half-Tracks	APCs/OAFVs	AIFVs	Tanks
Israel	500	5900	400	3800
Syria	0	1500	3305	4650
Jordan	0	1400	444	1204
Egypt	0	3,205	982	3855
Lebanon	0	1281	67	304

Source: Prepared by Anthony H. Cordesman, based upon discussions with US experts.

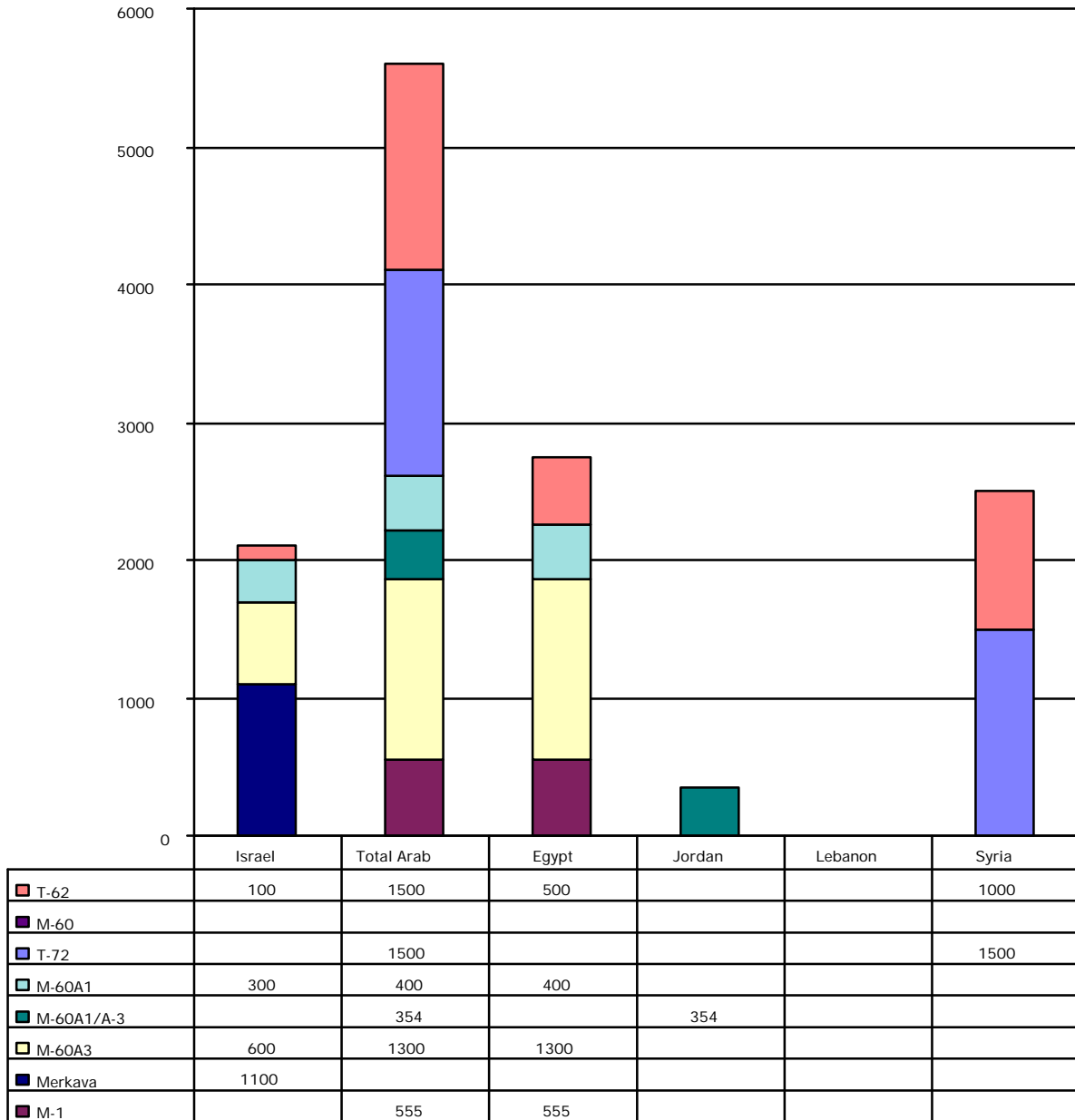
## Israel Versus Egypt, Syria, Jordan, and Lebanon: Operational Tanks by Type



Note: The totals include large numbers of vehicles that are in storage or are fixed in place. In 2000, these included 300 M-47/M-48A5s for Jordan, 1,200 tanks for Syria and an unknown number for Egypt, Israel, and Lebanon. Adapted from the IISS, Military Balance, various years. Some data adjusted or estimated by the author. Data differ significantly from estimated by US experts.

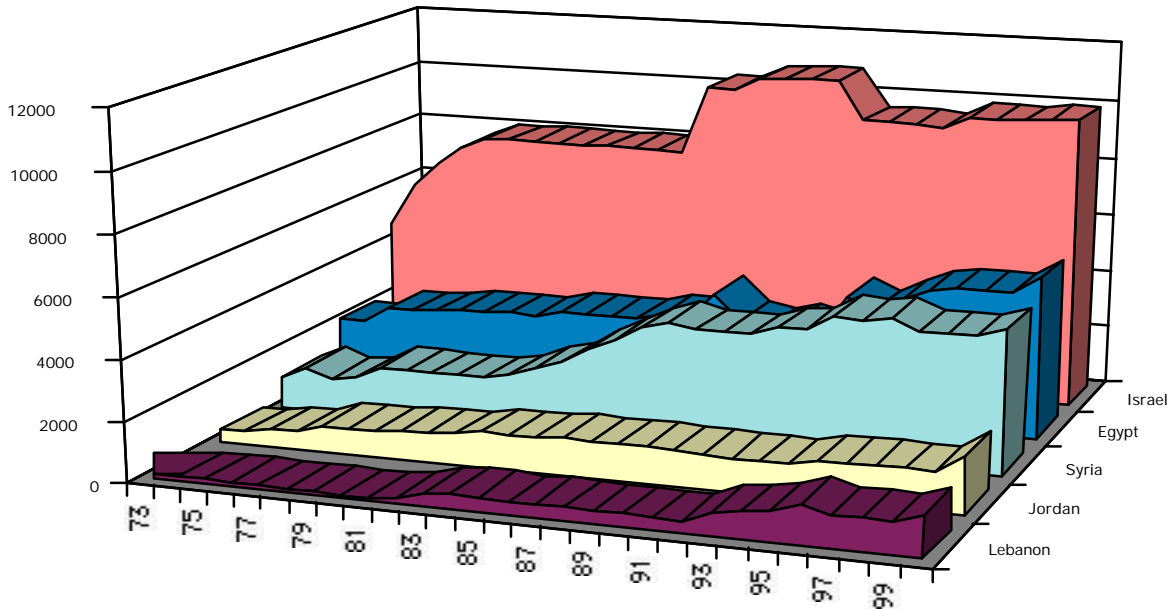
## Israel Versus Egypt, Syria, Jordan, and Lebanon: High Quality Tanks by Type

(High Quality Tanks include T-62s, T-72s, M-60s, M-1s, Merkavas)



Adapted from the IISS, Military Balance, various years. Some data adjusted or estimated by the author. Data differ significantly from estimated by US experts.

## Arab-Israeli Other Armored Fighting Vehicles (Lt. Tanks, AFVs, APCs, Scouts, Recce, OAFVs): 1973-2000



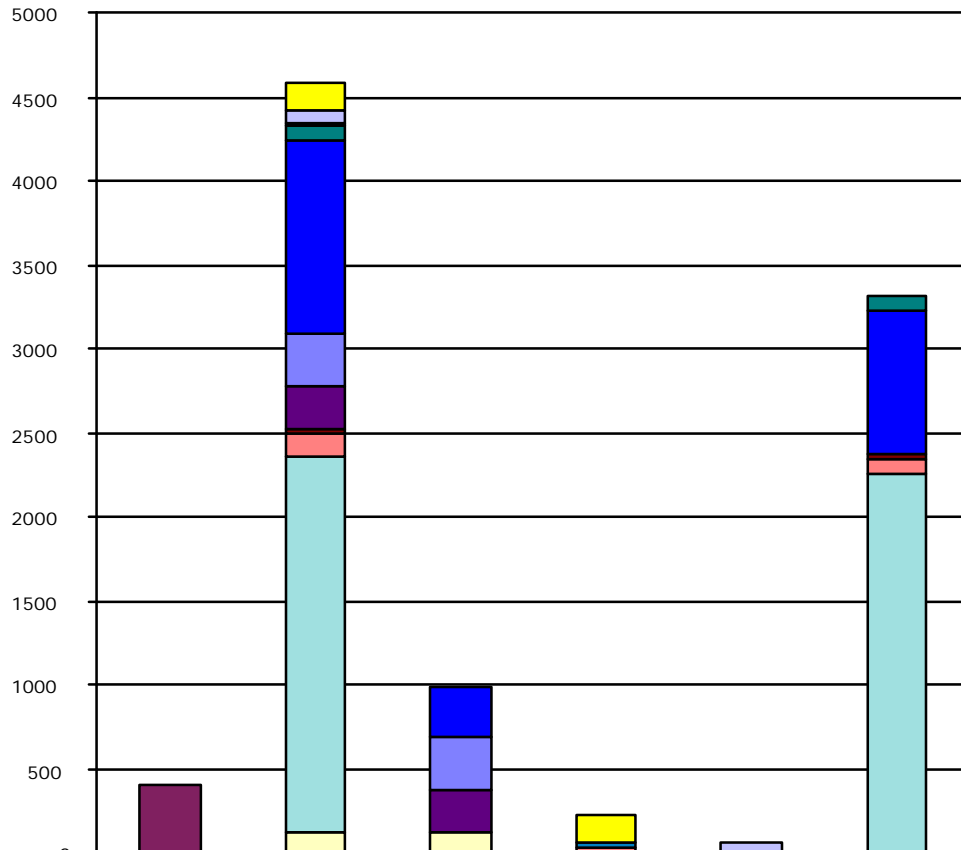
	73	75	77	79	81	83	85	87	89	91	93	95	97	99
Lebanon	80	139	111	80	80	418	490	470	417	382	754	1025	1080	1080
Jordan	400	580	860	870	952	1182	1182	1230	1259	1160	1125	1304	1324	1324
Syria	1100	1170	1700	1700	1700	2200	3000	3900	3950	3950	4300	4750	4510	4510
Egypt	2075	2630	2700	2780	2780	3030	3000	3230	3235	3290	4345	4389	4941	4941
Israel	4600	6965	8000	8000	8000	8000	8000	1030	1078	1078	9480	9400	9800	9880

Note: Includes APCs, scouts cars, half-tracks, mechanized infantry fighting vehicles, reconnaissance vehicles and other armored vehicles other than tanks. The totals include large numbers of vehicles that are in storage or not operational. In 2000, they included 3,000-3,500 half tracks for Israel, 220 BMP-1s and 1,075 BTR-60/OT-62s for Egypt, and an unknown number for Lebanon, and Syria.

Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, various years. Some data adjusted or estimated by the author

## Israel Versus Egypt, Syria, Jordan, and Lebanon: “True AFVs”

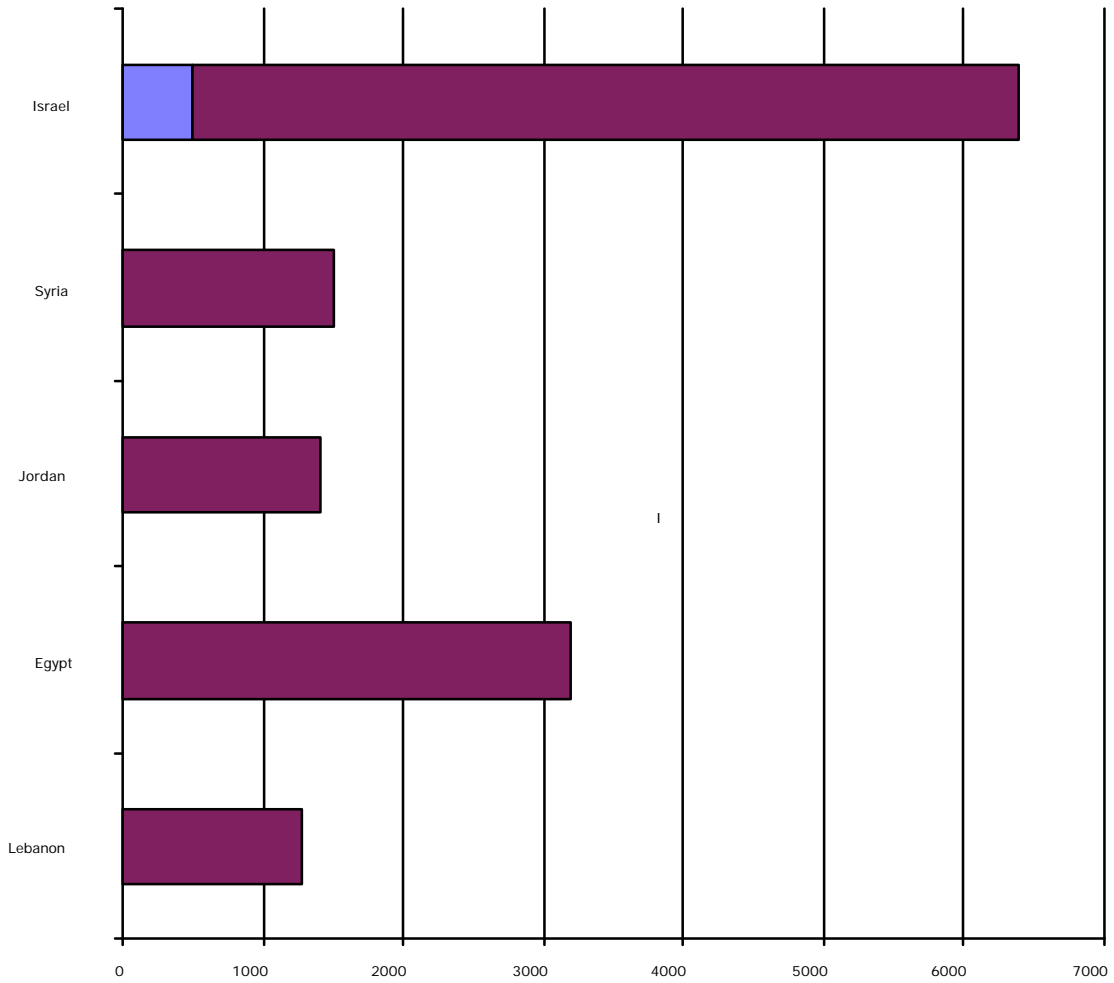
(AFVs include Light Tanks, MICVs, AIFVs, and Reconnaissance)



	Israel	Total Arab	Egypt	Jordan	Lebanon	Syria
■ Ferret		170		170		
■ AML-90		67			67	
■ Scorpion		19		19		
■ BDRM-2 Rkh		85				85
■ BDRM-2		1150	300			850
■ YPR-765		310	310			
■ BMR-600P		260	260			
■ BMP-3		25				25
■ BMP-2		135		35		100
■ BMP-1		2250				2250
■ Commando Scout		112	112			
■ Ramta, RBY, BDRM	400					

Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance. Some data adjusted or estimated by the author on the basis of comments by US experts.

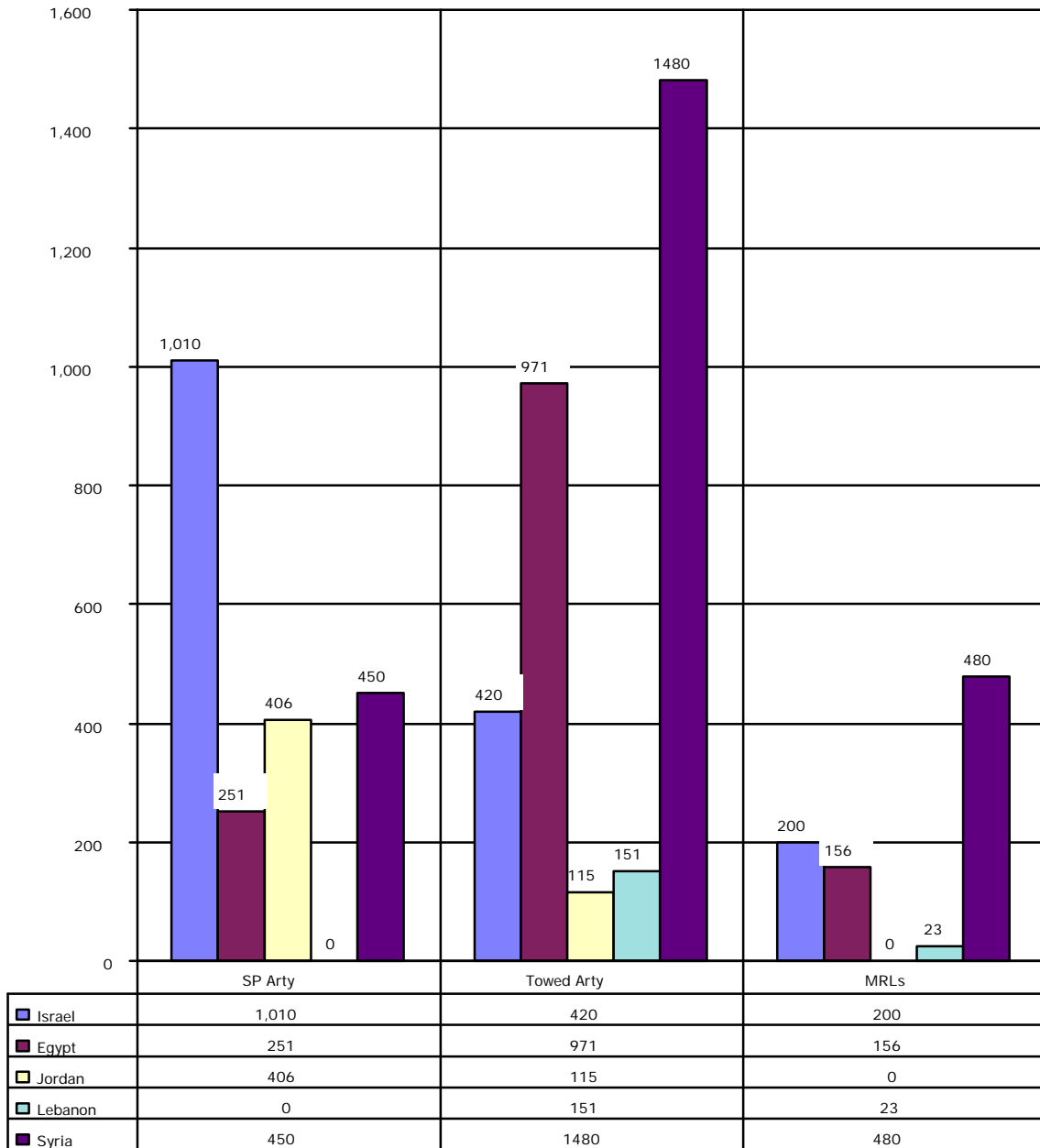
### Operational Arab-Israeli Armored Personnel Carriers in 2000



	Lebanon	Egypt	Jordan	Syria	Israel
APCs/OAFVs	1281	3,205	1400	1500	5900
Half-Tracks	0	0	0	0	500

Includes APCs, scouts cars, half-tracks, mechanized infantry fighting vehicles, reconnaissance vehicles and other armored vehicles other than tanks. The totals do not include large numbers of vehicles that are in storage or not operational. In 2000, they included 3,000-3,500 half tracks for Israel, 1,075 BTR-60/OT-62s for Egypt, and an unknown number for Lebanon, and Syria  
 Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance. Some data adjusted or estimated by the author on the basis of comments by US experts.

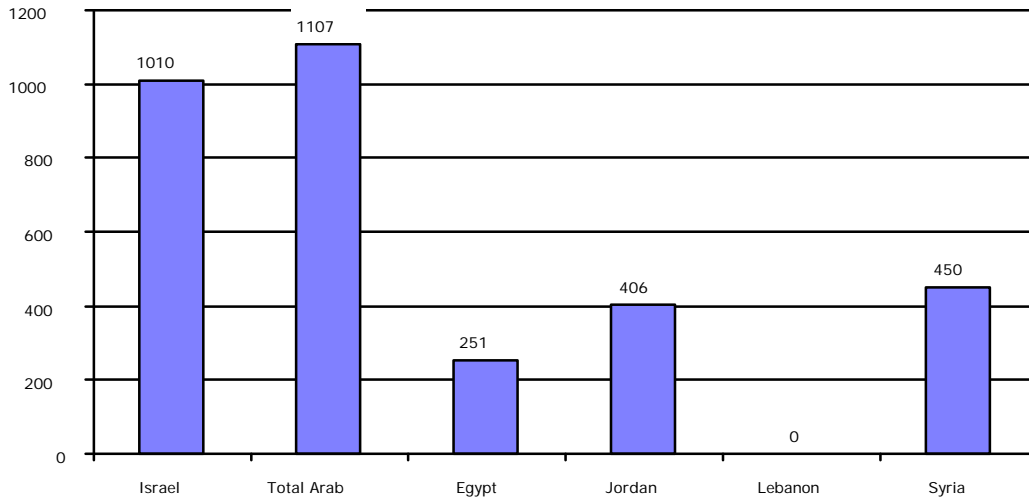
### Arab-Israeli Artillery Forces by Category of Weapon in 2000



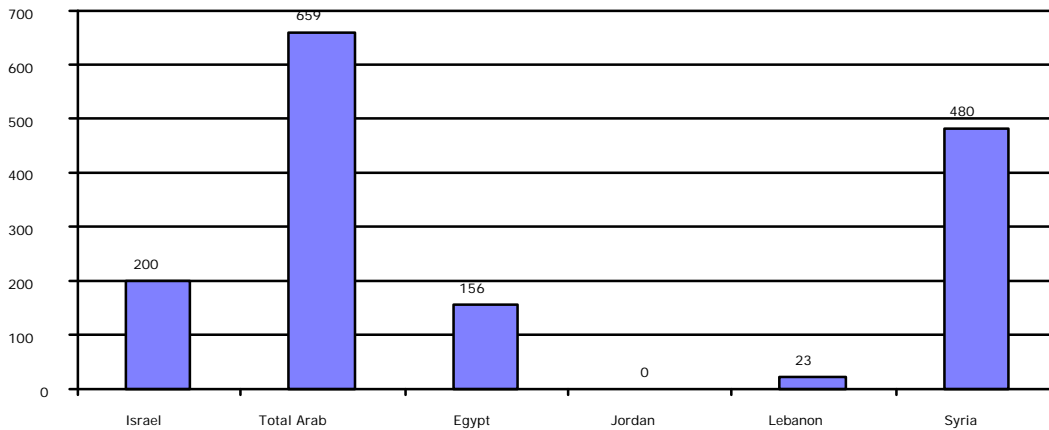
Source: Prepared by Anthony H. Cordesman, based upon the IISS Military Balance and discussions with US experts.

## Israel Versus Egypt, Syria, Jordan, and Lebanon: High Performance Artillery in 2000

### Modern Self Propelled Artillery

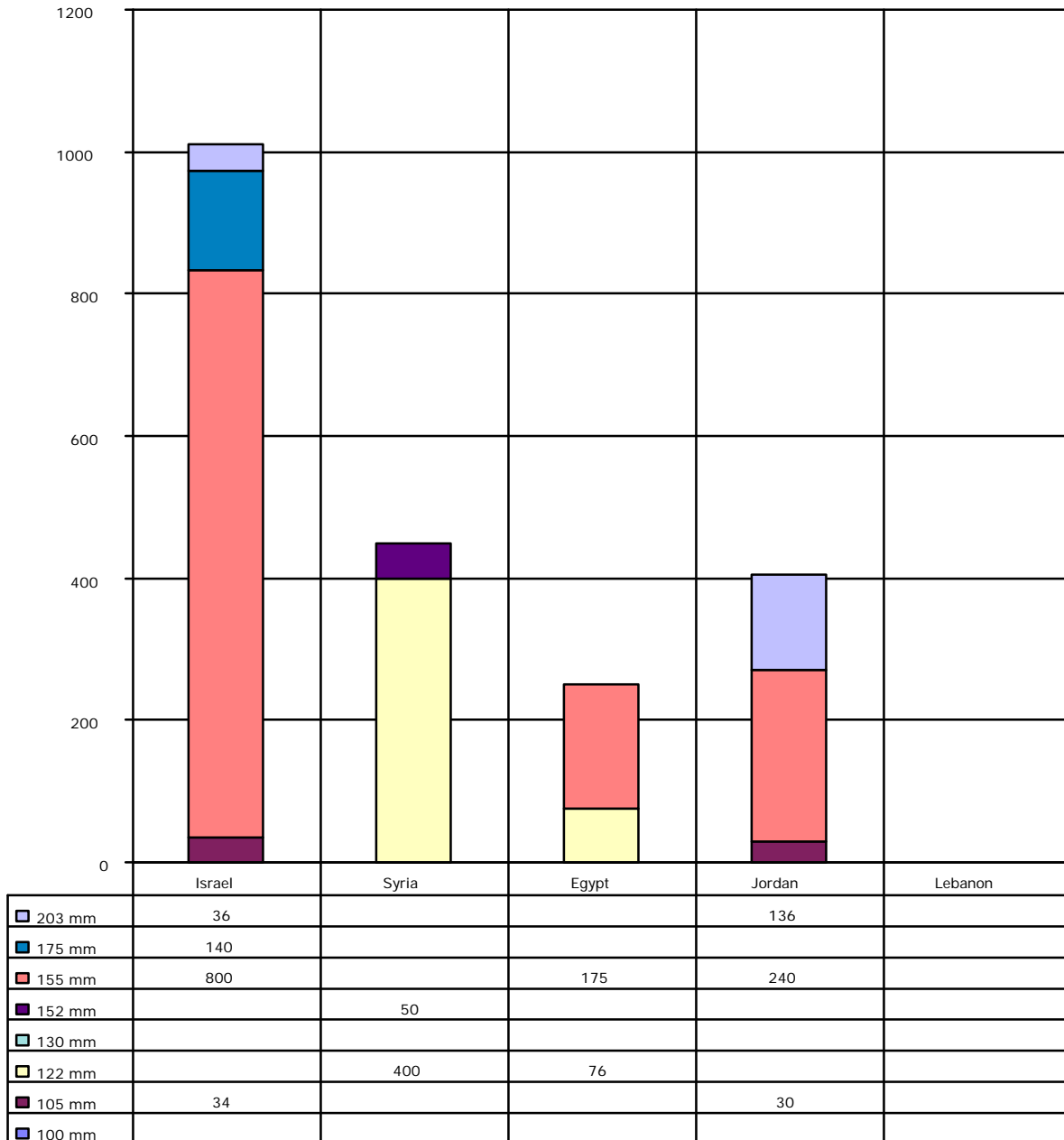


### Multiple Rocket Launchers



Source: Prepared by Anthony H. Cordesman, based upon the IISS [Military Balance](#) and discussions with US and regional experts.

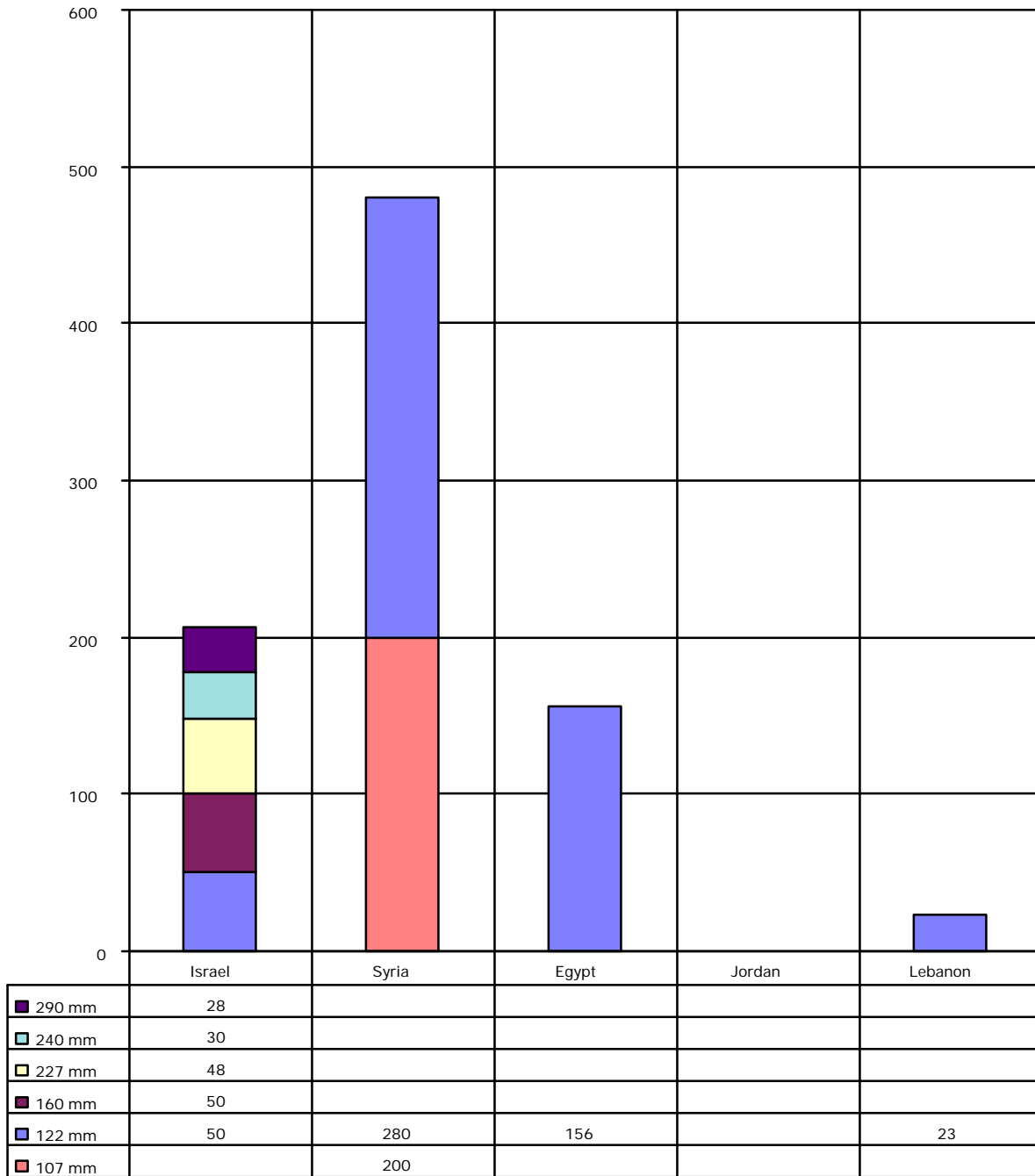
### Arab-Israeli Self-Propelled Artillery By Caliber in 2000



Note: Israel is phasing out its 175-mm weapons.

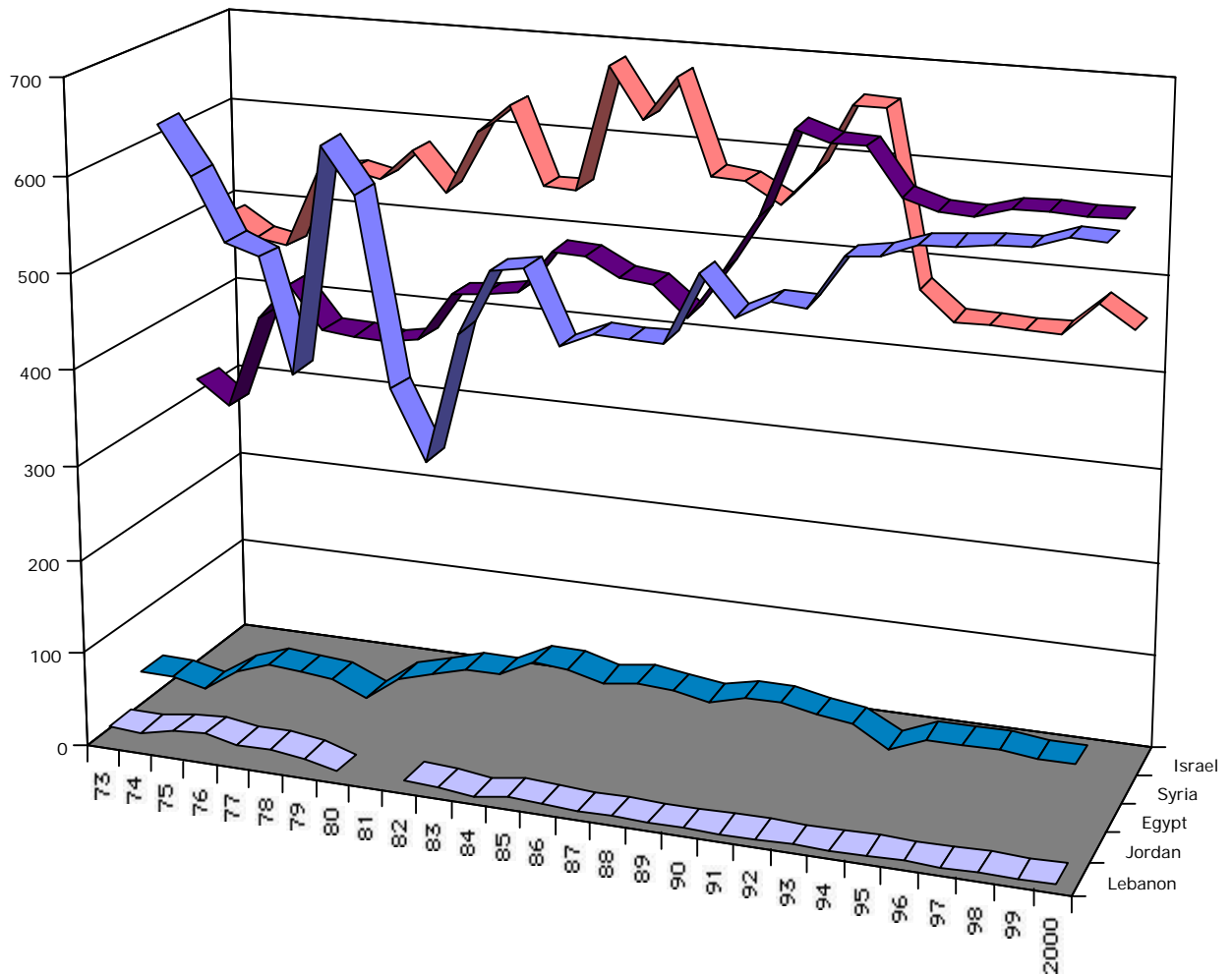
Source: Prepared by Anthony H. Cordesman, based upon the IISS Military Balance and discussions with US and regional experts.

### Arab-Israeli Multiple Rocket Launchers By Caliber in 2000



Source: Prepared by Anthony H. Cordesman, based upon the IISS Military Balance and discussions with US and regional experts.

Trends in Total Arab-Israeli Combat Aircraft: 1973-2000

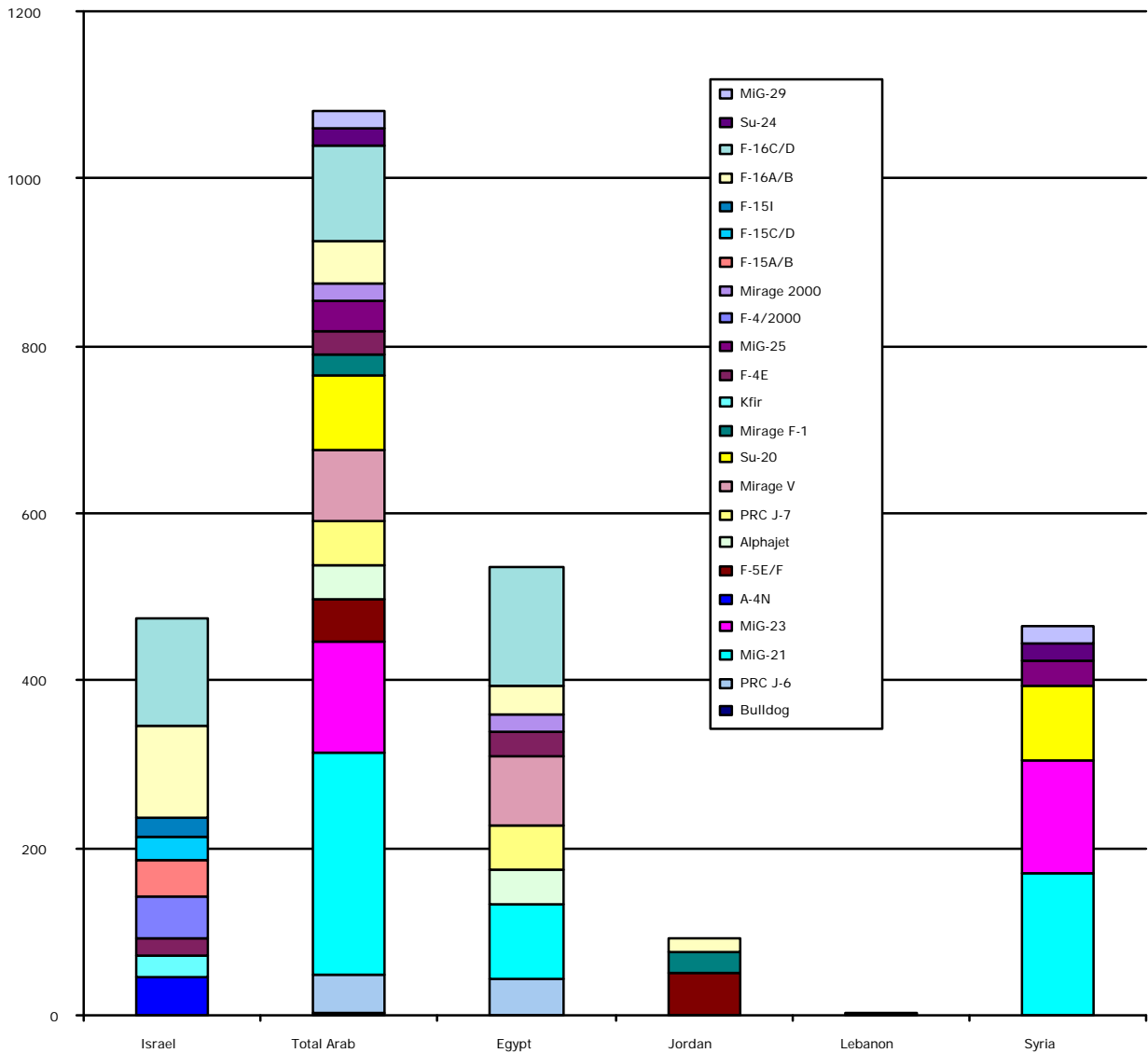


	73	74	76	77	78	80	81	82	84	85	86	88	89	90	92	93	94	96	97	98	2000
Lebanon	18	18	27	21	21	7		8	3	7	5	4	3	3	3	3	3	3	3	3	3
Jordan	52	50	66	78	76	58	84	94	103	121	119	114	111	104	113	106	102	97	97	97	93
Egypt	620	568	488	368	612	363	290	429	504	427	443	441	517	475	492	546	551	567	572	572	583
Syria	326	300	440	395	392	395	448	450	503	500	483	448	499	558	639	639	591	579	589	589	589
Israel	488	466	543	549	543	535	602	634	550	684	629	577	574	553	662	662	478	449	448	448	459

Source: Prepared by Anthony H. Cordesman, based upon the IISS Military Balance and discussions with US and regional experts.

## Total Operational Arab-Israeli Combat Fighter, Attack, Bomber, FGA and Reconnaissance Aircraft by Type in 2000

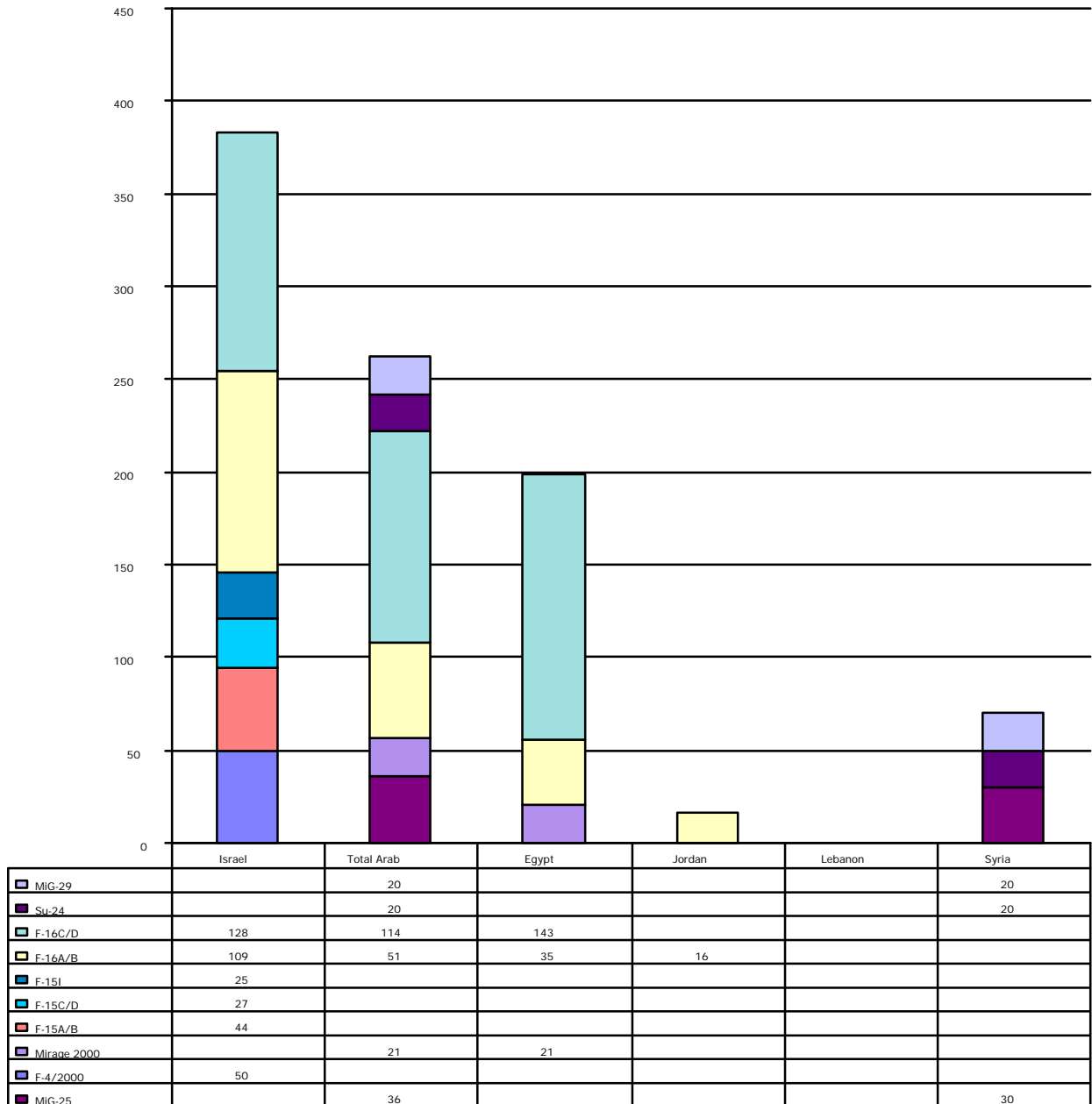
(Does not include stored, recce, unarmed electronic warfare and AC&W, trainer, and armored transport aircraft)



Source: Prepared by Anthony H. Cordesman, based upon the IISS Military Balance and discussions with US and regional experts.

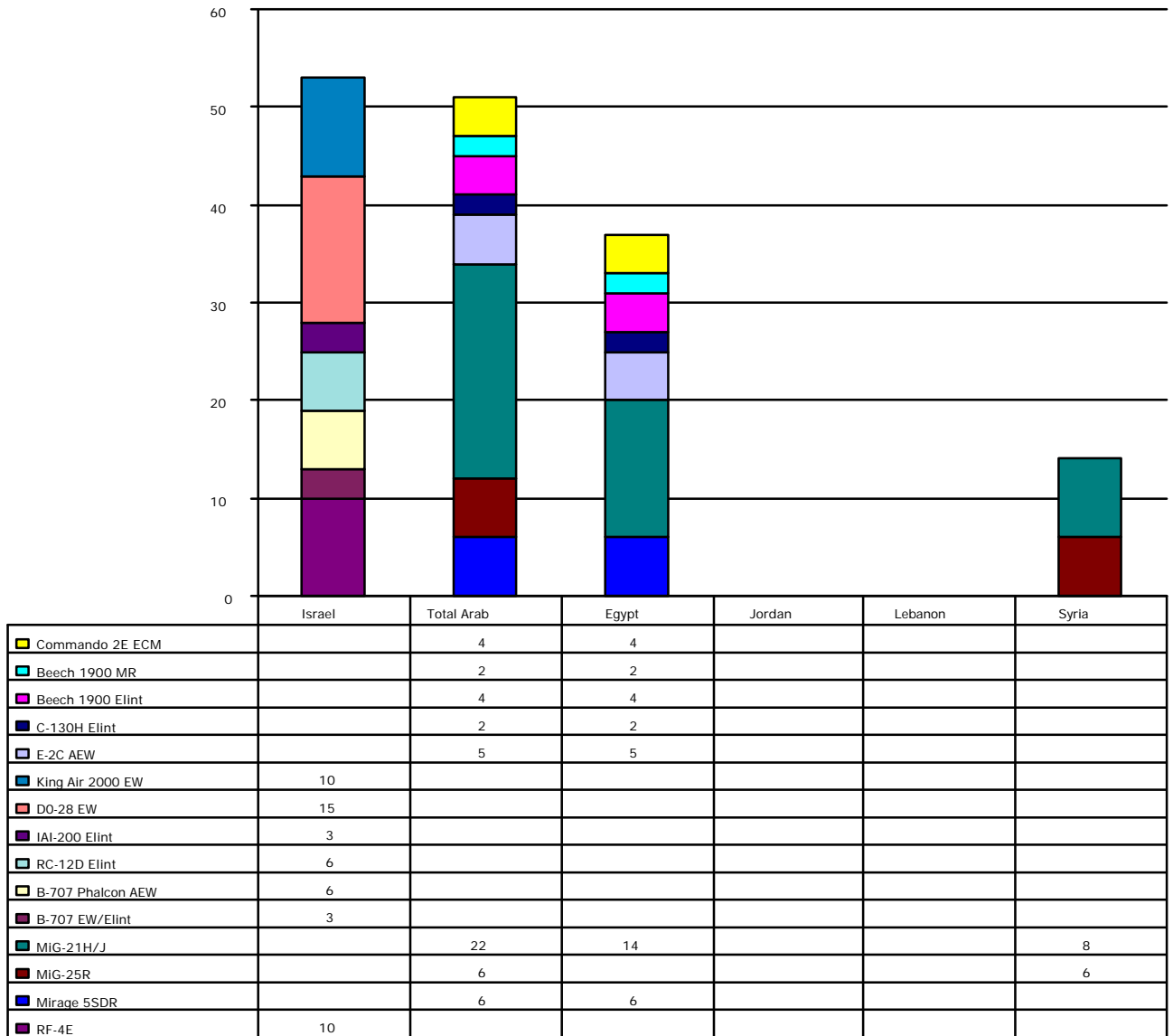
## High Quality Operational Arab-Israeli Combat Aircraft in 2000

(Does not include recce, stored, unarmed electronic warfare and AC&W, trainer, and armored transport aircraft)



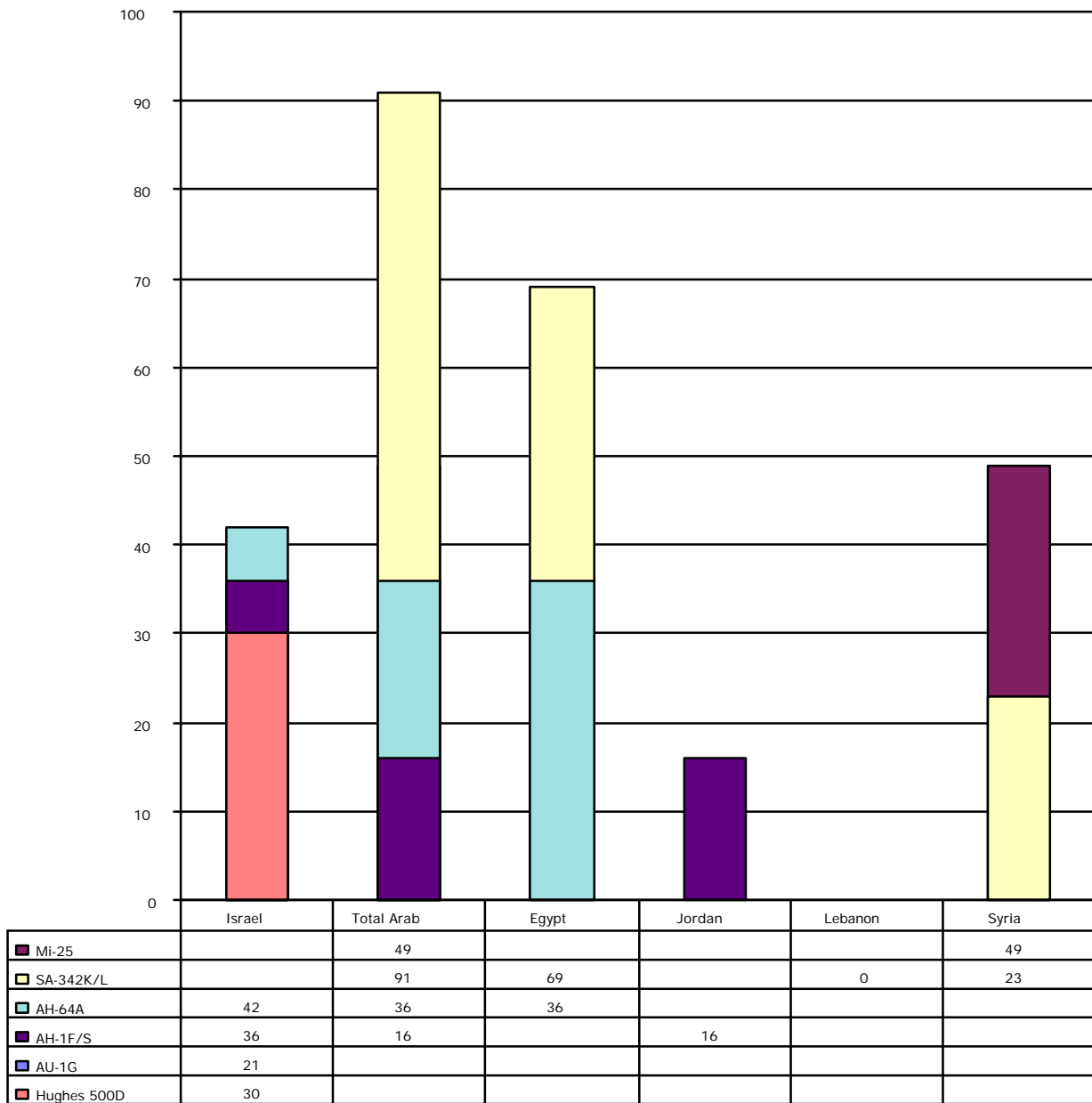
Source: Prepared by Anthony H. Cordesman, based upon the IISS [Military Balance](#) and discussions with US and regional experts.

## Unarmed Fixed and Rotary Wing Recce, Electronic Warfare, and Intelligence Aircraft in 2000



Source: Prepared by Anthony H. Cordesman, based upon the IISS [Military Balance](#) and discussions with US and regional experts..

## Operational Arab-Israeli Attack and Armed Helicopters in 2000



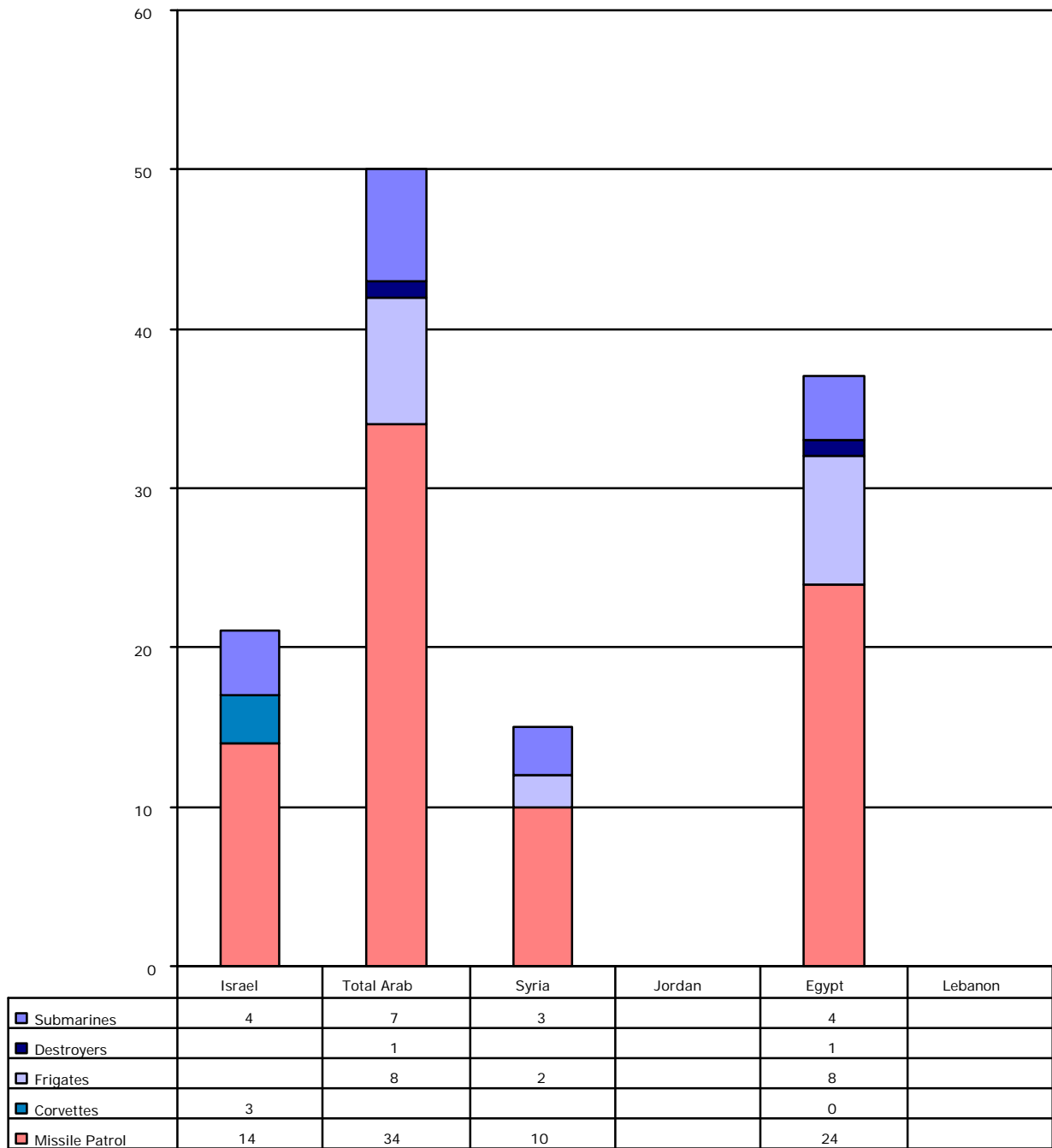
Source: Prepared by Anthony H. Cordesman, based upon the IISS [Military Balance](#) and discussions with US and regional experts.

## Arab-Israeli Land-Based Air Defense Systems in 2000

<u>Country</u>	<u>Major SAM</u>	<u>Light SAM</u>	<u>AA Guns</u>
<u>Egypt</u>	664 launchers 40/282 SA-2 53/212 SA-3 14/56 SA-6 12/78 I Hawk (4 Div./100 Btn.)	2,100 SA-7 Ayn as Saqr 20 SA-9 <u>26 M-54 Chaparral SP</u> 14/36 Crotale 18 Amoun Skyguard/ RIM-7F 36 quad SAM Ayn as Saqr  57mm, 85mm, 100mm	200 ZPU-2/4 14.5 mm 280 ZU-23-2 23mm 118 ZSU-23-4 SP 23mm 36 Sinai SP 23mm 200 M-1939 37mm 200 S-60 57mm <u>40 ZSU-57-2 SP 57mm</u> 14/- Chaparral 2000 20mm, 23mm, 37mm,  36 twin radar guided 35mm guns Sinai radar-guided 23mm guns
<u>Israel</u>	3/18 Patriot Bty. 17/102 I Hawk Bty.	250 Stinger 1,000 Redeye <u>8/48 Chaparral</u> 8 Stinger Bty. (IAF)	850 20 mm: including 20mm, Vulcan, TCM-20, M-167 35 M-163 Vulcan/ Chaparral 100 ZU-23 23mm 60 ZSU-23-4 SP M-39 37mm <u>L-70 40mm</u> 8 Chaparral Bty. (IAF)
<u>Jordan</u>	2/14/80 I Hawk	SA-7B2 50 SA-8 50 SA-13 300 SA-14 240 SA-16 250 Redeye	368 guns 100 M-163 SP 20mm 52 ZSU-23-4 SP 216 M-42 SP 40mm
<u>Lebanon</u>	None	SA-7 SA-14	20mm ZU-23 23mm 10 M-42A1 40mm
<u>Syria</u>	25 Ad Brigades 130 SAM Bty. 11/60/480 SA-2/3 11/27/200 SA-6 1/2/48 SA-5	35 SA-13 20 SA-9 <u>4,000 SA-7</u> 60 SA-8	2,060 Guns 650 ZU-23-2 400 ZSU-23-4 SP 300 M-1938 37mm 675 S-60 57mm 10 ZSU-5-2 SP 25 KS-19 100mm

Adapted by Anthony H. Cordesman from the IISS, Military Balance. Light SAMs and AA guns Weapons below line for Egypt, and Israel are weapons operated by air force.

### Arab-Israeli Major Combat Ships by Category in 2000



Adapted by Anthony H. Cordesman from the IISS, Military Balance and Jane's Fighting Ships, various editions.

## **Israeli Concerns Over Israel's Military Edge: Views Expressed in Interviews with General Itzhak Mordechai (MOD), Lt. General Amnon Lipkin-Shahak (COS), Major General Matan Vilani (DCOS), and Rear Admiral Micha Ram (Former Commander of the Navy) - Part One**

### Egypt

- “Peace with contingency plans:” Can never ignore Egyptian “front,” but can never discuss it or publicly plan for it.
- Risk of break down of peace process; radicalization of Egypt.
- Parity in many aspects of equipment, particularly tanks, AFVs, and aircraft.
- Growing understanding of C4I/BM, erosion of Israeli edge.
- Potential problem of Patriot/SA-10 upgrade of air defenses.
- E-2C, electronic warfare, F-16, BVR missile air defenses.
- Knowledge of US methods and tactics, experience gained in training with US forces.
- Lessons of Gulf War.
- Ability to use commercial satellite technology.

### Hizbollah/Proxy War in Lebanon

- Improved ordnance and technology. ATGMs, SHORADs, long-range rockets, mines, night vision, radio control. Added Iranian shipments and Syrian support.
- Loss of edge in LIC. Near parity in casualties, with far more sensitivity to losses on Israeli side.
- Uncertain ability to cost-effectively deter/retaliate for attacks on Israel if withdraw from security zone.
- Corruption and uncertain loyalty of much of SLA.
- Uncertain future of Syria: “Fourth front” under Syrian control?

### Iran

- No Dongs, refueling, attacks on Israel.
- Nuclear “time window”.
- Support of Hizbollah/PIJ.
- Ability to use commercial satellite technology.
- Targeting and strike challenge posed to IDF for preemption and retaliation.

### Iraq

- Can strike Israel with missiles.
- Retention of WMD capabilities, future break out.
- Retention of missiles and long-range strike aircraft.
- Break down in peace process, rapprochement with Syria and/or Jordan.
- Ability to use commercial satellite technology.
- Targeting and strike challenge posed to IDF for preemption and retaliation.

Israeli Concerns Over Israel's Military Edge: Views Expressed in Interviews with General Itzhak Mordechai (MOD), Lt. General Amnon Lipkin-Shahak (COS), Major General Matan Vilani (DCOS), and Rear Admiral Micha Ram (Former Commander of the Navy) - Part Two

Israel

- Break down of peace process; Palestinian despair.
- Problems in obtaining adequate manpower intake and retention: 1/3 no longer serve as conscripts. 15% get early out.
- Growing manpower costs.
- Caserne mentality, lack of aggressive edge. Conscripts compete to serve in rear areas, near home, not in prestige combat units.
- Bureaucratic problems: Colonels up by 17%, Brigadier Generals by 60%, Generals as a whole by 41%. High salaries and retirement bonuses for officers (Colonel earns \$5,900 a month. Retirement bonus of \$282,200 for Colonel as early as age 42.)
- Loss of readiness due to funding issues. Dead-lined aircraft and armor, stockpiles down. Mordechai has publicly said it would cost \$667 million in FY1998 to restore the IDF to proper readiness.
- Time problems grow in relying on mobilization and this creates windows of vulnerability.
- Shahak has warned of sharp decline in reserve training activity; loss of combat experienced cadres; poor reserve exercise performance and adaptation to new technology/C4I/BM systems.
- Sensitivity to casualties.
- "Who's a Jew" divisions within Israel affecting military; Rabbis who interfere in operations dealing with settlements.
- Last war was 1973 (1982). Loss of generations with combat experience.
- Inadequate military spending.
- Inability to fund "necessary" upgrades of OAFVs/APCs and helicopter force.
- Loss of edge in stand-off attack capability, targeting, and electronic warfare?
- What comes after E-2C, current ECM/recce aircraft/UAVs?
- Underfunding of Navy, new for added ASW capability.
- Shift of resources to security missions; Morale problems in dealing with Palestinians.
- Vulnerability to attacks with WMD, particularly terrorism.
- Hobson's TABM: The financial cost of funding the Arrow versus the military risks of not having the Arrow.
- Lag in Satellite program .
- Uncertain future of defense industry; political interference in IDF force plans to serve needs of industry.

Jordan

- Break down in peace process, rapprochement with Egypt, Syria and/Iraq.
- Uncertain political future: After King Hussein?
- Role in "new Intifada."
- Spoiler or added front role, particularly as gets new US equipment.

Israeli Concerns Over Israel's Military Edge: Views Expressed in Interviews with General Itzhak Mordechai (MOD), Lt. General Amnon Lipkin-Shahak (COS), Major General Matan Vilani (DCOS), and Rear Admiral Micha Ram (Former Commander of the Navy) - Part Three

Libya

- Minor "Spoiler" role.

New Intifada

- Jibril
- Rapid recruiting and training of suicide bombers.
- Hamas/PIJ
- Palestinian Authority security forces turn on Israel.
- Trying to enforce isolation of Palestinian enclaves. Mid- to long-term LIC war similar to Northern Ireland.

North Korea

- No Dong missile.

Syria

- Fear Syria might make a lasting strategic shift away from the peace process.
- Proxy war in Lebanon.
- Shift of land forces to aid in sudden attack on Golan/Mt. Hermon-- "four hours from the border." Shift of 14th Special Forces Division from Lebanon to Golan similar to steps taken in 1973.
- Build-up of armored forces (1,500 T-72s), risk of surprise attack, "Golan grab."
- Air force minor threat, but major improvement to SAM defenses could affect balance.
- Purchase of new missile craft and 27 naval attack helicopters.
- Scud Cs, No Dongs?
- VX gas.
- Chemically armed missiles: Volley fire against key Israeli targets?
- IDF estimate of at least 80 SSM launchers, many mobile and/or sheltered, and more than 1,000 missiles by 2000.
- Biological weapons?
- Ability to use commercial satellite technology.
- Targeting and strike challenge posed to IDF for preemption and retaliation in dealing with SSM/WMD threat.

Israeli Concerns Over Israel's Military Edge: Views Expressed in Interviews with General Itzhak Mordechai (MOD), Lt. General Amnon Lipkin-Shahak (COS), Major General Matan Vilani (DCOS), and Rear Admiral Micha Ram (Former Commander of the Navy) - Part Four

Russia/Ukraine

- Potential sale of advanced aircraft, refueling capabilities, AWACS.
- Potential SA-10 system sale.
- Security of nuclear materials.

Saudi Arabia

- Purchase of submarines.
- Qualitative parity in air with Tornados, F-15I, US support and training. Long-range strike and AWACS/BVR capability.
- Patriot air defense system.

UAE

- Potential transfer of AMRAAM to Arab country.

US

- Uncertain future of 6th Fleet.
- Decline in US defense investment, rate of modernization and innovation contributing to Israel's edge.
- Constant rises in real price of US weapons and military equipment.
- Sales and technology transfer to Arab states; transfer of training, joint operations, C4I/BM capabilities.
- Aid forever?
- Role in nuclear Middle East?
- Future size of power projection forces and resupply capabilities?
- Fights over possible Israeli compromise of US Patriot and F-16 technology.
- Arms control initiatives in terms of NPT, MTCR, CWC, BWC that challenge Israel's nuclear edge without limiting Iran, Syria, etc.

## **Military and Paramilitary Strength of Key Palestinian Factions and The Hizbollah**

### **Palestinian Authority**

- 35,000 Security and paramilitary pro-PLO forces enforcing security in Gaza and Jericho, including:
  - Public Security (14,000) – 6,000 in Gaza and 8,000 in West Bank
  - Civil police (10,000) – 4,000 in Gaza and 6,000 in West Bank
  - Preventive Security (3,000) – 1,200 in Gaza and 1,800 in West Bank
  - General Intelligence (3,000),
  - Presidential Security (3,000),
  - Military Intelligence (500), and
- Additional forces in Coastal Police, Air Force, Customs and Excise Police Force, University Security Service, and Civil Defense.
- Equipment includes 45 APCs, 1 Lockheed Jetstar, 2 Mi-8s, 2 Mi-17s, and roughly 40,000 small arms. These include automatic weapons and light machine guns. Israeli claims they include heavy automatic weapons, rocket launchers, anti-tank rocket launchers and guided weapons, and manportable anti-air missiles.
- The PA wants 12,000 more security forces after further withdrawals. Israel has proposed some 2,000.

### **Pro PLO**

- Palestinian National Liberation Army (PNLA)/Al Fatah - 5,000-8,000 active and semi-active reserves that make up main pro-Arafat force, based in Algeria, Egypt, Iraq, Lebanon, Libya, Jordan, Sudan, Syria, and Yemen under the tight control of the host government.
- Palestine Liberation Front (PLF) - Abu Abbas Faction - 300-400 men led by Al-Abbas, based in Syria.
- Arab Liberation Front (ALF) - 300-400 men based in Lebanon and Iraq.
- Democratic Front for the Liberation of Palestine (DFLP) - 400-600 men led by Naif Hawatmeh, which claims eight battalions, and is based in Syria, Lebanon, and elsewhere.
- Popular Front for the Liberation of Palestine (PFLP) - 800 men led by George Habash, based in Syria, Lebanon, West Bank, and Gaza.
- Palestine Popular Struggle Front (PSF) - 600-700 men led by Samir Ghawsha and Bahjat Abu Gharbiyah, based in Syria.

### **Anti-PLO**

- Palestinian Islamic Jihad (PIJ) - 350 men in various factions, led by Assad Bayud al-Tamimi, Fathi Shakaki, Ibrahim Odeh, Ahmad Muhana, and others, based in the West Bank and Gaza.
- Hamas - military wing of about 300 men, based in the West Bank and Gaza.
- As-Saiqa - 600-1,000 men in pro-Syrian force under Issam al-Qadi, based in Syria.
- Fatah Revolutionary Council (FRC)/Abu Nidal Organization (ANO) - 300 men led by Abu Nidal (Sabri al-Bana), based in Lebanon, Syria, and Iraq.
- Popular Front for the Liberation of Palestine - General Command (PFLP-GC) - 600 men led by Ahmad Jibril, based in Syria, Lebanon, elsewhere.
- Popular Front for the Liberation of Palestine - Special Command (PFLP-SC) - 50-100 men led by Abu Muhammad (Salim Abu Salem).
- Palestine Liberation Army (PLA) - 4,500 men, based in Syria.
- Fatah Intifada – 400-1,000 men led by Said Musa Muragha (Abu Musa). Based in Syria and Lebanon.

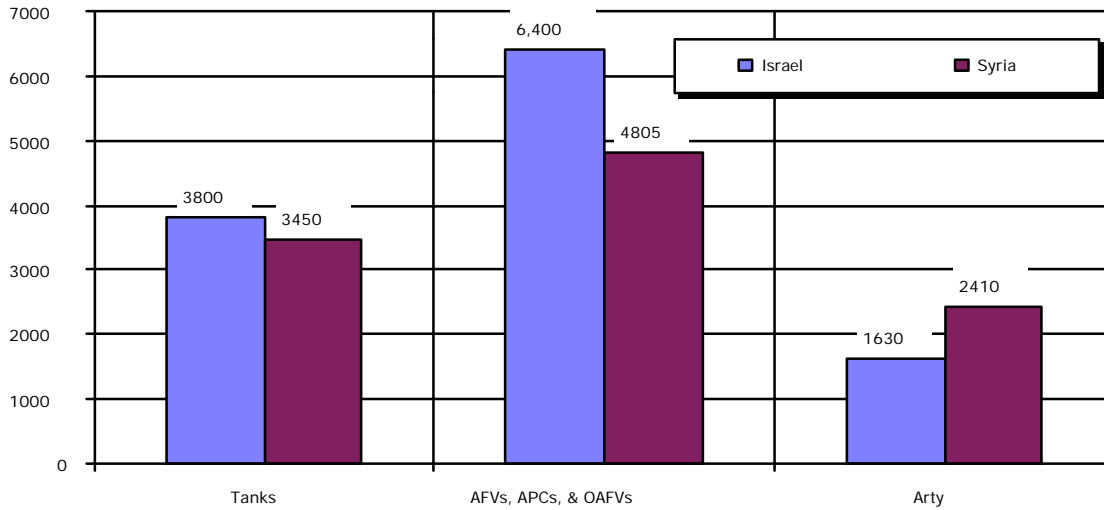
### **Hizbollah (Party of God),**

- About 300-5000 actives with 3,000 men in support, Shi'ite fundamentalist, APCs, artillery, MRLs. ATGMs, rocket launchers, AA guns, SA-7s, AT-3 Sagers.

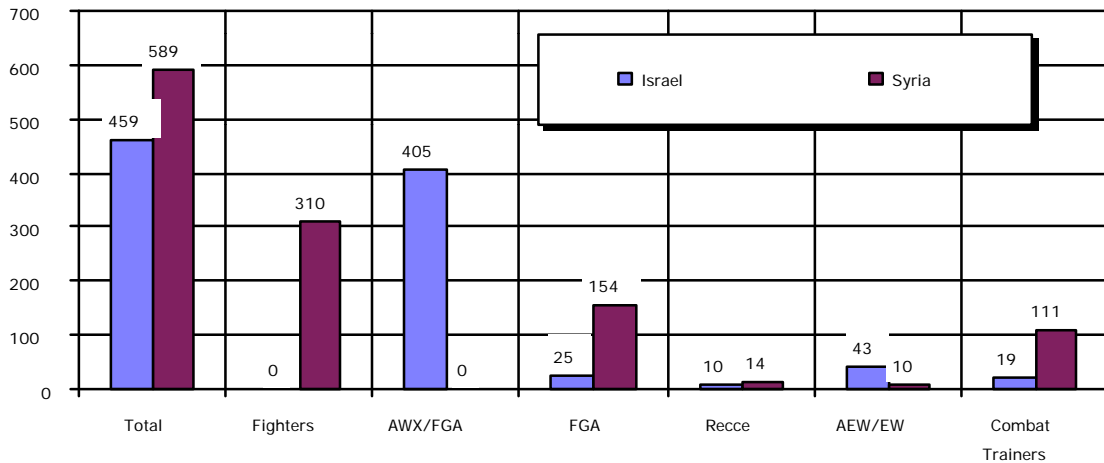
Source: Adapted from US Department of State, "Patterns of Global Terrorism, 1998," Washington, GPO, April 1999; IISS, Military Balance, 1998-1999 and 1999-2000.

## Israeli Versus Syrian Operational Force Strength in 2000

### Land Weapons



### Air Forces

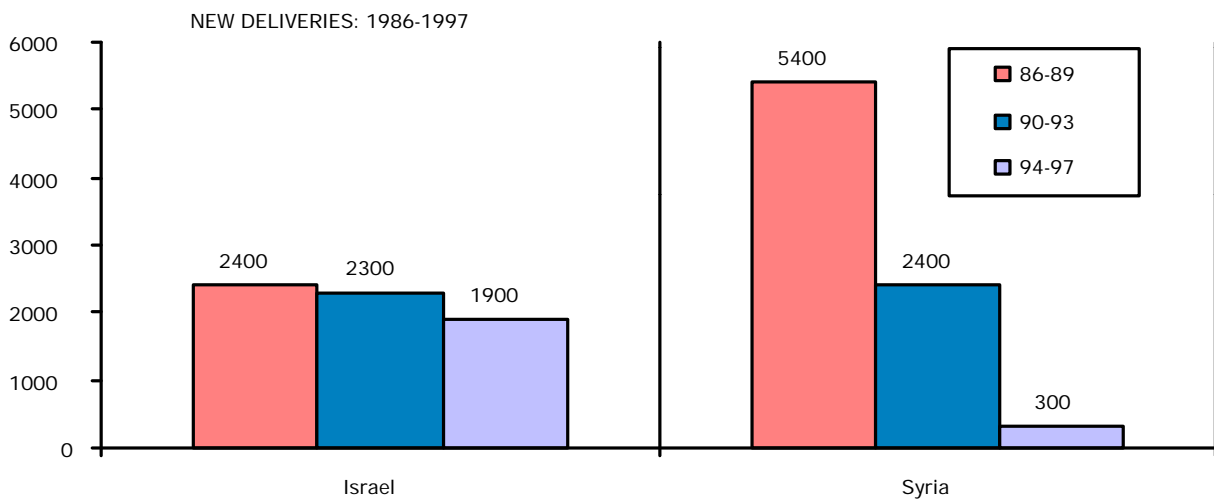
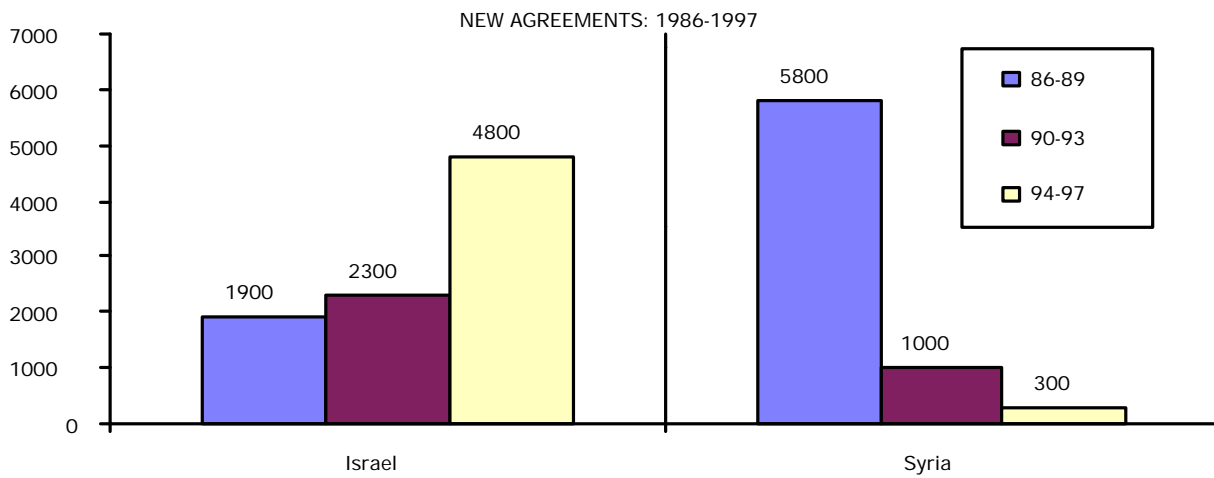


Note: Total Artillery includes towed and self-propelled tube artillery and multiple rocket launchers. Total air forces include only operational fixed wing fighter, fighter-attack, and reconnaissance aircraft in combat units, less aircraft in combat training units.

Source: Adapted by Anthony H. Cordesman from data provided by US experts, and the IISS, Military Balance.

## Syrian-Israeli Arms Agreements and Deliveries: 1985-1997

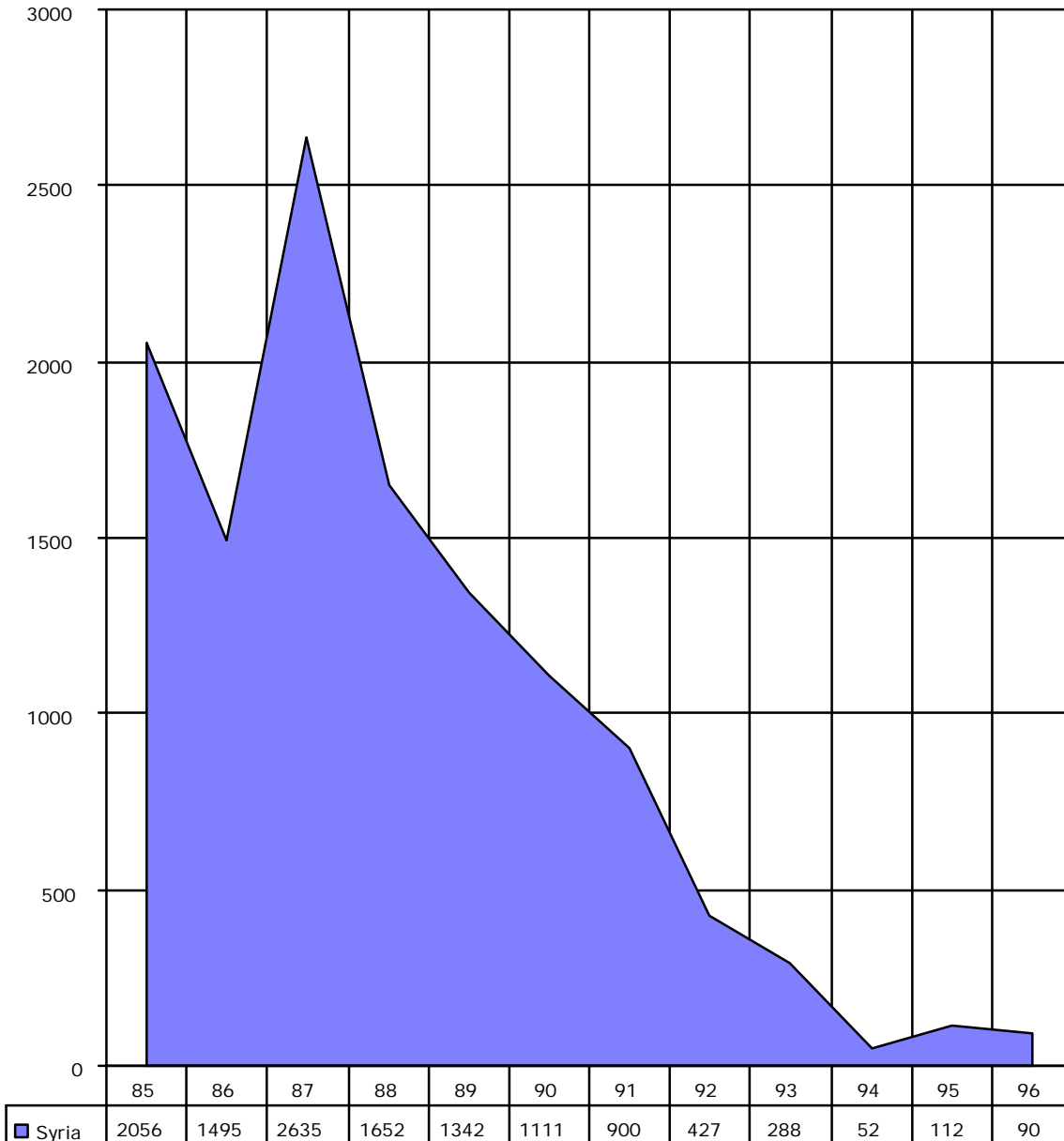
(\$Current Millions)



Source: Adapted by Anthony H. Cordesman, CSIS, from Richard F. Grimmett, Conventional Arms Transfers to Developing Nations, Washington, Congressional Research Service, various editions.

## The Syrian Recapitalization Crisis: Arms Deliveries During 1985-1996

(\$96 Constant Millions)



Source: Adapted by Anthony H. Cordesman from US Arms Control and Disarmament Agency, World Military Expenditures and Arms Transfers, GPO, Washington,, Table II, various editions.

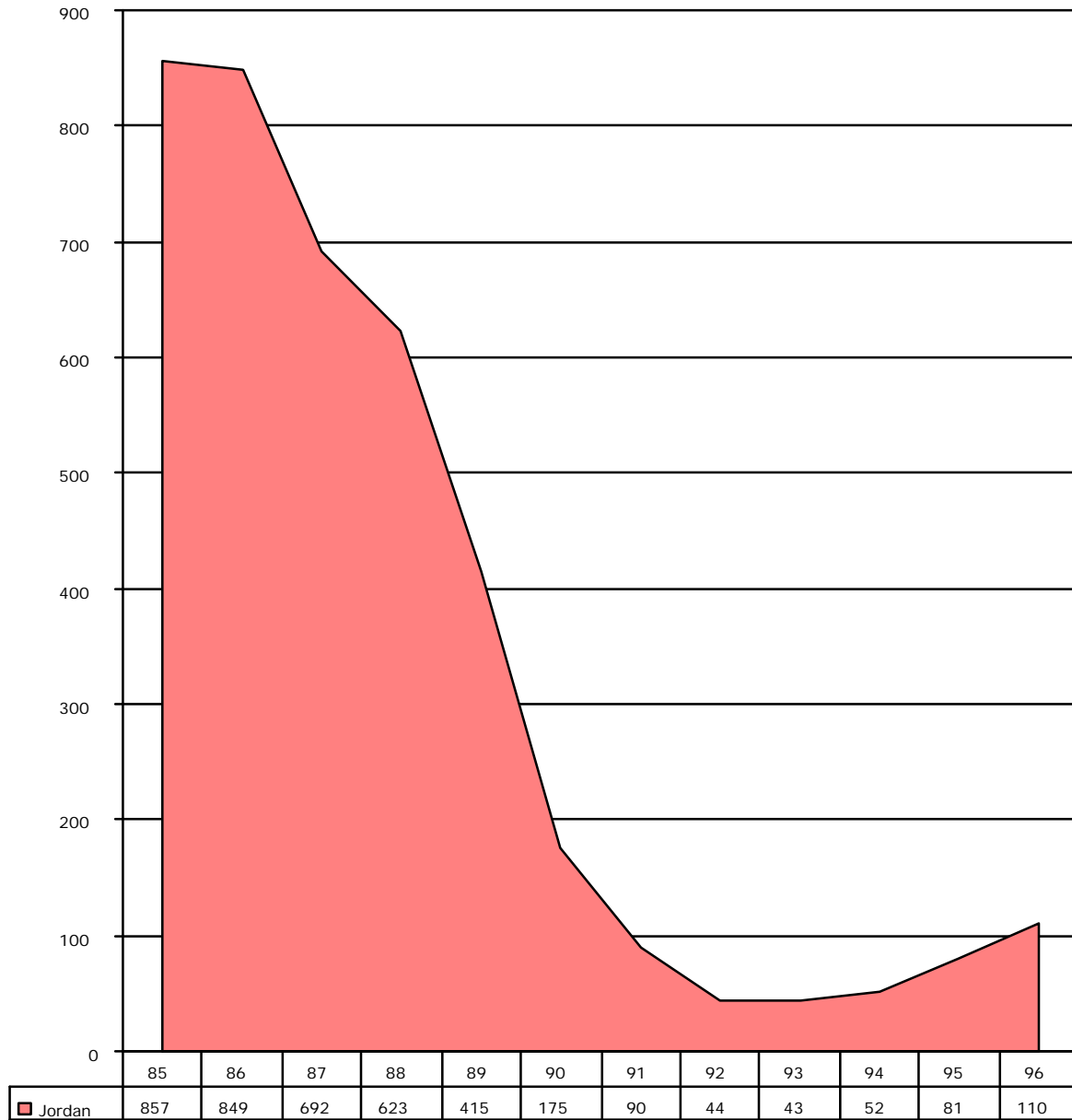
## Current Status of Lebanese Military Forces

- Lebanese army is fragmented along sectarian lines and has been largely confined to an internal security role with the support of 25,000-35,000 Syrian troops.
- Heavily influenced by Syria. Syrian military intelligence is believed to have many active agents in Lebanese forces and Lebanese military intelligence.
- Total strength of roughly 67,900
- Army has 65,000 actives authorized, 11 infantry brigades, 1 Presidential Guard Brigade, 1 commando/ranger regiment, 3 special forces regiments, 2 artillery regiments, and 1 air assault regiment.
- Equipment readiness and sustainability is improving, but is still poor. Standardization and spare parts situation very poor.
- Main Battle Tanks: 92 M-48A1/A5, 212 T-54/T-55.
- Other Armored Fighting Vehicles: 67 AML-90.
- Armored Personnel Carriers: 1,164 M-113s, 80 VAB-VCI, 30 VAB-VTT, 35 Panhard M3/VTT.
- Towed Artillery: 135 M-101A & 10 M-102 105mm; 33 M-1938, 10 D-30 122mm; 11 M-46, 130mm; 18 M-114A1, 35 M-198, 18 M-50 155mm
- Multiple Rocket Launchers: 23 BM-21 122mm.
- Mortars: 150 81mm; 130 120mm.
- Anti-tank Weapons: ENTAC, Milan, and 20 BGM-71 TOW ATGMs; RPG-7s, M-65 89mm rocket launchers; M-40A1 106mm recoilless rifles.
- Air Force has some 1,700 actives. Has no real fixed wing combat capability. Limited fair-weather helicopter capability with limited survivability, firepower, and tactical skill.
- Fighters: 3 Bulldog Trainers.
- Attack Helicopters: 4 SA-342 with AS-11 and AS-12 air-to-surface anti-armor missiles in inventory, evidently no longer active.
- Other Helicopters: 16 UH-1H. Operational status of 5 AB-212, 16 AB-205, 3 SA-330, 2 SA-318, and 4 SA-319 unclear.
- Training Aircraft: 3 CM-170, 3 Bulldog
- Transports: 1 Dove, 1 Turbo-Commander 690A.
- Navy has some 1,200 personnel. Is largely ineffective except in light patrol role against smugglers and guerrillas.
- Bases at Juniye, Beirut, and Tripoli.
- Combat Ships: 5 UK-made *Attacker* in-shore patrol craft; 2 UK-made *Tracker* in-shore patrol craft; 27 armed boats.
- Amphibious: 2 Sour-class LCTs, capable of carrying 33 troops each.
- Ministry of Interior security force has 13,000 men. Includes Beirut and regional Gendarmerie and Judicial Police. Equipped with small arms, automatic weapons, and 30 Chamite APCs.
- Customs: Equipped with 2 *Tracker* and 5 *Aztec* in-shore patrol craft.

## Developments in Hizbollah Military Forces in Lebanon in 1998-2000

- Roughly 2,500-3,500 men, heavily dependent on part-time and irregular forces. Many are now highly experienced, often well-educated forces.
- Composed of a core of around 300 guerrillas. Has deliberately cut its force over the past years to prevent infiltration and leaks.
- Hizbollah fighters are old by comparison to Israeli fighters. Any age up to 35, usually married, often university students or professional men.
- Roughly 150 Iranian Revolutionary Guards as advisors. Heavily supplied and financed by Iran, but Syrian personnel seem to be involved in training and in coordinating with Iran. Iranian and Syrian coordination of support for military supply and possibly operations of Hizbollah seems to occur at the general officer, deputy minister level.
- Iran has flown up to three 747 cargo jets monthly to Hizbollah via Syria in an effort to upgrade their arms capabilities. Weapons include the Russian-made Sagger and Strella antitank missiles. Iran's military camps in Lebanon appear to be offering training on the more advanced systems.
- Conflicting intelligence reports estimate Iranian aid to Hizbollah to be between 65 and 100 million dollars a year.
- Forces carry out an average of two operations a day against the SLA and Israeli forces. Some missions involve long-range shelling while others have included sophisticated roadside bombings and commando missions involving 40 well-trained guerrillas operating as a team.
- Equipped with APCs, artillery, multiple rocket launchers, mortars, anti-tank guided missiles (including AT-3s), recoilless rifles, SA-7s, anti-aircraft guns.
- Guerrilla mortar strikes have improved in both accuracy and range, indicating better range-finding systems, low signature weapons, and the use of mortar boosters that enable consistent hits for 2 to 3 miles.
- New anti-tank weapons capable of burning through the armor plate of Israel's M-60 tanks.
- Acquisition of anti-tank weapons with a longer range.
- Supply of Katyusha rockets is estimated to have risen to 1,000. These include 30 Iranian produced 240mm rockets with a range of 40 km, according to Israeli intelligence reports. Most of the rockets are 120mm and 127mm variants with a maximum range of 22 km.
- Improved radio detonated roadside bombs have been effective against the Israelis. Some are disguised as large rocks. The rocks are reportedly produced in Iran.
- Hizbollah is now winning against Israel. More Israeli soldiers are being killed than Hizbollah fighters; Israeli retaliatory air strikes and raids are aiding Hizbollah by alienating Lebanese. Considerable Christian and Sunni support now for Hizbollah.

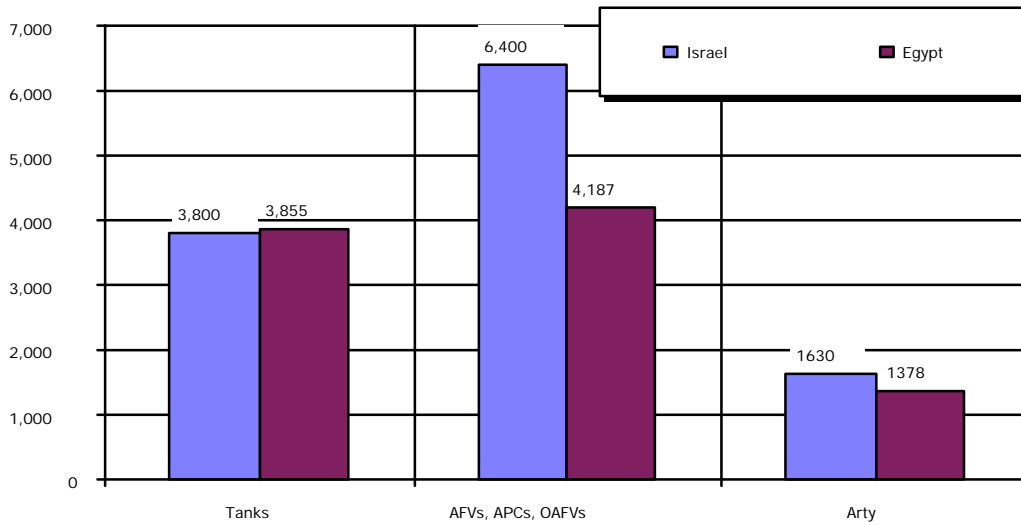
### The Jordanian Recapitalization Crisis: Arm Deliveries: 1985-1996 (\$96 Constant Millions)



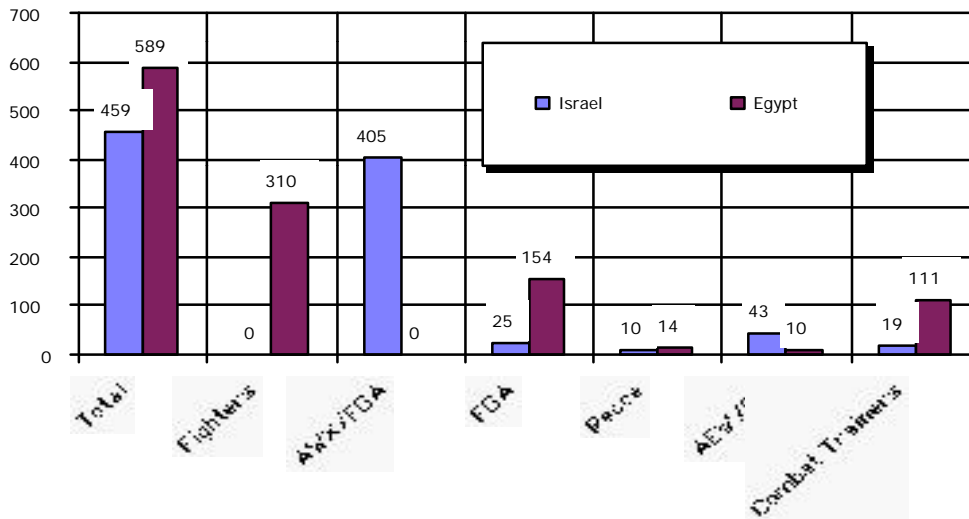
Source: Adapted by Anthony H. Cordesman from US Arms Control and Disarmament Agency, World Military Expenditures and Arms Transfers, GPO, Washington, Table II, various editions.

## Israel Versus Egypt in 2000

### Land Weapons



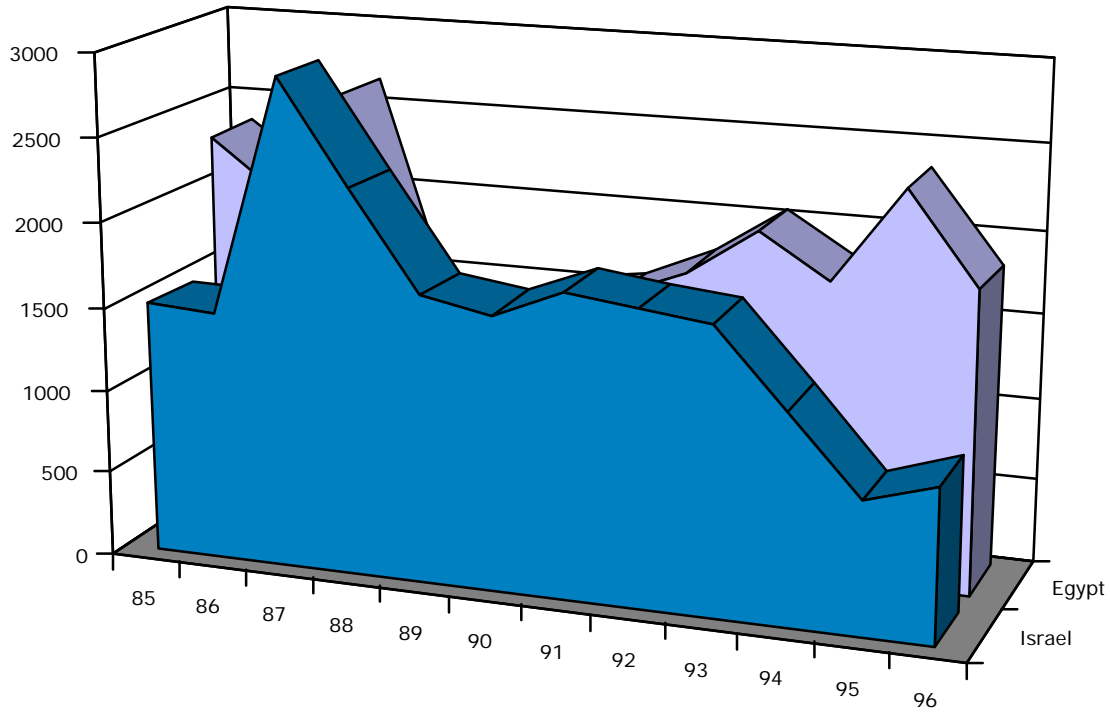
### Air Forces



Note: Total Artillery includes towed and self-propelled tube artillery and multiple rocket launchers. Total air forces include only operational fixed wing fighter, fighter-attack, and reconnaissance aircraft in combat units, less aircraft in combat training units.

## Trends in Egyptian-Israeli Arms Import Deliveries: 1983-1996

(\$96 Constant Millions)

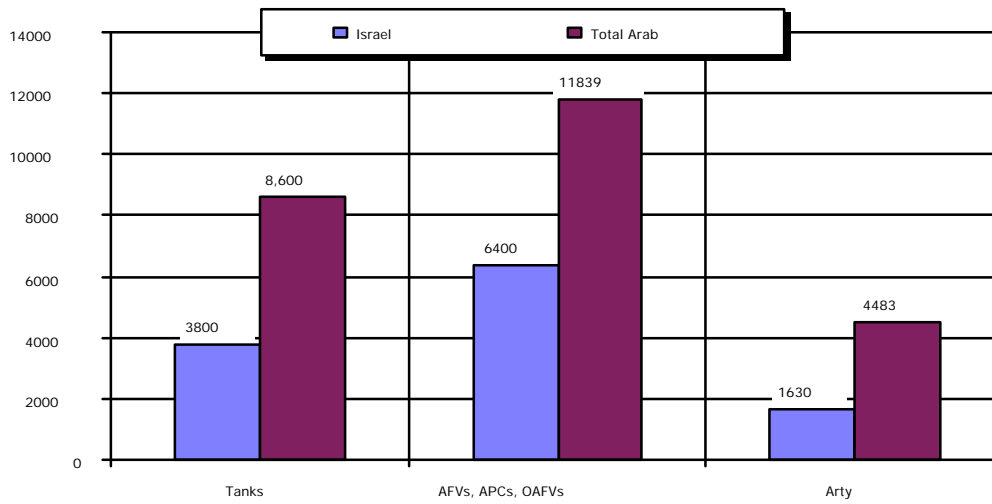


	85	86	87	88	89	90	91	92	93	94	95	96
■ Israel	1508	1495	2899	2288	1708	1637	1800	1752	1707	1250	789	925
■ Egypt	2330	2038	2635	1398	1220	1520	1575	1752	2027	1771	2343	1800

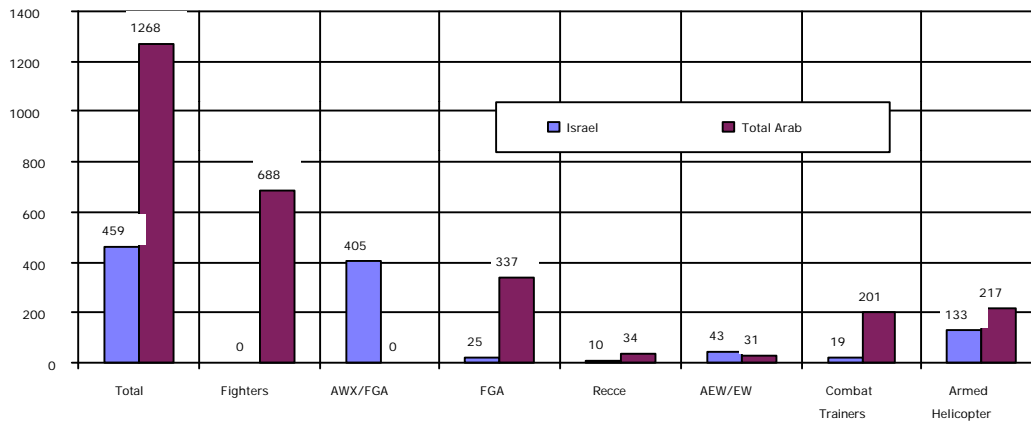
Source: Adapted by Anthony H. Cordesman from US Arms Control and Disarmament Agency, World Military Expenditures and Arms Transfers, GPO, Washington, various editions, Table II.

## Israel Versus Egypt, Syria, Jordan, and Lebanon

### Operational Land Weapons



### Operational Combat Aircraft



**Note: Total Artillery includes towed and self-propelled tube artillery and multiple rocket launchers. Total air forces include only operational fixed wing fighter, fighter-attack, and reconnaissance aircraft in combat units, less aircraft in combat training units.**

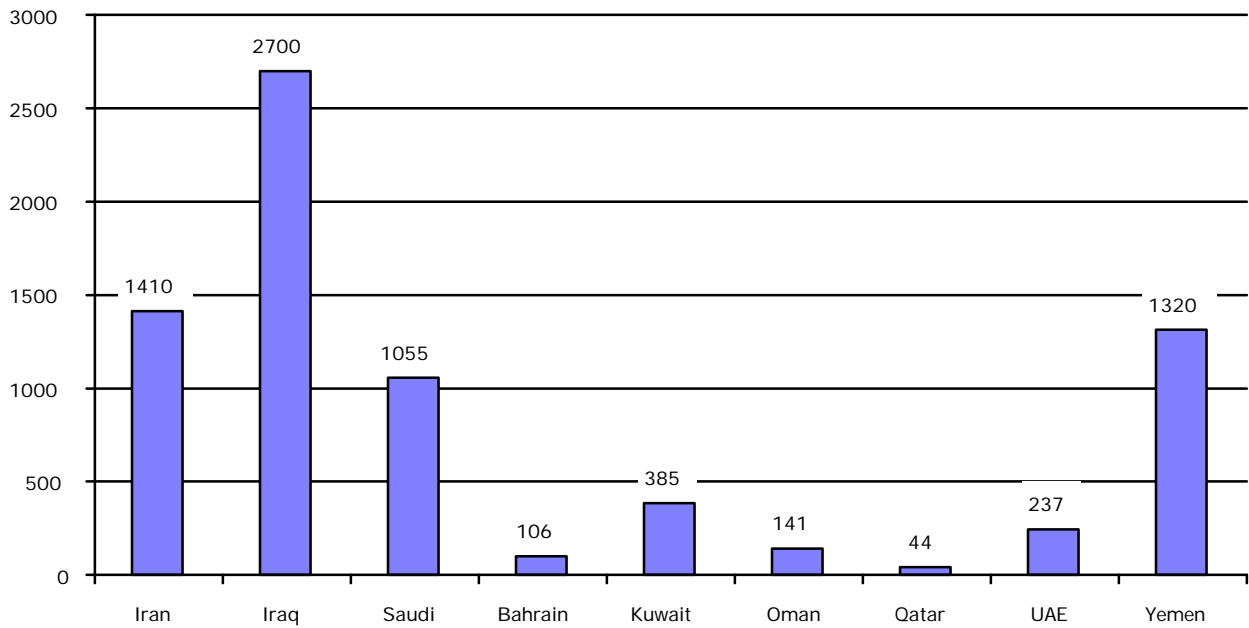
Source: Adapted by Anthony H. Cordesman from data provided by US experts, and the IISS, Military Balance.

# **Part Six**

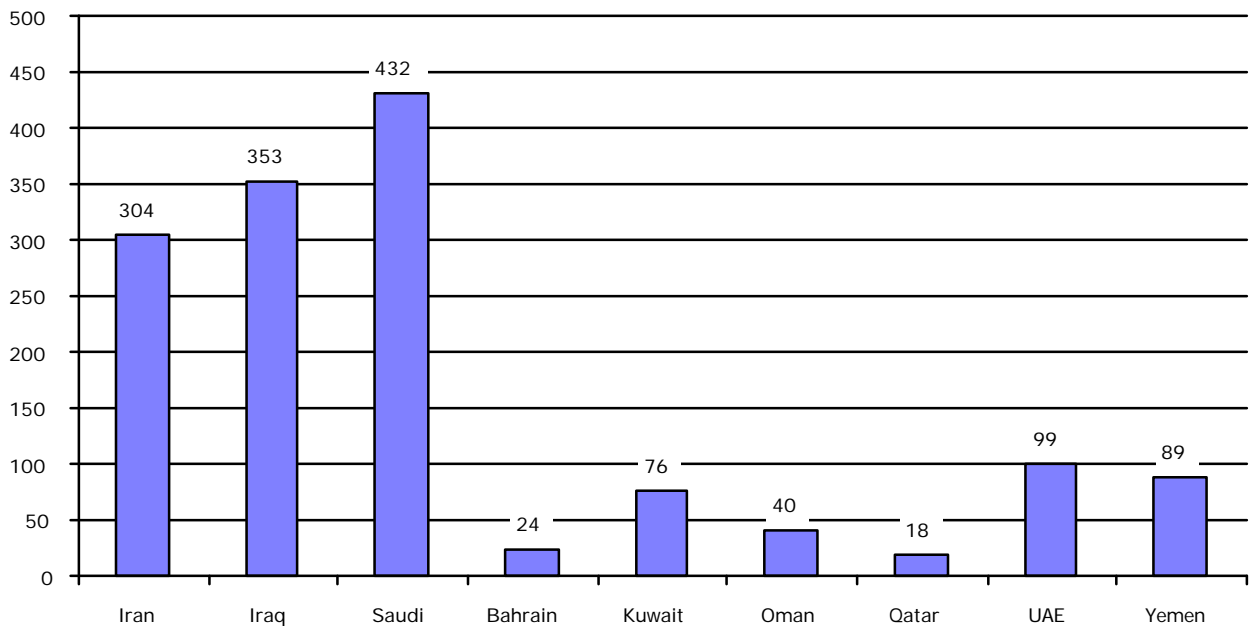
# **The Gulf**

## Major Measures of Key Combat Equipment Strength

### Total Main Battle Tanks in Inventory

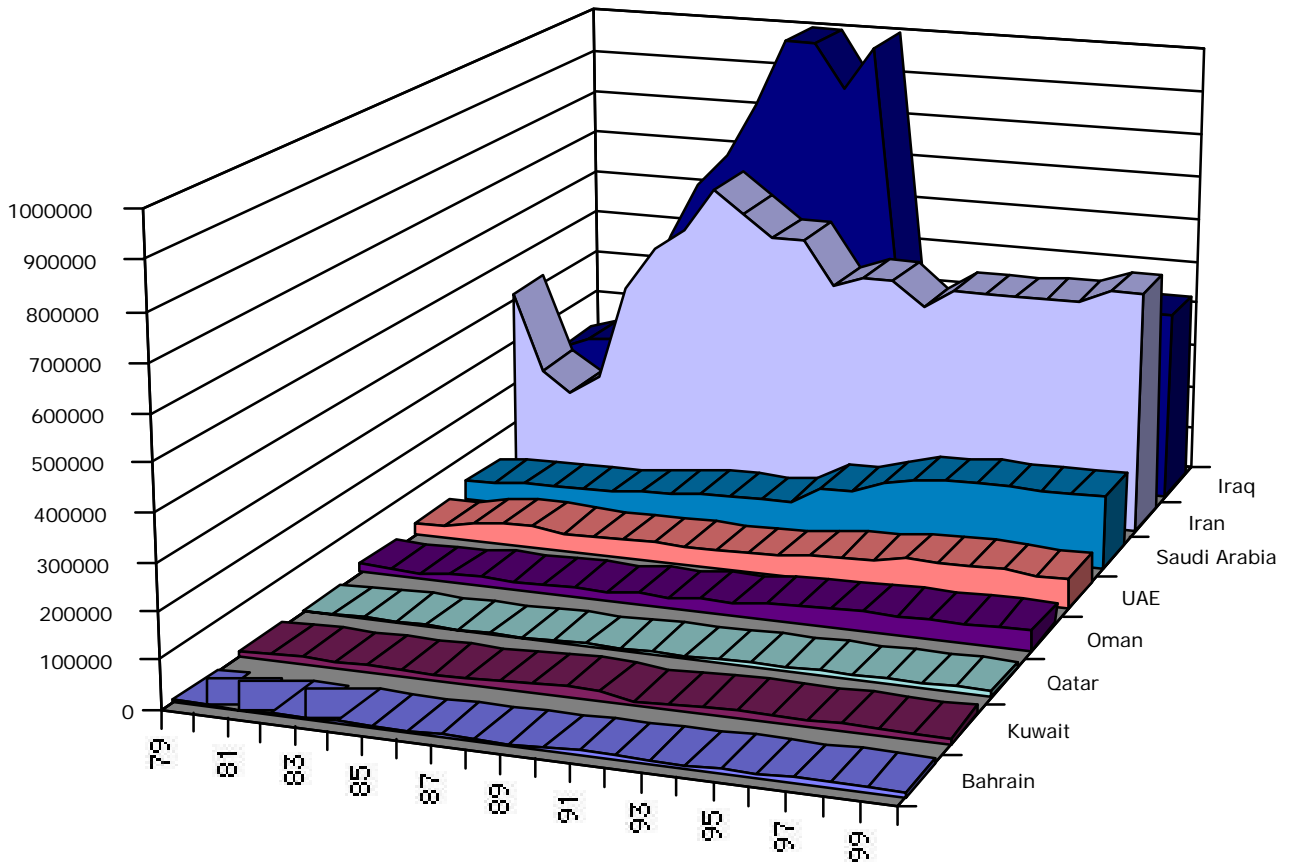


### Total Fixed Wing Combat Aircraft



Source: Adapted by Anthony H. Cordesman from various sources and the IISS, [Military Balance](#).

## Comparative Trends in Gulf Total Active Military Manpower: 1979-2000

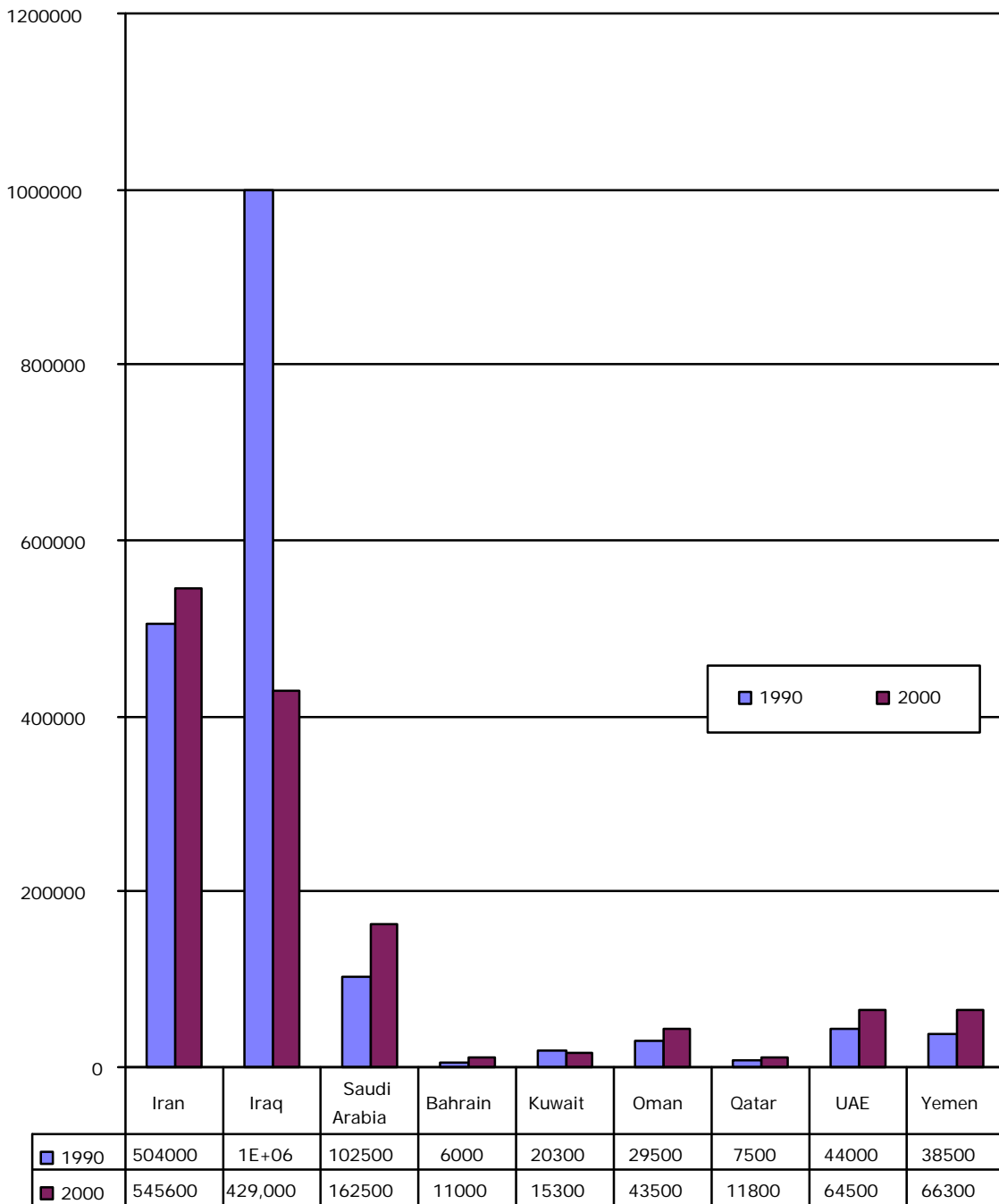


Source: Estimated by Anthony H. Cordesman using data from various editions of the IISS Military Balance, Jane's Sentinel, and Military Technology.

Note that Saudi includes full-time active National Guard, Oman includes Royal Guard, Iran includes Revolutionary Guards, and Iraq includes Republican Guards and Special Republican Guards.

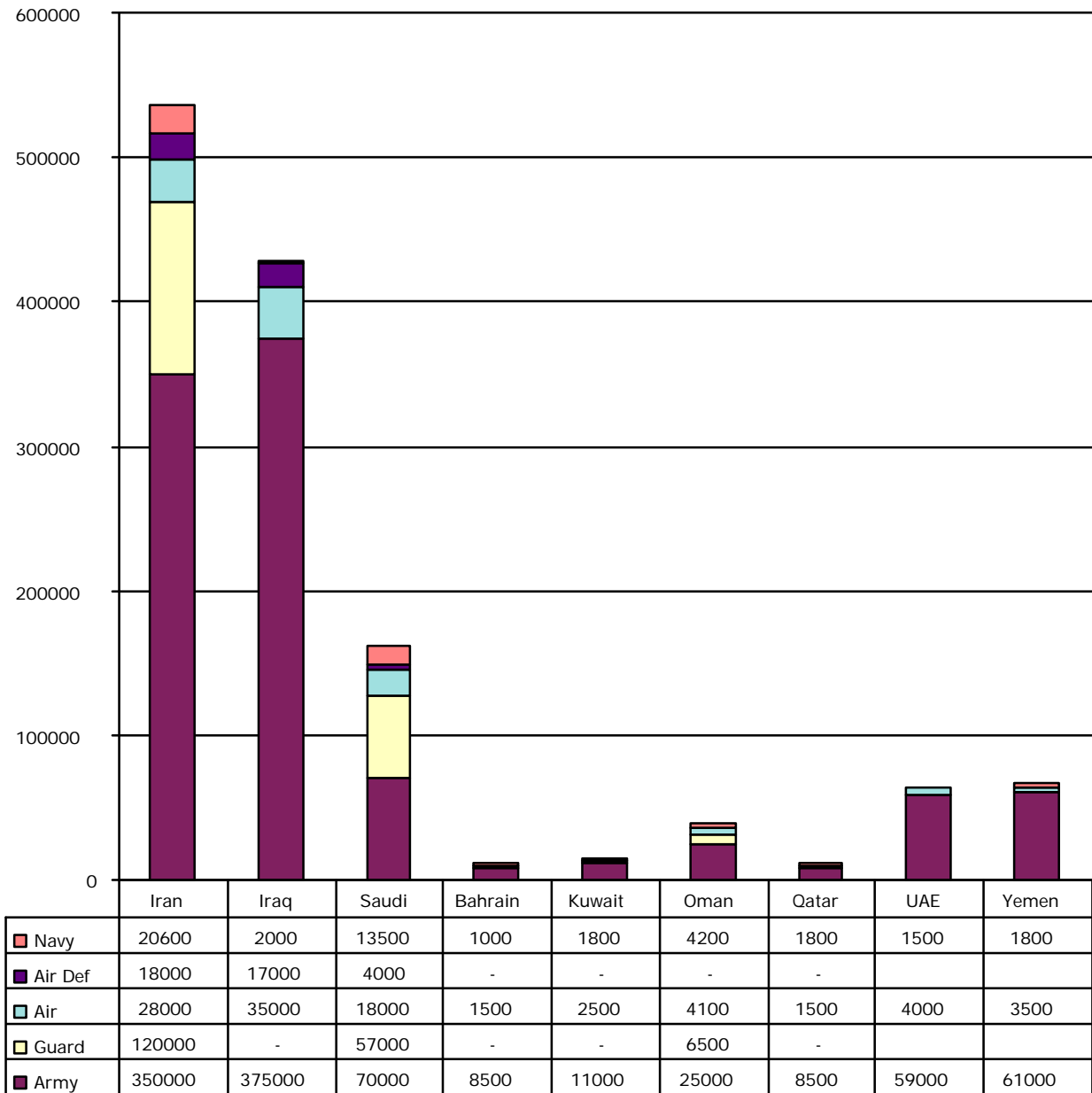
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### Total Active Military Manpower in All Gulf Forces 1990-2000



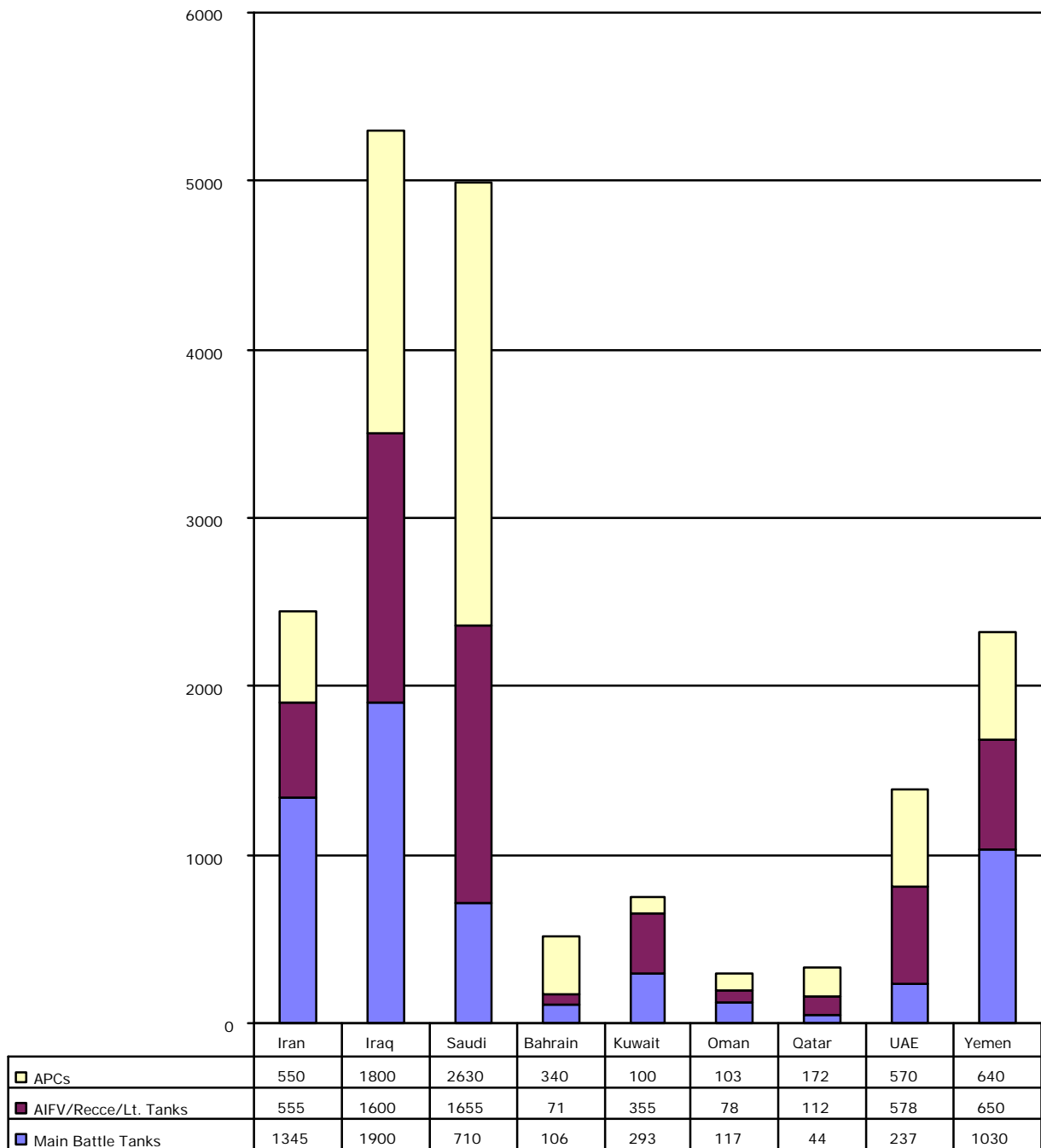
Note: Iran includes active forces in Revolutionary Guards. Saudi Arabia includes active in National Guard  
 Adapted by Anthony H. Cordesman from various sources and the IISS, Military Balance.

### Total Gulf Military Manpower By Service - 2000



Source: Estimated by Anthony H. Cordesman using data from the IISS Military Balance.

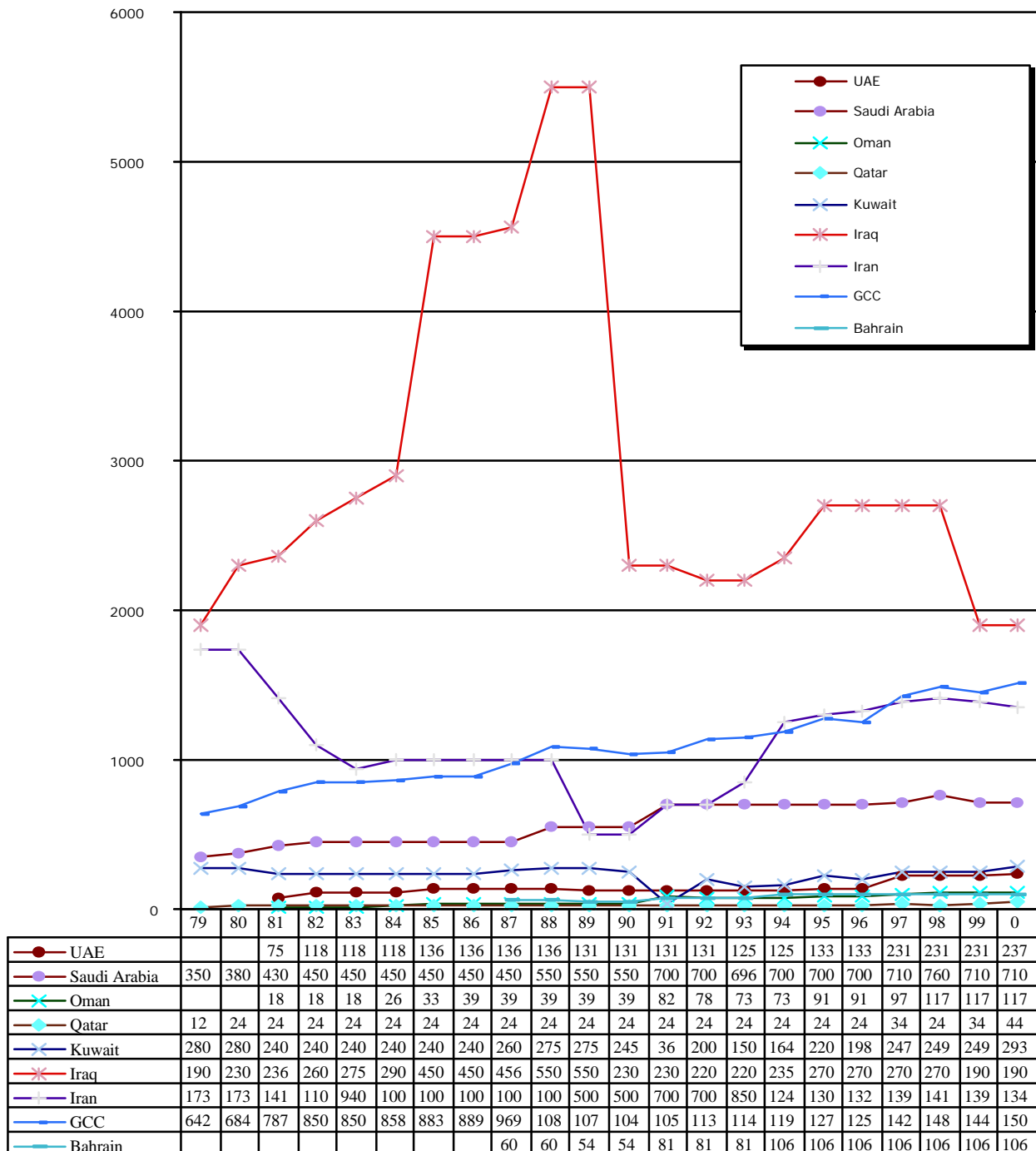
## Total Gulf Operational Armored Fighting Vehicles - 2000



Source: Estimated by Anthony H. Cordesman using data from various editions of the IISS Military Balance, and Jane's Sentinel.

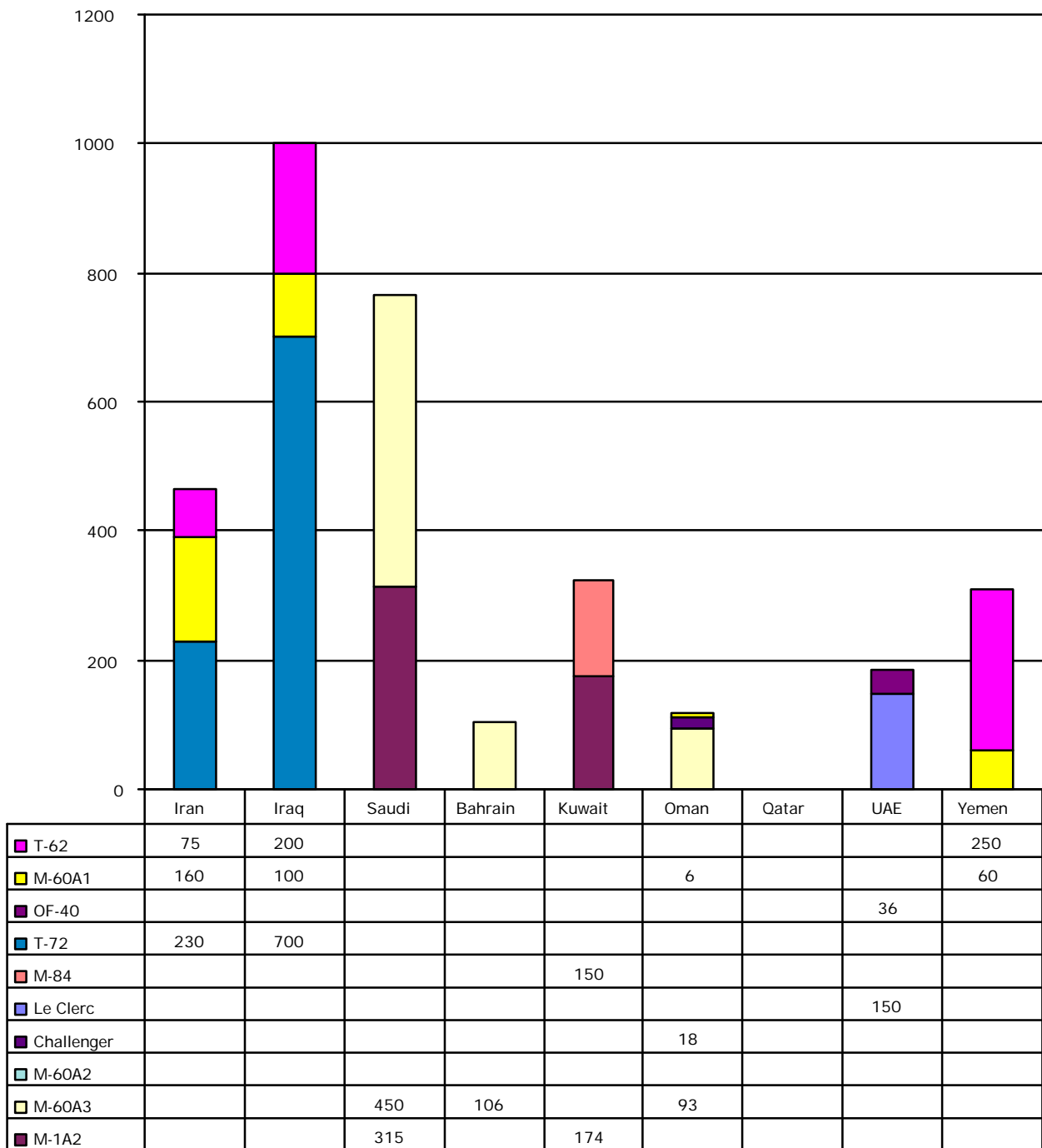
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## Total Operational Main Battle Tanks in All Gulf Forces 1979 to 2000



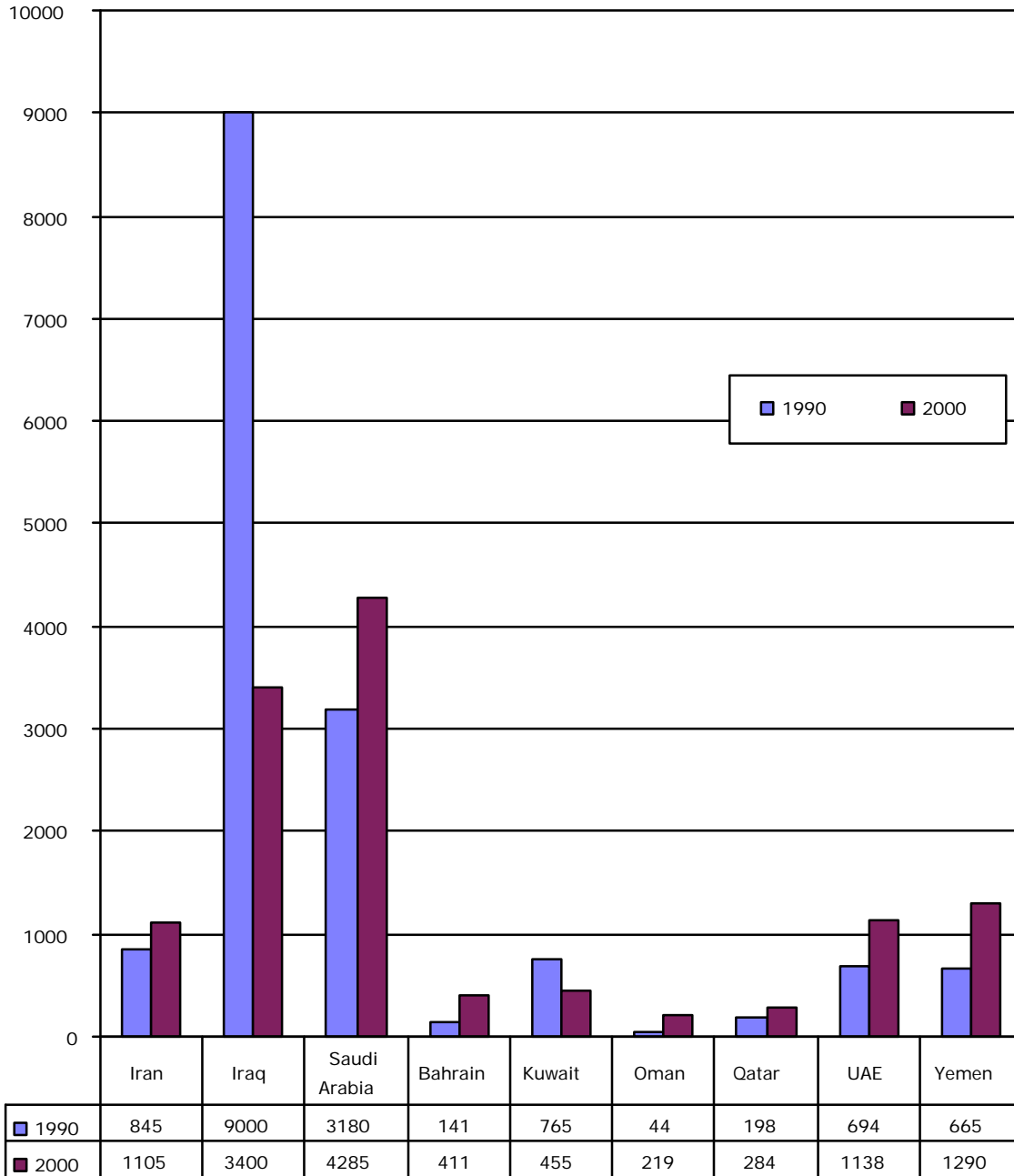
Note: Iran includes active forces in the Revolutionary Guards. Saudi Arabia includes active National Guard.  
 Source: Adapted by Anthony H. Cordesman from various sources and the IISS, Military Balance, various editions.

### Medium to High Quality Main Battle Tanks By Type in 1999



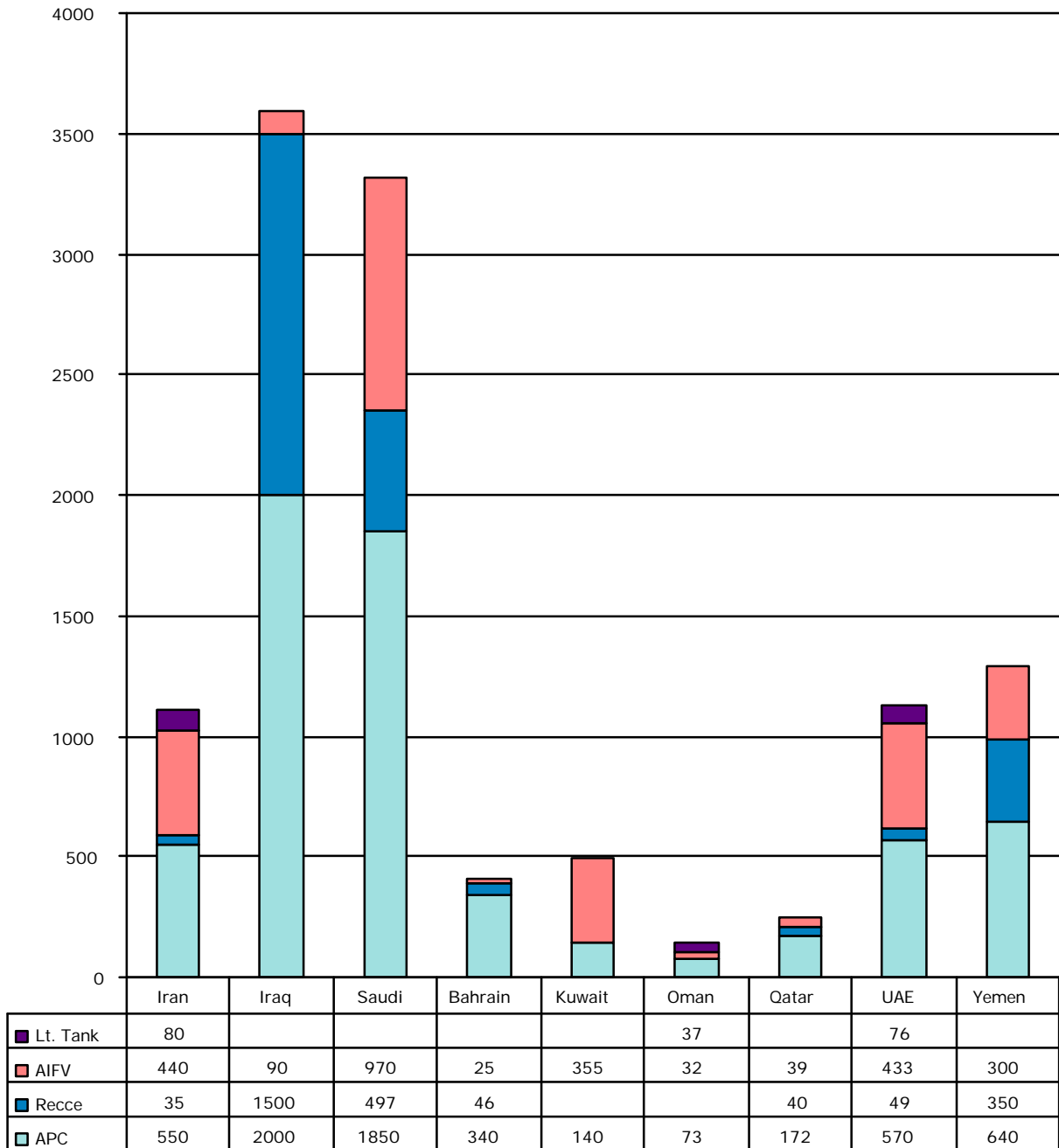
Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance.

### Total Operational Other Armored Vehicles (Lt. Tanks, Scout, AIFVs, APCs, Recce) in Gulf Forces 1990-2000



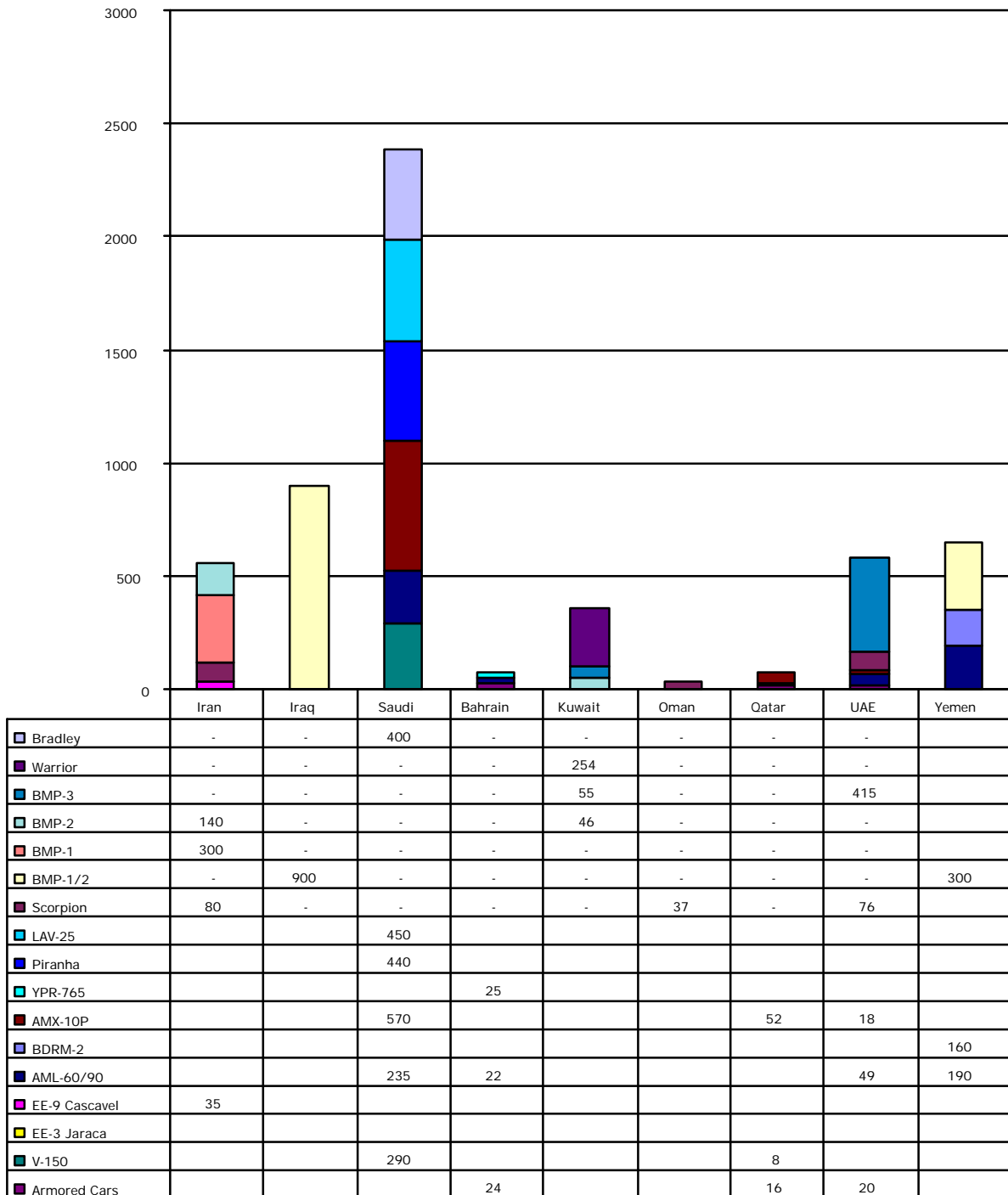
Note: Iran includes active forces in the Revolutionary Guards. Saudi Arabia includes active National Guard. Adapted by Anthony H. Cordesman from various sources and the IISS, Military Balance.

## Gulf Other Armored Fighting Vehicles (OAFVs) by Category - 2000



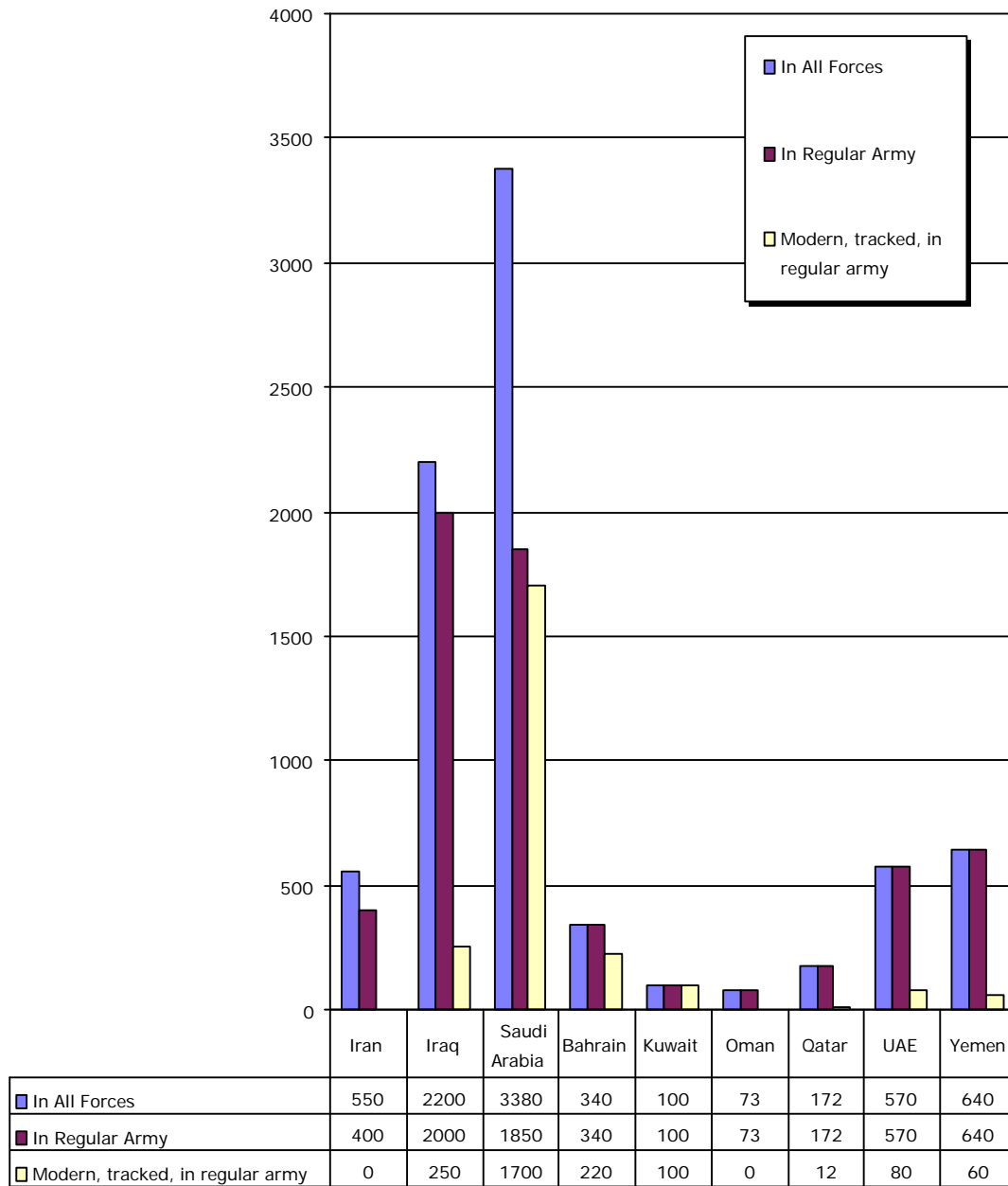
Source: Estimated by Anthony H. Cordesman from various sources and the IISS, Military Balance.

## Advanced Armored Infantry Fighting Vehicles, Reconnaissance Vehicles, Scout Vehicles and Light Tanks by Type in 1999



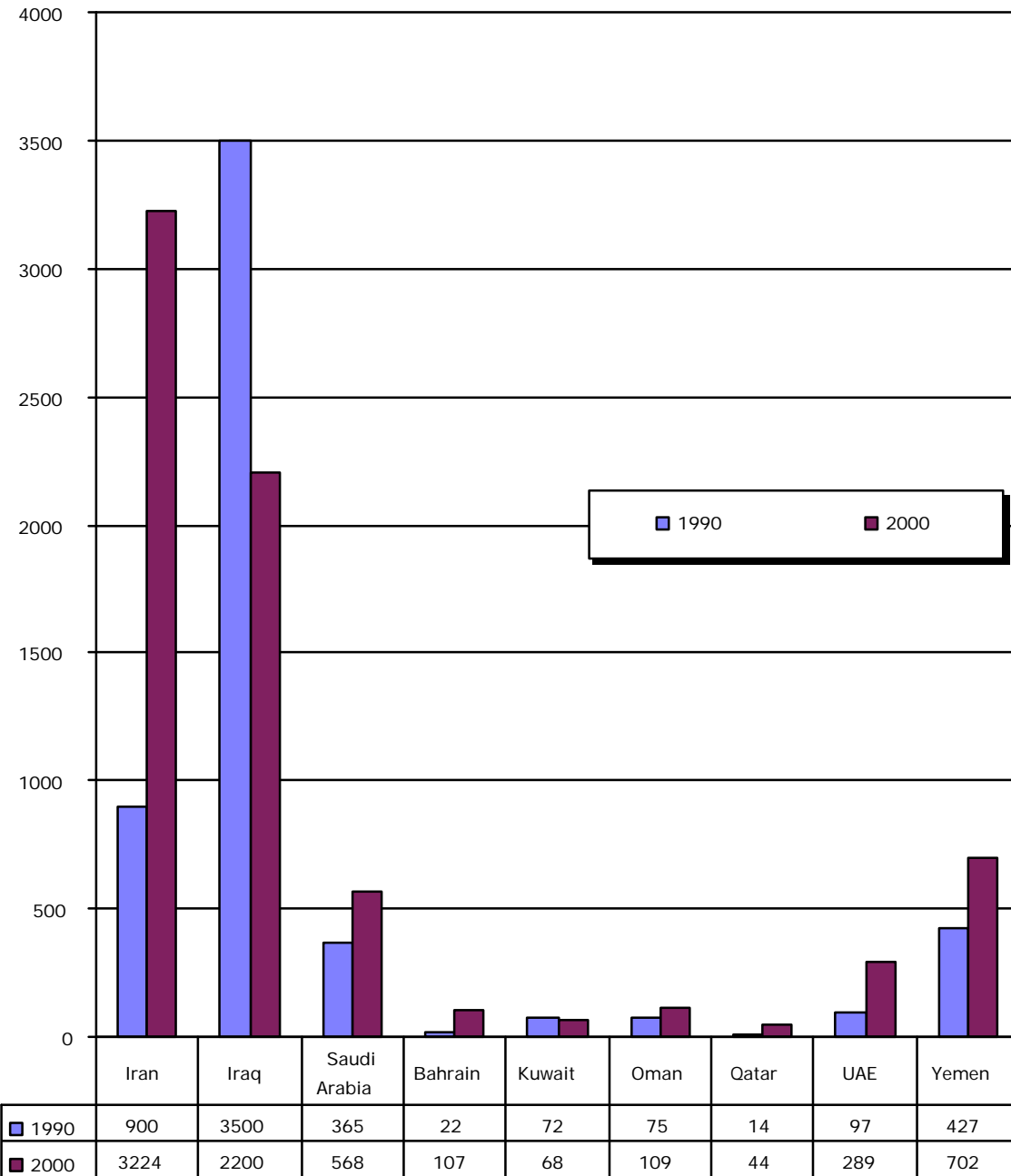
Source: Estimated by Anthony H. Cordesman from various sources and the IISS, Military Balance.

## Armored Personnel Carriers (APCs) in Gulf Armies - 1998



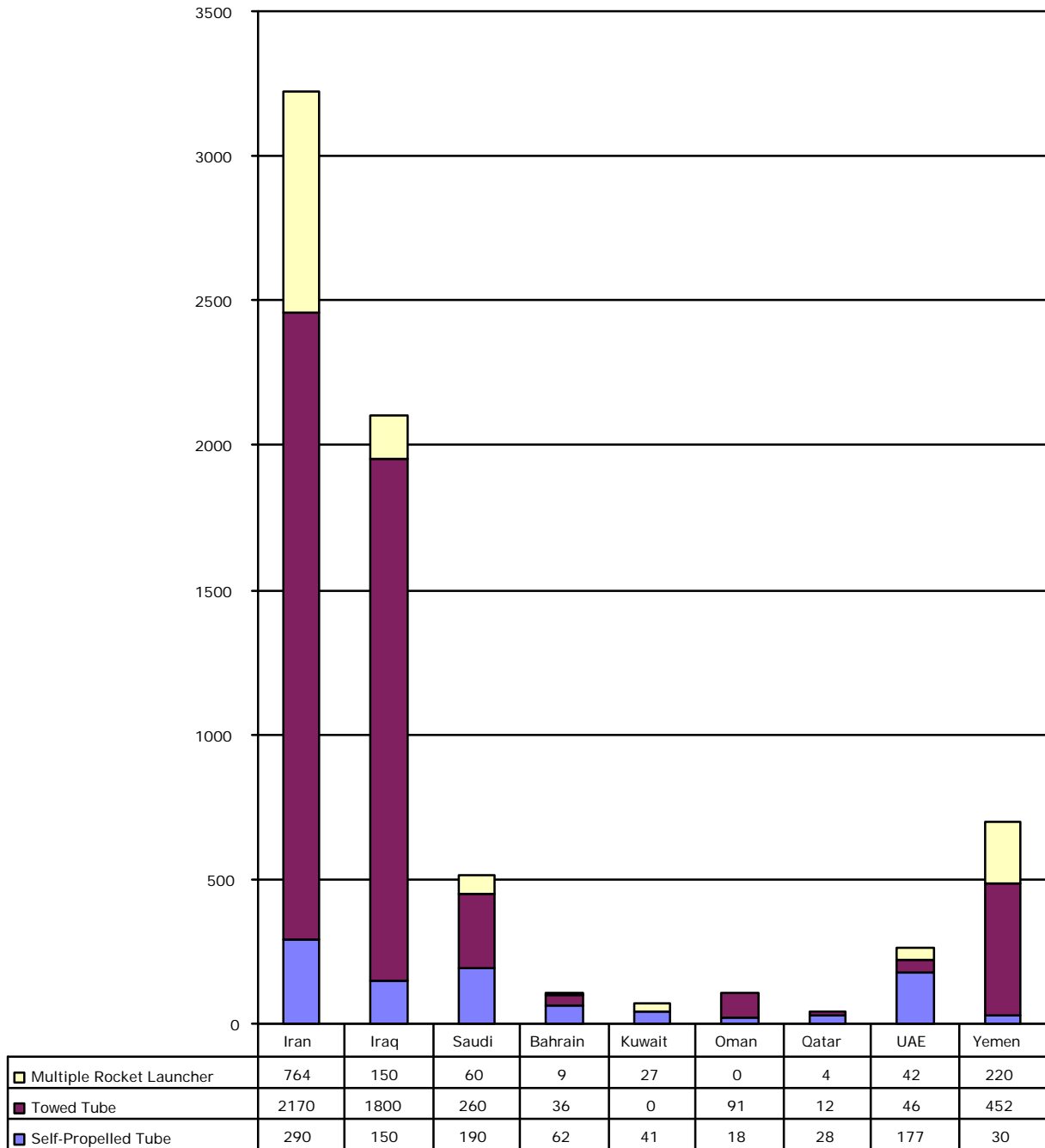
Note: Iran includes active land forces in the Revolutionary Guards. Saudi Arabia includes the active forces in the National Guard  
 Source: Estimated by Anthony H. Cordesman from various sources and the IISS, Military Balance.

### Total Operational Self-Propelled and Towed Tube Artillery and Multiple Rocket Launchers in Gulf Forces 1990-2000



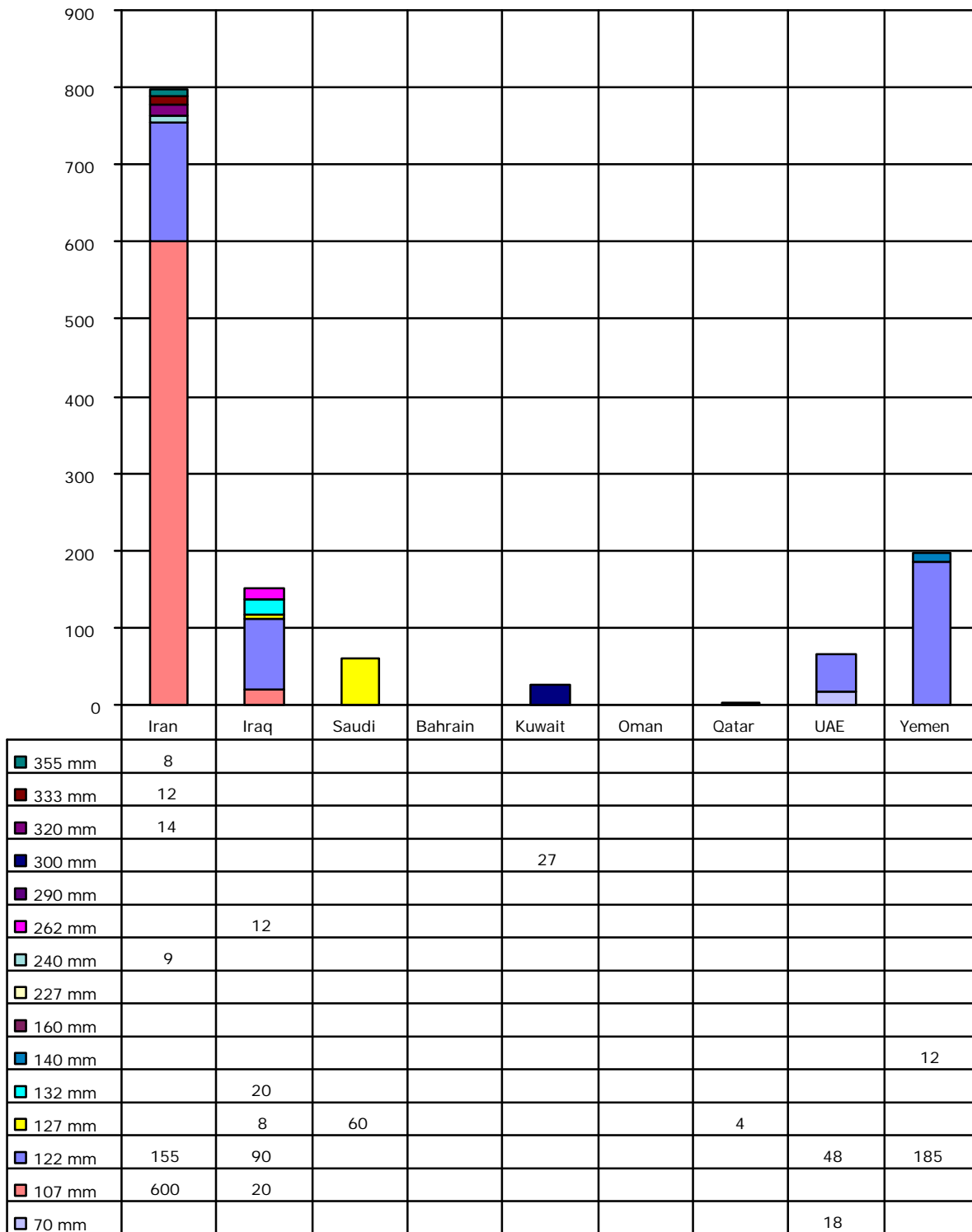
Note: Iran includes active forces in the Revolutionary Guards. Saudi Arabia includes active National Guard. Adapted by Anthony H. Cordesman from various sources and the IISS, Military Balance.

### Total Operational Gulf Artillery Weapons - 2000



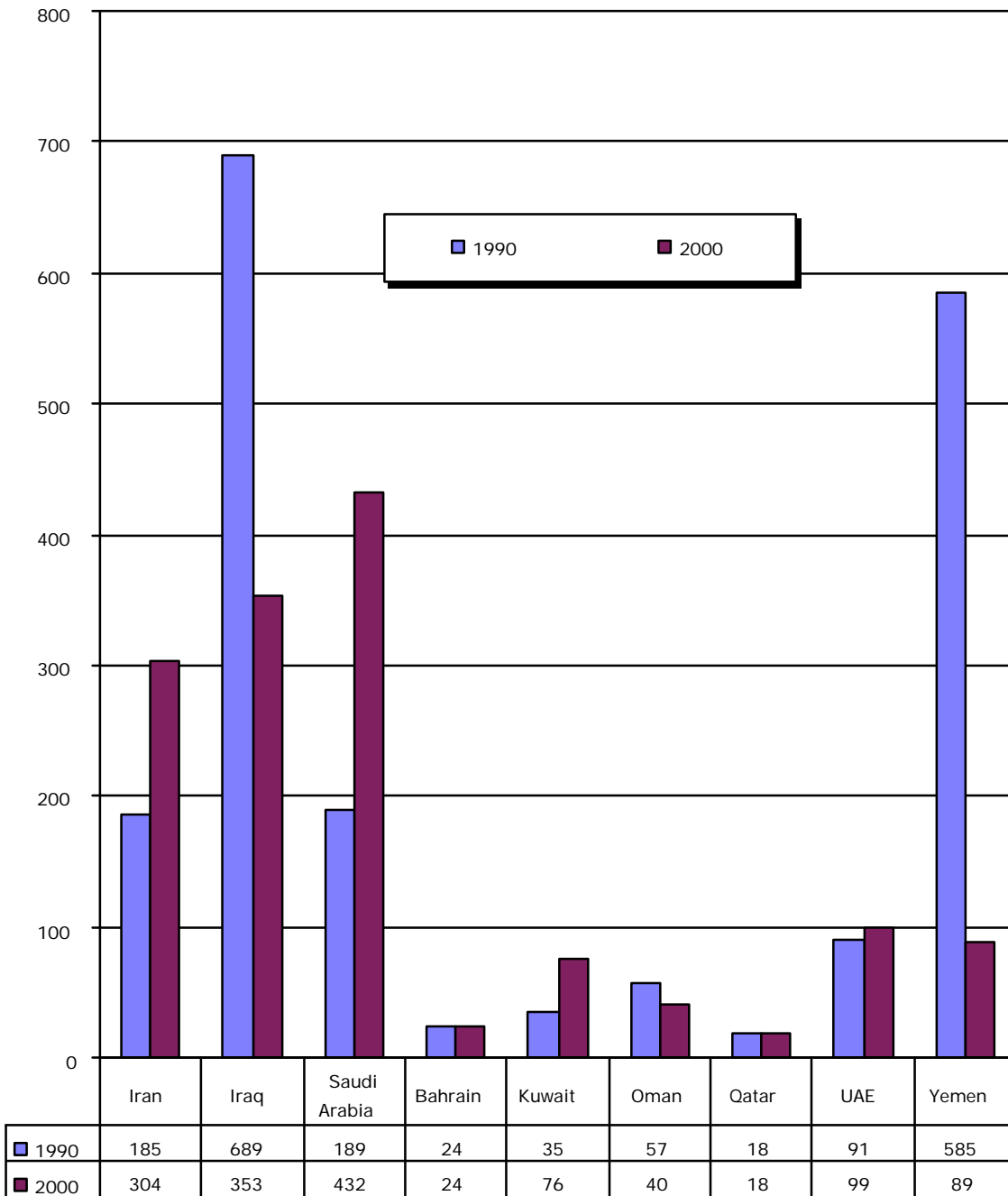
Source: Estimated by Anthony H. Cordesman from various sources and the IISS, Military Balance.

### Gulf Inventory of Multiple Rocket Launchers by Caliber in 1999



Source: Prepared by Anthony H. Cordesman, based upon discussions with US experts.

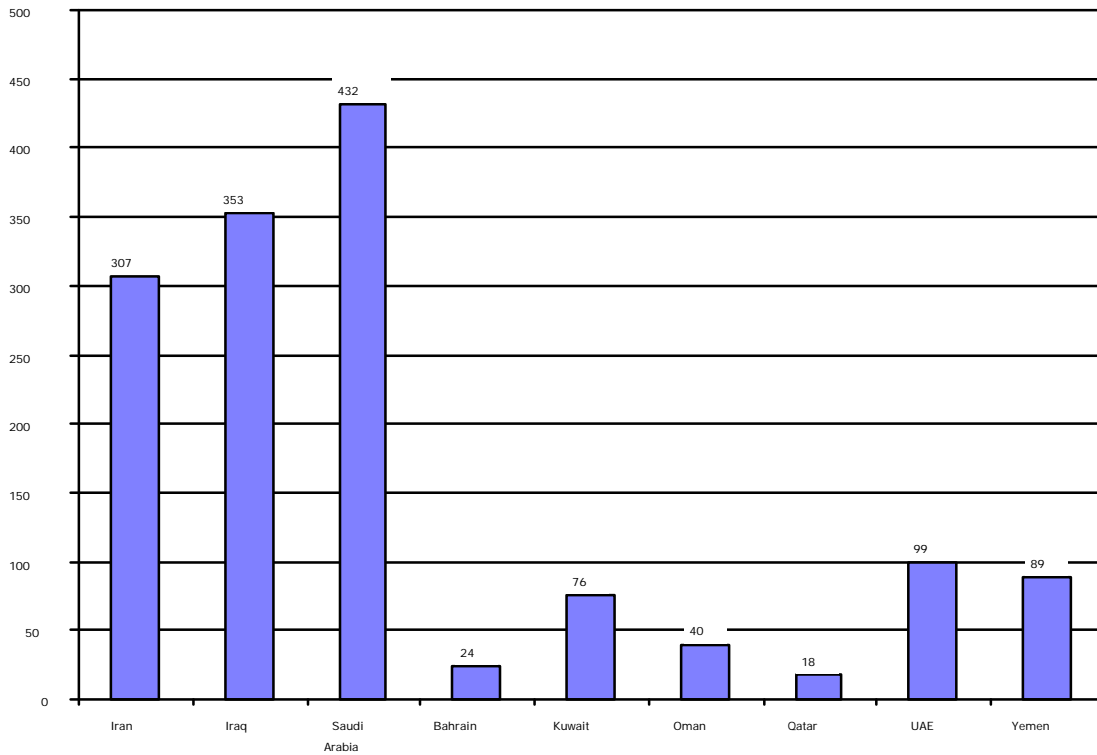
### Total Operational Combat Aircraft in All Gulf Forces 1990-2000



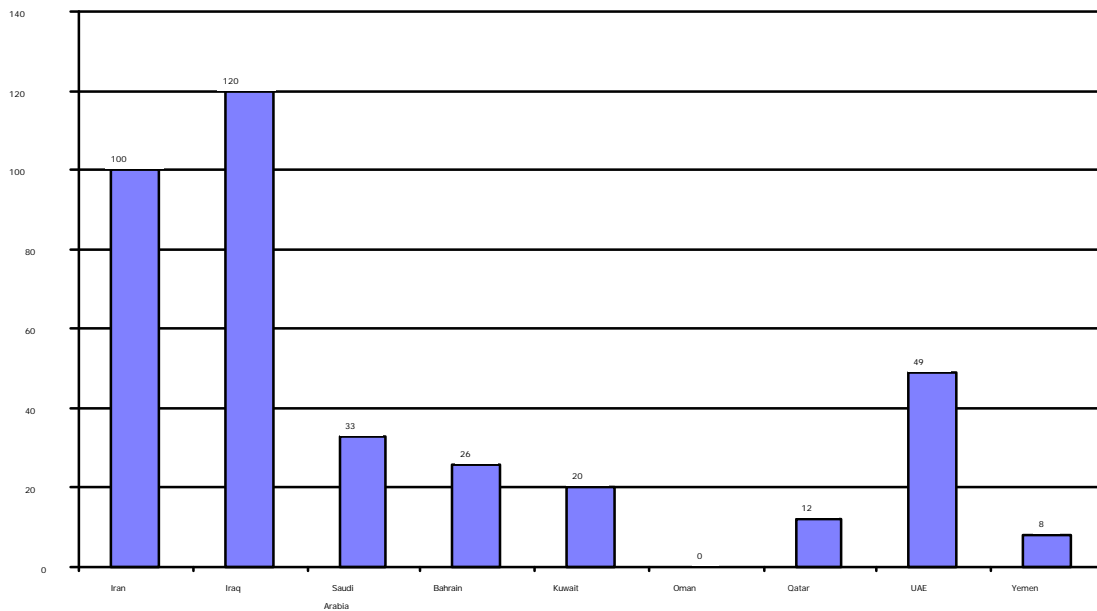
Adapted by Anthony H. Cordesman from various sources and the IISS, Military Balance.

## Total Gulf Holdings of Combat Aircraft – 2000

### Fixed Wing Combat Aircraft



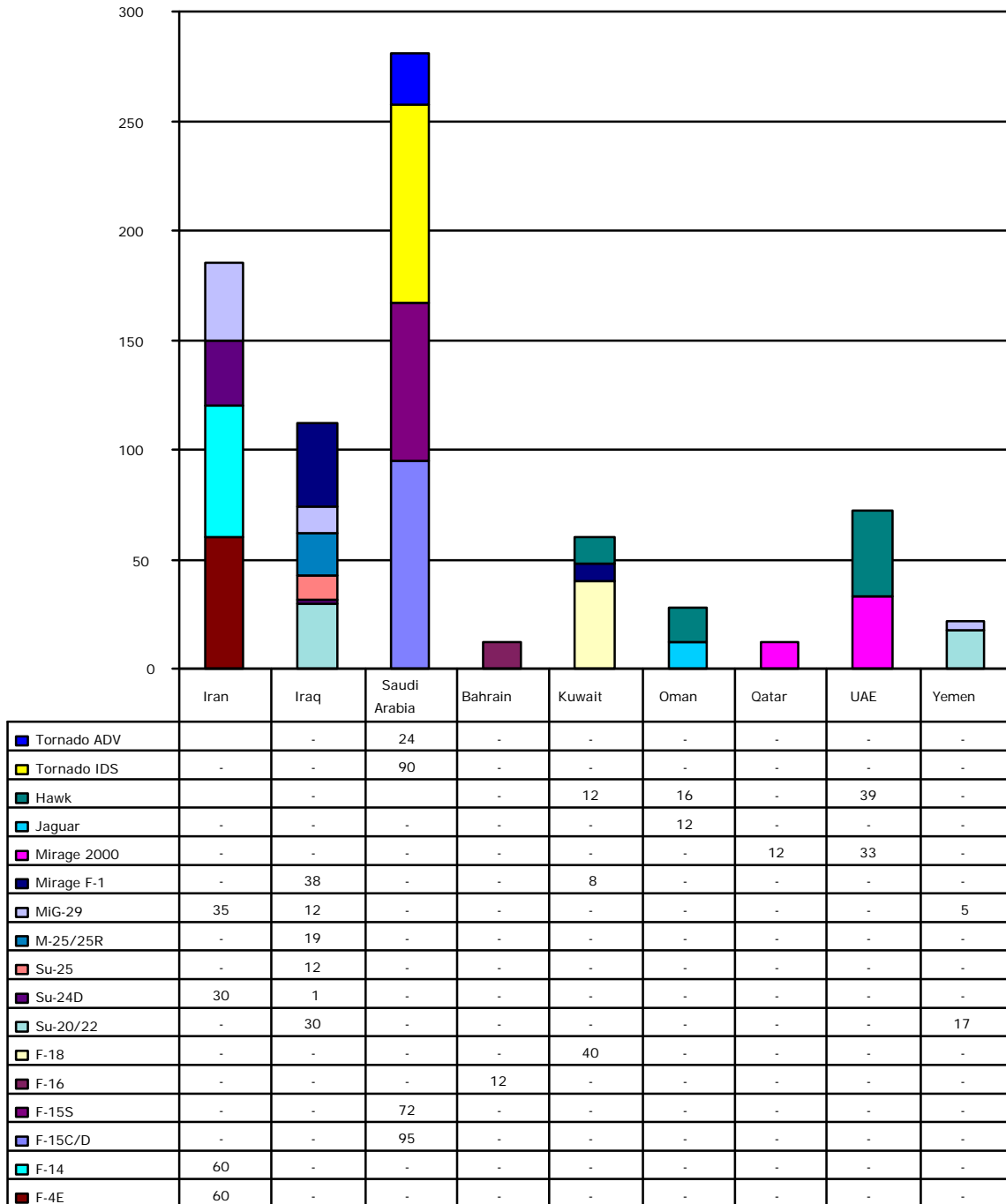
### Armed and Attack Helicopters



Adapted by Anthony H. Cordesman from the [IISS, Military Balance](#)

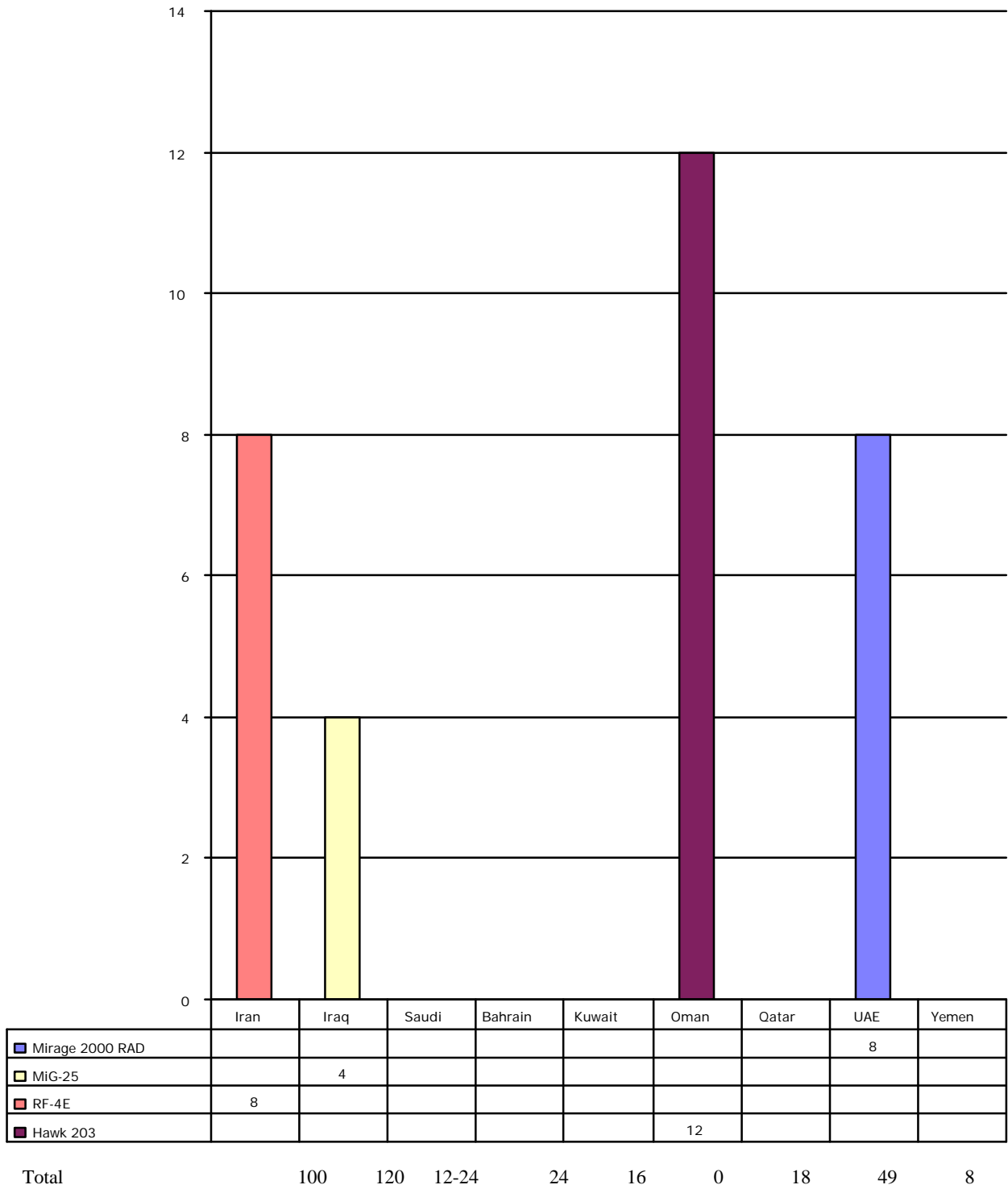
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## Gulf High and Medium Quality Fixed Wing Fighter, Fighter Attack, Attack, Strike, and Multi-Role Combat Aircraft By Type - 1998



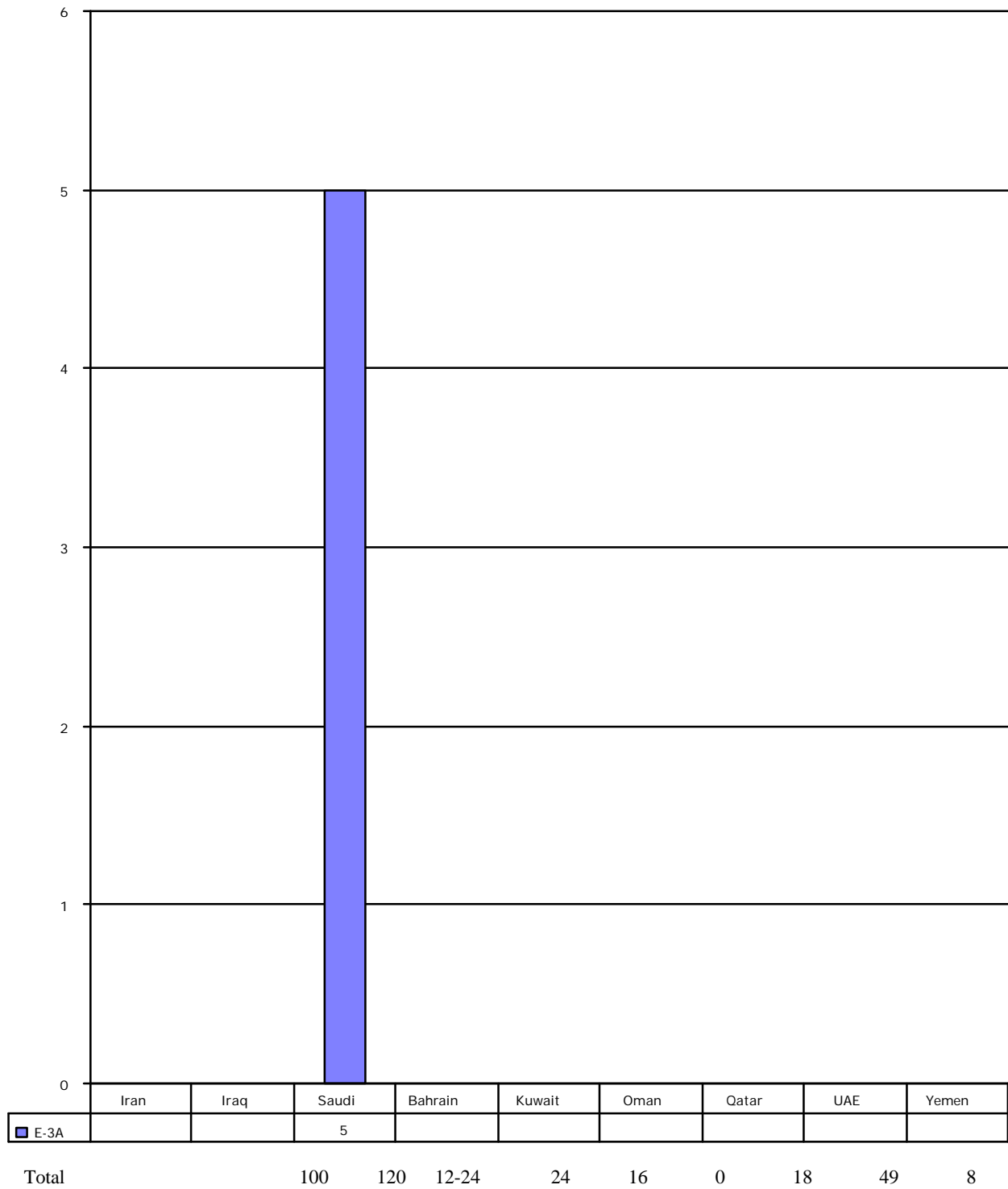
Source: Estimated by Anthony H. Cordesman from various sources and the IISS, Military Balance.

### Gulf Reconnaissance Aircraft in 1999



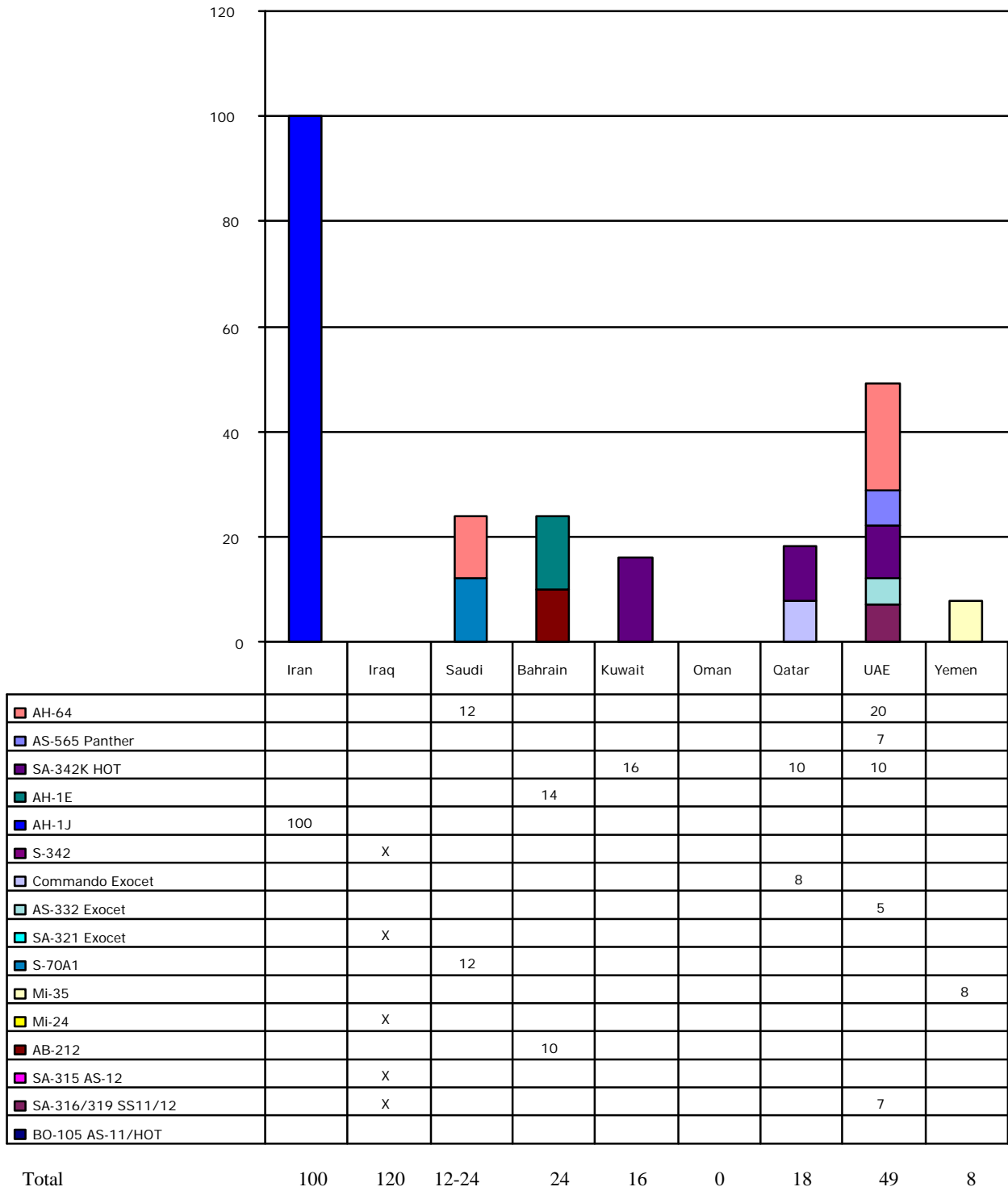
Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance.

### Sensor, AWACs, C4I, EW and Elint Aircraft in 1999



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance.

### Gulf Attack Helicopters in 1999



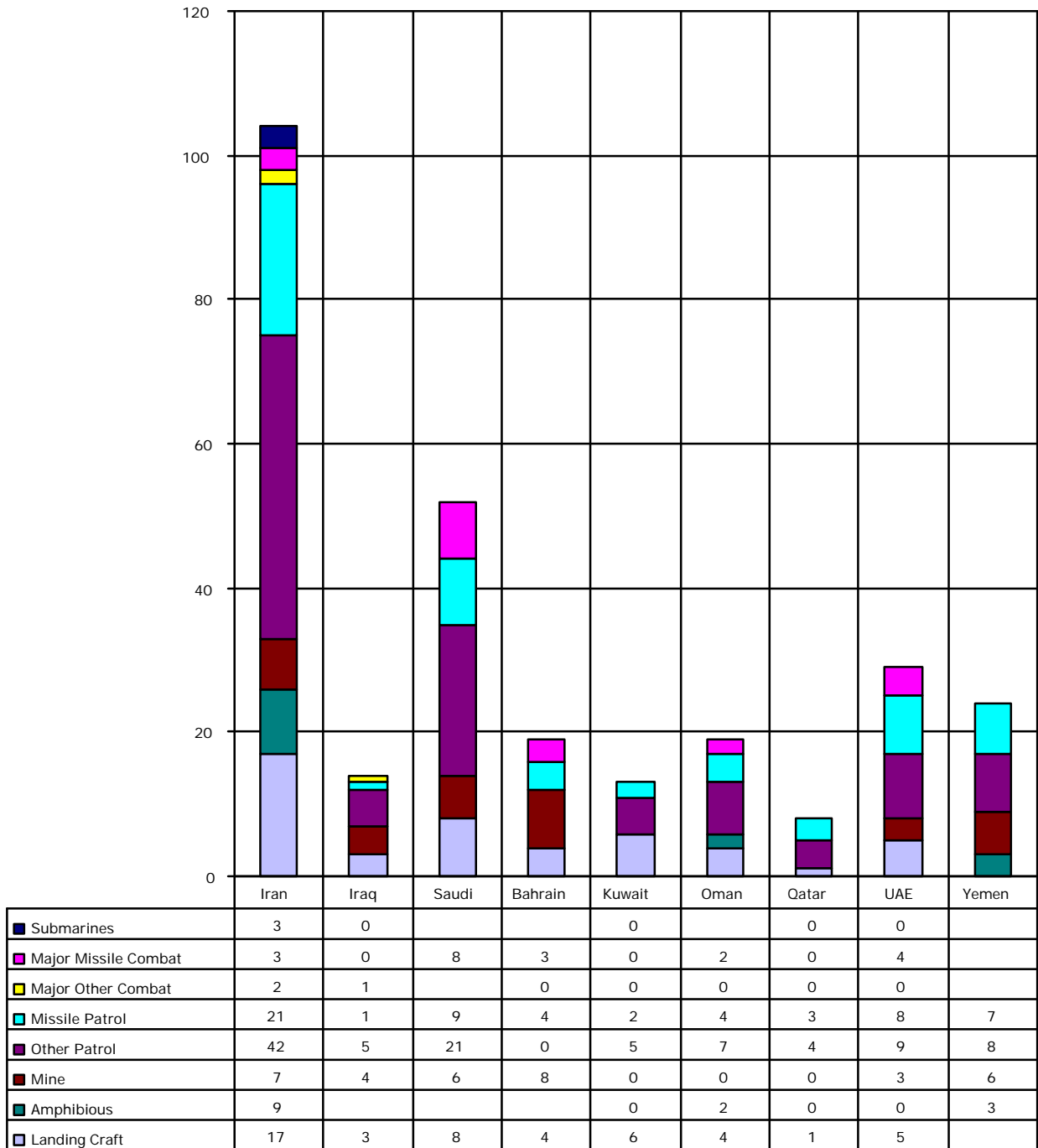
Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance.

## Gulf Land-Based Air Defense Systems in 1999

<u>Country</u>	<u>Major SAM</u>	<u>Light SAM</u>	<u>AA Guns</u>
<u>Bahrain</u>	8 IHawk	40+ RBS-70 15 Stinger 7 Crotale	12 Oerlikon 35 mm 12 L/70 40 mm
<u>Iran</u>	12/150 I Hawk 3/? SA-5 45 HQ-2J (SA-2) ? SA-2	SA-7 <u>HN-5</u> 30 Rapier FM-80 (Ch Crotale) 15 Tigercat	1,700 Guns ZU-23, ZSU-23-4, ZSU-57-2, KS-19 ZPU-2/4, M-1939, Type 55
<u>Iraq</u>	SA-2 SA-3 SA-6	Roland SA-7 SA-8 SA-9 SA-13 SA-14, SA-16	5,500 Guns ZSU-23-4 23 mm, M-1939 37 mm, ZSU-57-2 SP, 57 mm 85 mm, 100 mm, 130 mm
<u>Kuwait</u>	4/24 I Hawk 4/16 Patriot	6/12 Aspede 48 Starburst	6/2X35mm Oerlikon
<u>Oman</u>	None	Blowpipe 34 SA-7 <u>28 Javelin</u> 28 Rapier	2 VAB/VD 20 mm 4 ZU-23-2 23 mm 12 L-60 40 mm
<u>Qatar</u>	None	Blowpipe <u>12 Stinger</u> 9 Roland Stinger, SA-7, Mistral	?
<u>Saudi Arabia</u>	16/128 I Hawk ? Patriot	Crotale Stinger <u>500 Redeve</u> 17/68 Shahine mobile 40 Crotale 73 Shahine static	92 M-163 Vulcan 20 mm 128 35 mm guns <u>150 L-70 40 mm (in store)</u> 50 AMX-30SA 30 mm
UAE	5 I Hawk Bty.	20+ Blowpipe <u>Mistral</u> 12 Rapier 9 Crotale 13 RBS-70 100 Mistral	42 M-3VDA 20 mm SP 20 GCF-BM2 30 mm
<u>Yemen</u>	SA-2, SA3, SA-6	SA-7, SA-9, SA13, SA-14	52 M-167 20mm 20 M-163 Vulcan 20mm 100 ZSU-23-4 23 mm 150 M-1939 23 mm 120 S-60 37 mm KS-12 85 mm

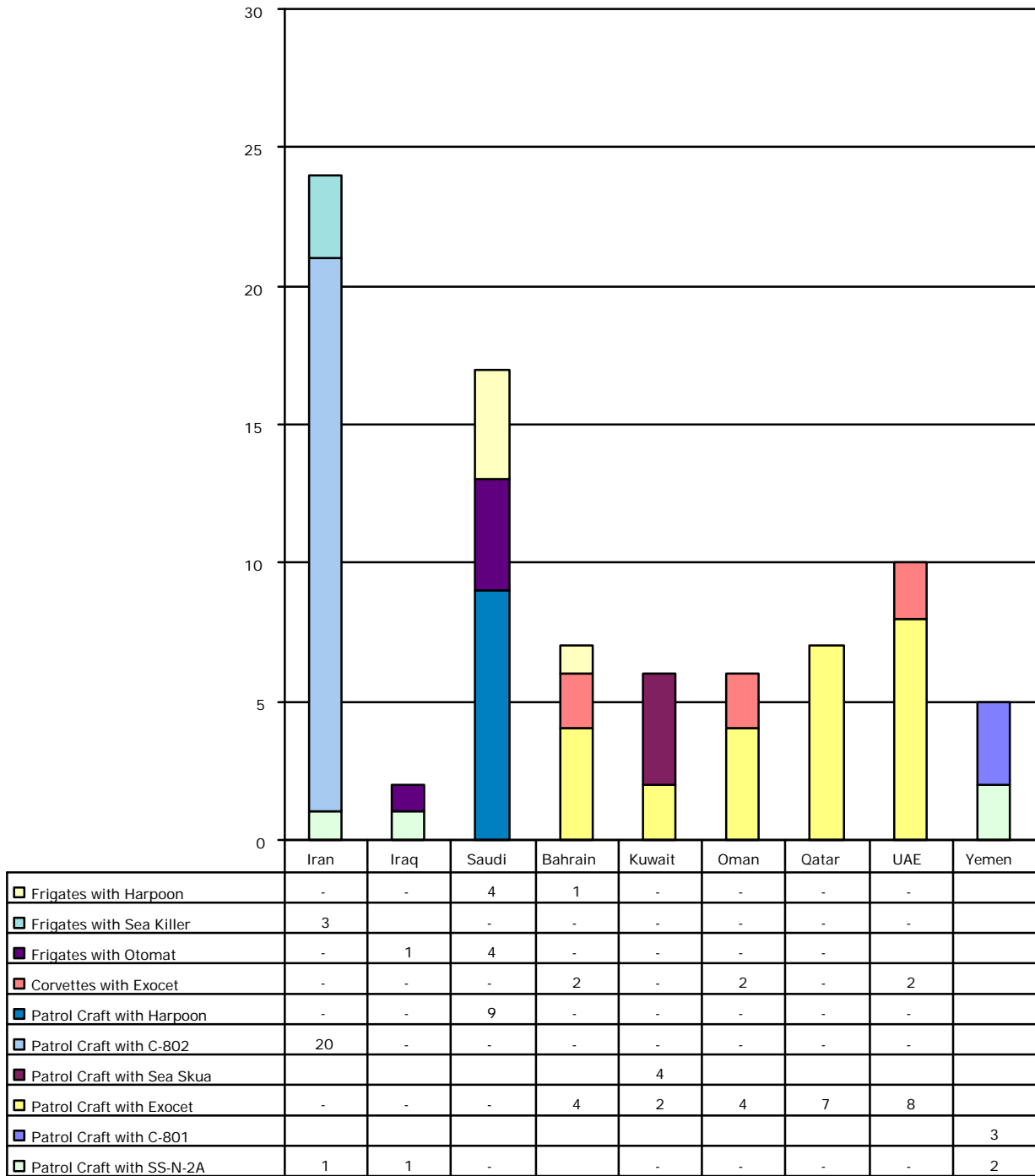
Source: Adapted from the IISS, Military Balance, various years. Some data adjusted or estimated by the author.

### Gulf Naval Ships by Category



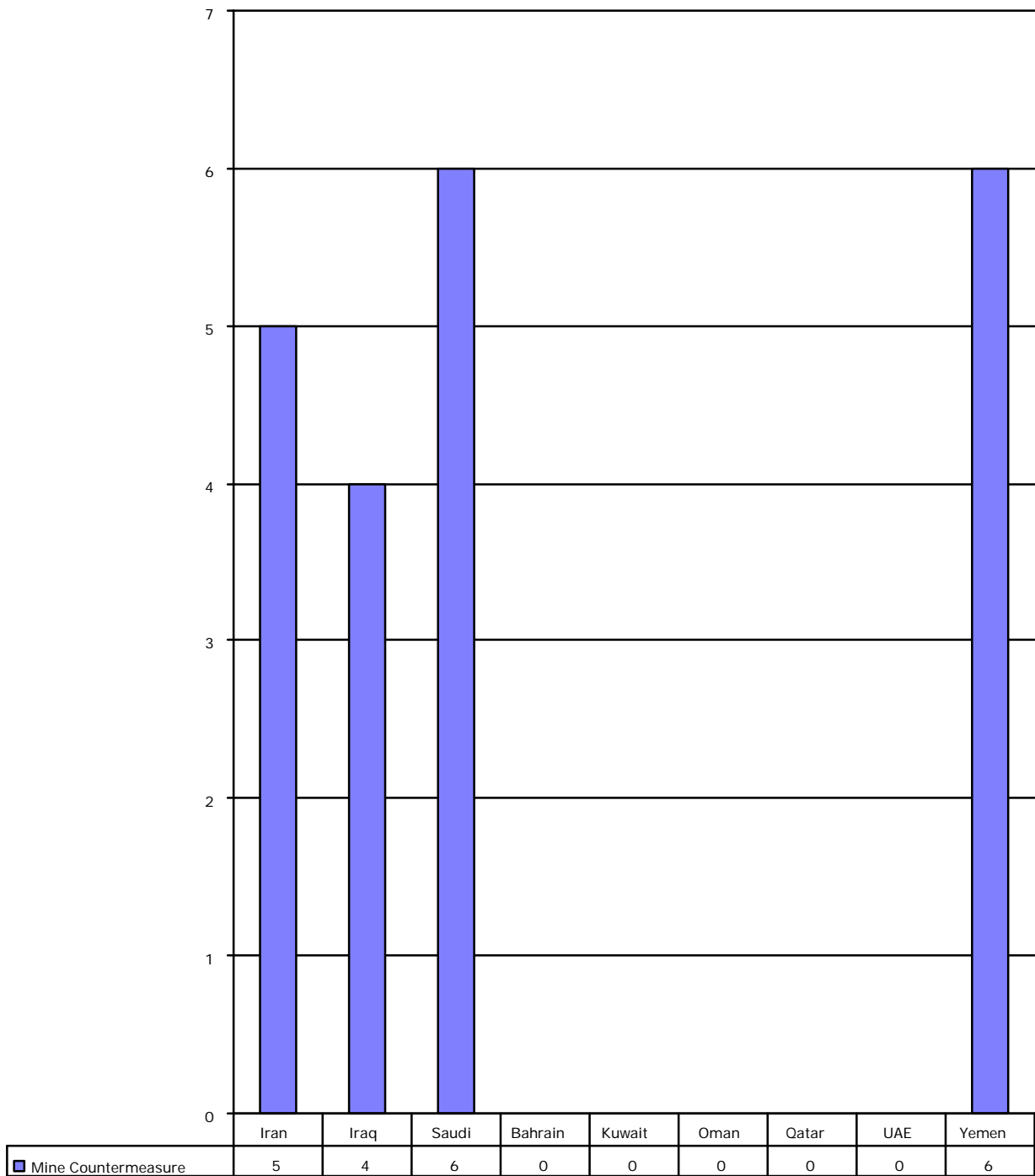
Source: Adapted by Anthony H. Cordesman from the IJSS, Military Balance, and material provided by US experts.

### Gulf Warships with Anti-Ship Missiles



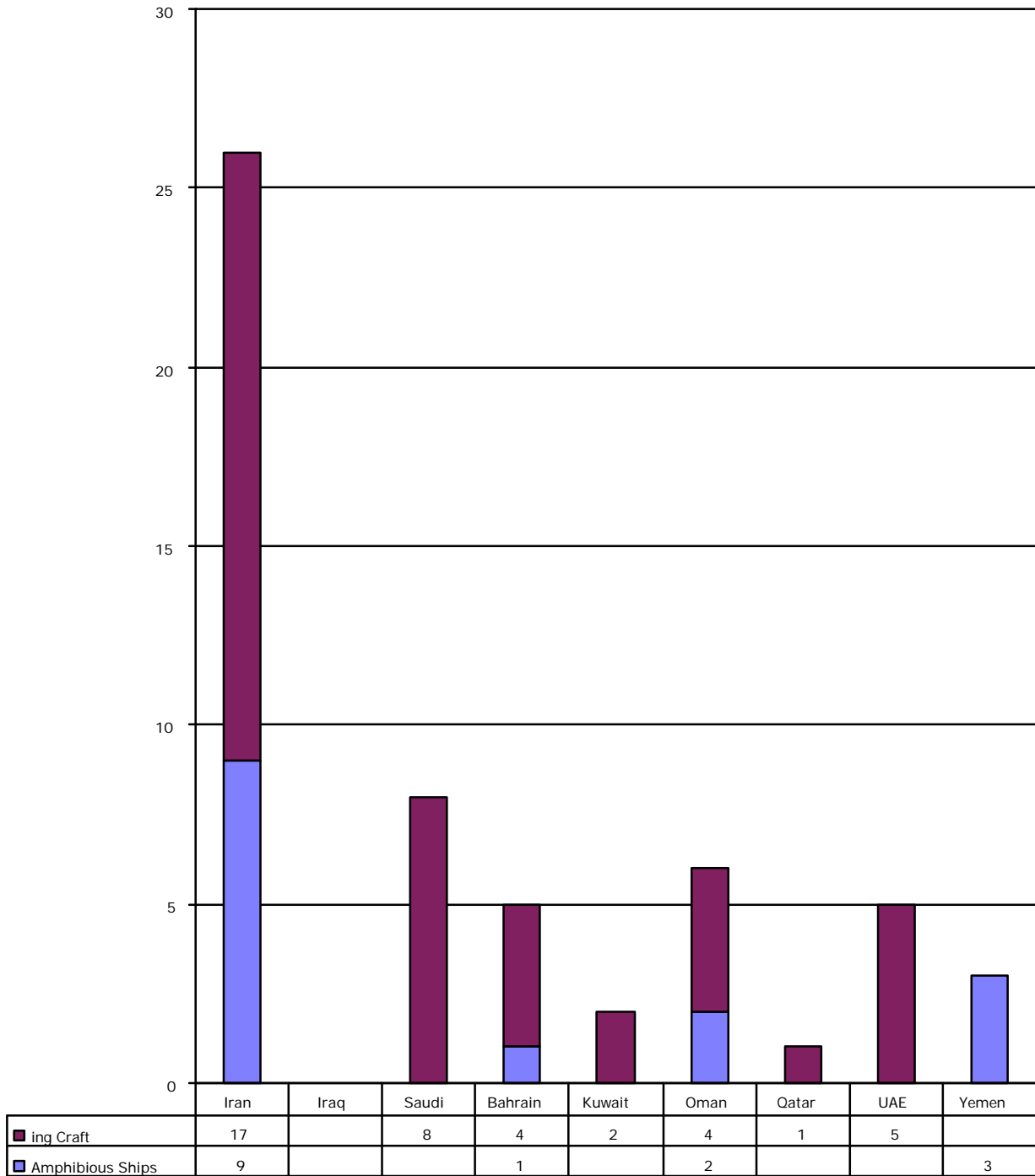
Source: Adapted by Anthony H. Cordesman from the [IISS, Military Balance](#), and material provided by US experts.

### Gulf Mine Warfare Ships



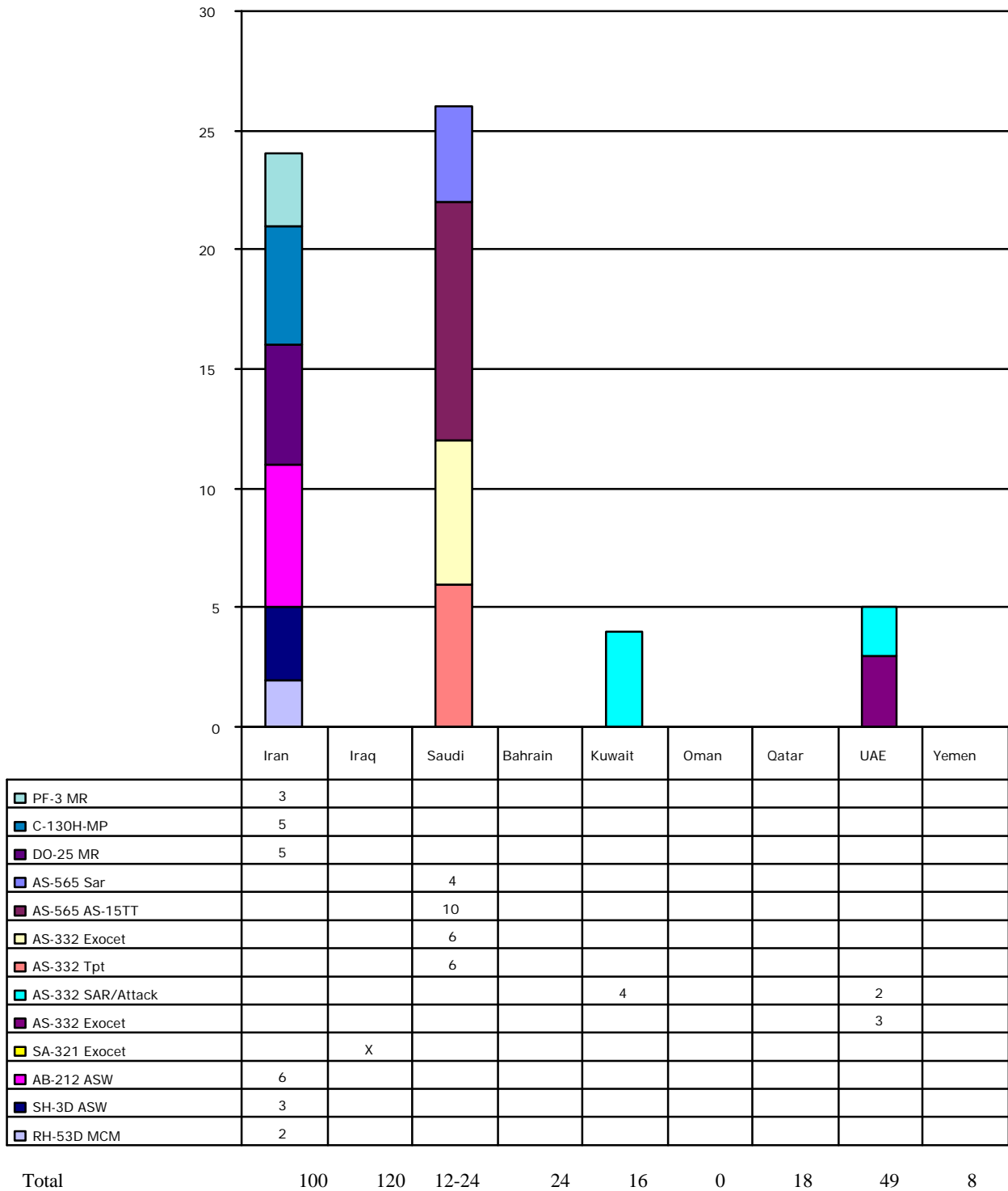
Source: Adapted by Anthony H. Cordesman from the [IISS, Military Balance](#), and material provided by US experts.

### Gulf Amphibious Warfare Ships



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, and material provided by US experts.

## Gulf Naval Aircraft and Helicopters Aircraft in 1999



Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance.

# **Part Seven**

# **Weapons of Mass Destruction**

## **Proliferation is Already Here: Middle Eastern Case Studies in Creeping Proliferation**

- **Israel relies on nuclear weapons, deterrence, and “soft strike” preemption.**
- **Iran has chemical and probably biological weapons, nuclear effort continues.**
- **Iraq’s massive pre-Gulf War efforts give it a major “break out” effort the moment containment efforts cease and may give a major biological break out capability even with such efforts.**
- **Syria has significant chemical warfare capabilities and will soon acquire significant biological capabilities -- if it does not have them.**
- **Libyan chemical effort continues.**
- **Algerian and Egyptian efforts uncertain.**
- **Saudi Arabia is studying options as a result of its CSS-2 replacement planning.**
- **Terrorists, extremists, and “proxies” may also acquire such capabilities.**

## **The Current Track: Reasons for Proliferating Outweigh Perceived Risks**

- **Prestige**
- **Deterrence**
- **War fighting**
- **Lessons of Iran-Iraq War and Gulf War: Missiles and weapons of mass destruction have been used against military and civilian targets.**
- **Arms race with neighbors: Algeria-Libya-Morocco, Egypt-Israel-Syria, Iran-Iraq-Southern Gulf.**
- **Inability to know the future enemy, characterize risk.**
- **The “greater Middle East” -- growing overlap of arms races listed above, plus impact of North Korea and India-Pakistan arms race.**
- **Deterrence and safeguards: No way to know the scale of the efforts of key threats and other major regional actors.**
- **Intimidation**
- **Alternative to expensive conventional investments**
- **Compensate for conventional weakness and cost of conventional weapons.**
- **“Glitter Factor”**
- **Limit or attack US and other outside power projection options**
- **Create existential threat**
- **Force arms control; react to absence of meaningful arms control regimes.**
- **Momentum of arms race/respond to proliferation elsewhere**
- **State, proxy, or private terrorism.**
- **Exploit lack of effective civil and critical facility defense and anti-tactical ballistic missile defense capabilities.**

## **Unstable Possible Combinations of Adversaries**

- **Iran versus Iraq**
- **Iraq versus Southern Gulf, US, and/or Israel**
- **Israel versus Syria**
- **Iran versus Southern Gulf, US, and/or Israel**
- **Libyan and Algerian wild cards**
- **Vestigial Yemeni use of gas**
- **Saudi Arabia joins the club in reaction to Iranian and Iraqi proliferation, changing the nature of war fighting involving the Southern Gulf.**
- **The US extends deterrence, compellance, and/or retaliation in reaction to an attack on an Arab ally or Israel.**
- **Egypt joins the club after arms control efforts fail, and finds itself involved against Iraq or dragged into confrontation with Israel.**

## **A Wide Range of War Fighting Options that Go Far Beyond Missile Attacks**

- **Covert-indirect, unconventional warfare, “terrorism”**
- **Surprise attack to support conventional war fighting**
- **Avoid conventional defeat**
- **Pose political threat - intimidation**
- **Regional Deterrence - threatened or illustrative use**
- **Attack power projection facilities**
- **Counterproliferation**
- **Extended deterrence**
- **Controlled escalation ladder**
- **Asymmetric escalation/escalation dominance**
- **“Firebreaks”**
- **Launch on warning/launch under attack**
- **Seek to force conflict termination**
- **Destroy enemy as state**
- **Martyrdom**
- **Alter strategic nature of conflict**

## **Unstable Patterns of War Fighting and Escalation**

- **Arms race is multipolar and cuts across subregions, making it difficult to contain the scope of conflicts.**
- **Technologies are new and there is little or no combat experience; operations research and exercises are difficult.**
- **Acquisition does not mean war planning; policy statements do not mean war planning, doctrine does not mean war planning.**
- **Lies, denial, and covert efforts make it extremely difficult to predict opposing force and enemy actions.**
- **Impossible to predict ride out capability and survival of retaliatory forces in many cases, possible “use or lose” reaction.**
- **War fighting concepts are likely to lack clear structure and be highly volatile in terms of enemy, targets, and crisis behavior.**
  - **Only a few leadership and military elites -- such as Egypt and Israel -- have shown a concern with highly structured strategic planning in the past.**
  - **Iran-Iraq and Gulf Wars have demonstrated missiles and weapons of mass destruction will be used, and that escalation can be unpredictable.**
  - **Israeli actions in 1967 and attack on Osirak, Egyptian and Syrian attack on Israel in 1973, demonstrate regional focus on surprise and preemption.**
  - **Iraq has already demonstrated regional concern with launch on warning, launch under attack options. Syria probably has some option of this kind.**
- **Concentration of population and leadership in single or a few urban areas makes existential attacks possible and attractive.**
- **Covert, terrorist, and proxy attacks are increasingly possible, particularly using biological weapons.**

## Major Uncertainties

- **Who is the enemy, the ally, the enemy's ally?**
- **Uncertain weapons accuracy, reliability, and effectiveness: The CEP problem, the weapons effect problem**
- **Probable lack of full operational testing for all weapons: The “Heisenberg factor.”**
- **C<sup>4</sup>I/BM breakdowns/lack of accurate battle damage assessment by both attacker and attacks.**
- **Uncertainties coming from use of different types of WMDs and delivery systems**
- **Unattributable attacks/proxy attacks**
- **Unconventional warfare, mass terrorism, covert delivery, delayed effects**
- **Impact of “Cocktails” = mixes of different agents or types of weapon of mass destruction**
- **Reliance on authoritarian leaders or elites who will never take the time to fully understand the technology and effects of weapons of mass destruction for sudden crisis decisions**
- **Coupling effects -- US linkages to allies**
- **Unknown targeting concepts and capabilities; Random impact of inaccuracy and targeting errors.**
- **Different perceptions of values/escalation ladder**
- **Risk of escalation “total war”: willingness to risk use of infectious agents,**
- **Instability of preemption, launch on warning, launch under attack options.**
- **The risk of martyrdom and nothing to lose: Unplanned “doomsday machines”**
- **Unexpected collateral damage**
- **Uncertain impact on conventional conflict**
- **Uncertain capabilities for NBC defense/counterproliferation**
- **Impact on peripheral states**

- **Long-term damage effects**

## **Technological Developments and Imperatives 2010-2020: Missiles and Other Delivery Systems**

- **Satellite targeting and weather models, GPS launch location data.**
- **Cheap cruise missiles, drones, aircraft conversions**
- **Indigenous production of medium to long-range solid fuel designs and high payload, multi-stage liquid-fueled designs. “Add a stage” range extensions.**
- **Widespread deployment of systems with high range-payloads and very high terminal velocities. Some “smart” warhead technology for penetration and terminal guidance.**
- **Hardened or mobile launch facilities, large numbers of dispersed systems**
- **Rapid launch with minimal warning indicators.**
- **Mobile, rapidly replaceable separate warheads. Easy conversion and concealment.**
- **Advanced computer modeling and simulation, test range facilities. Reduced testing requirements.**
- **Strike Aircraft with some stealth features.**
- **Advanced warhead and munitions designs with sophisticated fusing and dissemination systems.**
- **Highly sophisticated covert delivery systems and “terrorist” devices.**

## **Technological Developments and Imperatives 2010-2020: Chemical Weapons**

- **Rapid, often covert, precursor production. Complex precursor assembly combinations.**
- **Stable binary nerve agents for persistent and non-persistent agents.**
- **Rapid production of mustard and other incapacitating agents.**
- **Weapons with mixed agents or “cocktails” to help defeat antidotes and protection systems.**
- **“Breakout” facilities for rapid conversion to production.**
- **Effective cluster warheads and bombs, with reliable fusing and dissemination systems.**
- **Widespread deployment of systems with high range-payloads and very high terminal velocities. Some “smart” warhead technology for penetration and terminal guidance.**
- **Advanced weather and targeting data. Computer modeling of attack contours.**
- **Highly sophisticated covert delivery systems and “terrorist” devices.**

## **Technological Developments and Imperatives 2010-2020: Biological Weapons**

- **Genetic engineering – generational change capability to weaponize new weapons, defeat vaccines, detection, and protection systems..**
- **Widespread deployment of dry, storable agents.**
- **Ability to rapidly convert civilian pharmaceutical, fermentation, and other facilities..**
- **Possible ability to weaponize infectious agents like Ebola**
- **Ability to use complex cocktails of different biological weapons to defeat warning, detection, treatment, and protection.**
- **Lethality of small nuclear weapons.**
- **Advanced warhead and munitions designs with sophisticated fusing and dissemination systems. Line source dissemination systems.**
- **Rapidly convertible warheads and bombs.**
- **Advanced weather and targeting data. Computer modeling of attack contours.**
- **Highly sophisticated covert delivery systems and “terrorist” devices. Ability to delay effect of weapon.**

## **Technological Developments and Imperatives 2010-2020: Nuclear Weapons**

- **Widespread understanding of complex weapons designs and access to key computer modeling data.**
  - **Reduced need for fissile material and sharply reduced weapon weight.**
  - **Can reduce or eliminate need for testing.**
- **High speed, high capacity centrifuge capability.**
- **Power reactors can be rapidly converted or cannibalized?**
- **Indigenous design and production of explosive lenses, initiators, and boosting technology.**
- **Advanced computer modeling and simulation. Ability to use non-fissile material for most testing purposes.**
- **Advanced warhead designs with sophisticated fusing. Controlled height of burst and enhanced radiation weapons. Safe use of weapons near own and friendly territory.**
- **Advanced weather and targeting data. Computer modeling of fall out contours.**
- **Highly sophisticated covert delivery systems and “terrorist” devices.**

## **Technological Developments and Imperatives 2010-2020: Counterproliferation and Defensive Options**

- **“Defensive” systems can protect:**
  - **Missile and greatly improved air defenses.**
  - **Major improvements in chemical and biological detection and warning.**
  - **Some improvement in treatment and protection systems.**
  - **Civil defense options.**

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- **“Defensive” systems can also threaten:**
  - **Greatly improved access to satellite surveillance systems, ability to piggyback on any arms inspection efforts to ease targeting burden.**
  - **Widespread access to long-range precision-guided strike systems and some ability to hit hardened targets.**
  - **Possible access to small covert sensors and detection systems.**
  - **Long-range UAVs, RPVs.**
  - **Possible improvement in Sigint/Comint systems.**

## The Status of Major Arms Control Agreements

Country	Geneva Protocol	NPT	BWC	CWC of Pelindaba*	Treaty	CTBT	
<b>North Africa</b>							
Algeria	R	R	-	R	R	R	SRR
Libya	R	R	A	-	-	S	-
Morocco	R	R	S	R	R	R	S
Tunisia	R	R	R	R	R	S	S
<b>Near/Middle East</b>							
Egypt	R	R	S	-	-	S	SRR
Israel	R	-	-	S	-	NA	SRR
Jordan	R	R	R	A	-	NA	R
Lebanon	R	R	R	-	-	NA	-
Syria	R	R	S	-	-	NA	-
<b>Gulf</b>							
Bahrain	R	R	A	R	-	NA	S
Iran	R	R	R	R	-	NA	SRR
Iraq	R	R	R	-	-	NA	-
Kuwait	R	R	R	R	-	NA	S
Oman	-	R	R	R	-	NA	-
Qatar	R	R	R	R	-	NA	R
UAE	-	R	S	S	-	NA	S
Yemen	R	R	R	S	-	NA	S
<b>Periphery</b>							
Ethiopia	R	R	R	R	-	S	S
Eritrea	-	R	-	-	-	S	-
Sudan	R	R	-	-	-	S	-
India	R	-	R	R	-	NA	NSRR
Pakistan	R	-	R	R	-	NA	NSRR

**R = Ratified, S = Signed, A = Acceded, NA = Not Applicable, SRR = Signed – Ratification Required, and NSRR = Not signed – Ratification Required**

**\* African Nuclear Weapons Free Zone Treaty**

**Source: State Department as of March, 1999**

## Major Risks in Regional Arms Control

- **“Breakout”**: Technology allows sudden or covert break out of weapons production and delivery capability – particularly in terms of biological weapons.
- **“Squeezing the balloon”**: Limiting one area of proliferation simply increases activity in another.
- **“Liar’s contest”**: Accept agreements that do not intend to honor. Carry out covert efforts and deny them. Obtain access to technology and equipment.
- **“Only the honest suffer:”** Limit moderate states, but fail to contain and deter rogue or high-risk states. License technology transfer to nations that claim to comply, but do not.
- **“War fighting risk”**: Create a covert climate of proliferation involving sudden activation of forces with limited planning and/or control, higher risk of misunderstandings, accidents, unnecessary preemption, launch under and through attack, and escalation.
- **“Existential minimalism”**: Reducing weapons to minimal levels creates an added use or lose risk, leads to countervalue (civilian casualties and damage)/existential threats and targeting.
- **“Destabilizing truth”**: Added transparency, inspection, declarations either stimulate arms race or lead to constantly increasing pressure to reveal or reduce more.
- **“Climate of illusions”**: Inspection, verification, declarations give the impression of added transparency and stability without being trustworthy.
- **“Conventional paradox”**: Reducing or constraining weapons of mass destruction increases risk of conventional war.
- **“Nth Weapon”** problem in trying to eliminate all weapons when a few concealed nuclear or biological weapons can produce existential damage.
- **“Valid Paranoia”**: Can encourage covert delivery and strikes, use of third parties and terrorists.
- **“Arms control is an extension of war by other means”**: Well, yes!

## Algeria's Search for Weapons of Mass Destruction

### Delivery Systems

- 10 Su-24 long range strike aircraft.
- 40 MiG-23BN fighter ground attack aircraft.
- Tube artillery and multiple rocket launchers.
- Possible modification of Soviet SS-N-2B Styx.

### Chemical Weapons

- Possible development. No evidence of deployed systems.

### Biological Weapons

- Some early research activity.
- No evidence of production capability.

### Nuclear Weapons

- Deliberately sought to create a covert nuclear research program under military control with Chinese support.
- Secretly built a research reactor (Es Salam) at the Ain Oussera nuclear research facility. This was announced to be a 10-15 megawatt reactor using heavy water and low enriched uranium. The size of its cooling towers, however, indicated it might be as large as 60 megawatts. It was also located far from population centers, had no visible electric generating facilities and was defended by SA-5s. There were also indications Algeria might be constructing a facility to separate out weapons grade plutonium.
- In May 1991, following the exposure of the reactor by US intelligence, Algeria agreed to place the reactor under IAEA safeguards. As early as December 1993, Algerian officials pledged adherence to the NPT, and on January 12, 1995, Algeria formally acceded to the Treaty. On March 30, 1996, Algeria signed a comprehensive IAEA safeguards agreement providing for IAEA inspections of all of Algeria's nuclear facilities and IAEA technical assistance to Algeria. The agreement entered into force on January 7, 1997.
- Algeria signed a "second stage" agreement of nuclear cooperation with China on June 1, 1996. According to an October 1996 "letter of intent", China was to assist Algeria with the construction of facilities for the research and production of radioactive isotopes for use in the medical, industrial, and agricultural sectors. China and Algeria intend to move into a third phase of cooperation under which China will share the know-how to enable Algeria to operate hot cells in the facility (mentioned previously) at the Es Salam compound. These hot cells would give Algeria the capability to separate plutonium from spent fuel. Algeria claims that the hot cells are intended for the purpose of producing medical isotopes, and the US is reportedly "satisfied" that the hot cells will be operated under IAEA safeguards.
- While it appears that the Zeroual government is cautiously expanding Algeria's civil nuclear research program in compliance with the NPT, uncertainties about the long-term goals of the nuclear research program and Algeria's political future make the program a potential threat.
  - Algeria has uranium deposits west of Tamanrasset in southeast Algeria, has a 1 megawatt reactor (Nur) at Draria on the coast east of Algiers, and has hot cells for the production of radioactive isotopes at Draria.
- A Spanish paper, El Pais, claimed on August 23, 1998 that Spain's military secret service, the CESID, had issued a report that Algeria will be able in two years to produce military-grade plutonium, a key ingredient for making atomic weapons, a Spanish newspaper reported on Sunday. The report is said to have concluded that Algeria, had forged ahead with a nuclear program with Chinese and Argentine technical support that far exceeded its civilian needs, despite having signed the international nuclear non-proliferation treaty, said. The report is said to have been submitted to the Spanish government in July and to have sounded a warning of the danger involved if Algeria decided to divert its nuclear program to military purposes. The report indicated that the nuclear complex at Birine, 250 km (155 miles) south of Algiers, already had a heavy-water reactor in

operation capable of producing weapons-grade plutonium. The CESID report stated that Algeria “has all the installations needed to carry out activities linked to the complete cycle for the creation of military plutonium” by the end of the century, the newspaper said. CESID concluded that if the Algerian government decided to change its current policy of not acquiring atomic weapons, “the knowledge gathered by a significant team of technicians and scientists, in addition to the availability of facilities ... will place this country in the position of initiating a program of military purposes.”

## Libya's Search for Weapons of Mass Destruction

### Delivery Systems

- Has developed a liquid-fueled missile with a range of 200 kilometers. No evidence of deployment.
- Al-Fatih solid-fueled missile with 300-450 mile range reported to have been under development with aid of German technical experts, but no signs of successful development.
- FROG-7 rocket launchers with 40 kilometer range.
- Deployed 80 Scud B launchers with 190 mile range in 1976, but could not successfully operate system. Many of the launchers and missiles sold to Iran.
- Fired Scud missiles against the Italian island of Lampadusa in 1987.
- Purchased SS-N-2C and SSC-3 cruise missiles. Little operational capability.
- Pursued other missile development programs with little success. There are unconfirmed reports of some Libyan interest in the Iranian Shahab 3 program.
- Tu-22 bombers with minimal operational capability.
- Su-24 long range strike fighters. These are operational and have with limited refueling capability using C-130s.
- operational Mirage 5D/DE and 10 Mirage 5DD fighter ground attack aircraft.
- Mirage F-1AD fighter ground attack aircraft.
- MiG-23BM Flogger F and 14 MiG-23U fighter ground attack.
- Su-20 and Su-22 Fitter E, J. F fighter ground attack aircraft.
- Tube artillery and multiple rocket launchers.
- The CIA estimated in January 1999 that, Libya continued to obtain ballistic missile-related equipment, materials, and technology during the first half of 1998. Outside assistance is critical to keeping its fledgling ballistic missile development programs from becoming moribund. Nevertheless, the UN embargo has restricted the flow of ballistic missile goods and technology reaching Libya.
- Libya is caught smuggling Scud components from Hontex in Southern China which are being shipped from Taiwan via BA to Malta in November 1999. The parts include elements for the rocket propulsion system. The shipment is in 32 crates discussed as automobile parts.

### Chemical Weapons

- Claims will not sign CWC as long as other states have nuclear weapons.
- May have used mustard gas delivered in bombs by AN-26 aircraft in final phases of war against Chad in September, 1987.
- Pilot plant near Tripoli has been producing small amounts of chemical weapons since early 1980s.
- Are probably two other small research/batch production facilities.
- Main nerve and mustard gas production facilities in an industrial park at chemical weapons plant at Rabta. This plant can produce both the poison gas and the bombs, shells, and warheads to contain it. Are probably two other research facilities.
- Rabta Plant seems to have started test runs in mid-1988. It is a 30 building facility defended by SAM batteries and special troops. Has sheltered underground areas.
  - Libya has acquired large stocks of feedstocks for mustard gas like thiodiglycol, and precursors for nerve gas, and extensive amounts have been sent to Rabta.

- At least 100 metric tons of blister and nerve agents have been produced at Rabta since the late 1980s, but production rate has been very low and plant is either not successful or is not being utilized because of fear of attack.
- The plant would have a capacity of 100 metric tons per year if operated at full capacity.
- Fabricated fire at Rabta in 1990 to try to disguise the function of plant and fact was operating.
- German courts have convicted a German national in October 1996, for selling Libya a computer designed for use in chemical weapons programs and helping Libya to import equipment to clean the waste emissions from poison gas production from India using an Irish dummy corporation.
- Additional major chemical weapons plant in construction in extensive underground site near Tarhunah, a mountainous area 65 kilometers southeast of Tripoli, but few recent signs of activity.
- Tarhunah has been designed to minimize its vulnerability to air attack and has twin tunnels 200-450 feet long, protected by 100 feet of sandstone above the tunnels and a lining of reinforce concrete. This is far beyond the penetration capabilities of the US GBU-27B and GBU-28 penetration bombs. The GBU-28 can penetrate a maximum of 25-30 meters of earth or 6 meters of concrete.
- Libya rejected the proposal of President Mubarak that it open the Tarhuna facility to third country inspection to prove it was not a chemical weapons facility in April 1996.
- Reports of construction of another sheltered major facility near Sabha, 460 miles south of Tripoli.
- Reports of Chinese, North Korean, German, Swiss, and other European technical support and advisors.
- Reports of shipments of chemical weapons to Syria and Iran do not seem valid.
- Very low quality weapons designs with poor fusing and lethality.
- The CIA estimated in January 1999 that Libya remains heavily dependent on foreign suppliers for precursor chemicals and other key CW-related equipment. UN sanctions continued to severely limit that support during the first half of 1998. Still, Tripoli has not given up its goal of establishing its own offensive CW capability and continues to pursue an independent production capability for the weapons.

### **Biological Weapons**

- Some early research activity.
- No evidence of production capability.

### **Nuclear Weapons**

- Has sought to create a development and production capability, but no evidence of any real progress or success.
- Unsuccessfully attempted to buy nuclear weapons from China in the 1970s.
- Qadhafi called for Libyan production of nuclear weapons on April 29, 1990.
- Has explored for uranium, but no active mines or uranium mills.
- 10 megawatt, Soviet-supplied nuclear research reactor at Tajura acquired from the USSR in 1970s. Operates under IAEA safeguards.
- Had plan to build at 440 megawatt, Soviet-supplied reactor near the Gulf of Sidra in the 1970s, but canceled project.
- Ratified NPT in 1975. Declares all facilities under IAEA safeguards.
- Continues to train nuclear scientists and technicians abroad.

## Egypt's Search for Weapons of Mass Destruction

### Delivery Systems

- Began three major design programs based on the V-2 missile in the 1950s, with help from German scientists. Test two missiles by 1965: A 350 kilometer range al-Zafir and a 600 kilometer range Al Kahir. A 1,500 kilometer range Ar-Ra'id was designed but never tested. These missiles were liquid fueled and development ceased around 1967.
- Cooperated with Iraq in paying for development and production of "Badar 2000" missile with a 750-1,000 kilometer range. This missile is reported to be a version of the Argentine Condor II or Vector missile. Ranges were reported from 820-980 kilometers, with the possible use of an FAE warhead.
  - Egyptian officers were arrested for trying to smuggle carbon materials for a missile out of the US. in June 1988.
  - Covert US efforts seem to have blocked this development effort.
  - The Condor program seems to have terminated in 1989-1990.
- Has Scud B TELs and missiles with approximately 100 missiles with 300 kilometers range.
- Reports has developed plant to produce an improved version of the Scud B, and possibly Scud C, with North Korean cooperation.
  - North Korean transfers include equipment for building Scud body, special gyroscope measuring equipment and pulse-code modulation equipment for missile assembly and testing.
  - Reports in June 1996 that has made major missile purchase from North Korea, and will soon be able to assemble such missiles in Egypt. Seven shipments from North Korea reported in March and April.
  - Another liquid-fueled missile under development known as 'Project T' has an estimated range of 450 kilometers. It is believed to be an extended-range Scud designed with North Korean assistance.
  - Media reports that US satellites detected shipments of Scud C missile parts to Egypt in February-May, 1996 -- including rocket motors and guidance devices -- do not seem correct. The Scud C has a range of roughly 480 kilometers.
  - The CIA reported in June 1997, that Egypt had acquired Scud B parts from Russia and North Korea during 1996.
  - The CIA reported in January 1999 that Egypt continues its effort to develop and produce the Scud B and Scud C and to develop the two-stage Vector short-range ballistic missiles (SRBMs). Cairo also is interested in developing a medium-range ballistic missile (MRBM). During the first half of 1998, Egypt continued to obtain ballistic missile components and associated equipment from North Korea. This activity is part of a long-running program of ballistic missile cooperation between these two countries.
- US suspects Egypt is developing a liquid-fueled missile called the Vector with an estimated range of 600-1200 kilometers.
- FROG 7 rocket launch units with 40 kilometers range.
- Cooperation with Iraq and North Korea in developing the Saqr 80 missile. This rocket is 6.5 meters long and 210 mm in diameter, and weighs 660 kilograms. It has a maximum range of 50 miles (80 kilometers) and a 440 pound (200 kilogram) warhead. Longer range versions may be available.
- AS-15, SS-N-2, and CSS-N-1 cruise missiles.
- F-4E fighter ground attack aircraft.
- Mirage 5E2 fighter ground attack.
- Mirage 2000EM fighters.
- F-16A and 80 F-16C fighters

- Multiple rocket launcher weapons.
- Tube artillery

#### **Chemical Weapons**

- Produced and used mustard gas in Yemeni civil war in 1960s, but agents may have been stocks British abandoned in Egypt after World War II. Effort was tightly controlled by Nasser and was unknown to many Egyptian military serving in Yemen.
- Completed research and designs for production of nerve and cyanide gas before 1973.
- Former Egyptian Minister of War, General Abdel Ranny Gamassay stated in 1975, that, "if Israel should decide to use a nuclear weapon in the battlefield, we shall use the weapons of mass destruction that are at our disposal."
- Seems to have several production facilities for mustard and nerve gas. May have limited stocks of bombs, rockets, and shells.
- Unconfirmed reports of recent efforts to acquire feed stocks for nerve gas. Some efforts to obtain feed stocks from Canada. May now be building feed stock plants in Egypt.
- Industrial infrastructure present for rapid production of cyanide gas.

#### **Biological Weapons**

- Research and technical base.
- No evidence of major organized research activity.

#### **Nuclear Weapons**

- Research and technical base.
- No evidence of major organized research activity.
- President Mubarak did say in October 1998, that Egypt could acquire nuclear weapons to match Israel's capability if this proves necessary,<sup>i</sup> "If the time comes when we need nuclear weapons, we will not hesitate. I say 'if' we have to because this is the last thing we think about. We do not think of joining the nuclear club." This speech was more an effort to push Israel towards disarmament talks, however, than any kind of threat.
- Mubarak also said that Israel, "enhances its military expenditure and develops its missile systems that are used for military purposes. It knows very well that this will not benefit it or spare it from harm. Its efforts to use the help of foreign countries will plunge the region into a new arms race which serves nobody's interests." Egypt has supported the indefinite extension of the NNPT, has long been officially committed to creating a nuclear weapons-free zone in the Middle East, and had advocated an agreement that would ban all weapons of mass destruction from the region

## Israel's Search for Weapons of Mass Destruction

### Delivery Systems

- Israel has done technical work on a TERCOM type smart warhead. It has examined cruise missile guidance developments using GPS navigation systems. This system may be linked to a submarine launch option.
- As part of its first long-range missile force, Israel deployed up to 50 "Jericho I" (YA-1) missiles in shelters on mobile launchers with up to 400 miles range with a 2,200 pound payload, and with possible nuclear warhead storage nearby. These missiles were near copies of the two-stage, solid-fueled, French MD-620 missile. Some reports claim the first 14 were built in France. (Some reports give the range as 500 kilometers.)
- There are convincing indications that Israel has deployed nuclear armed missiles on mobile launchers. Most outside sources call the first of these missiles the "Jericho I", but Israel has never publicly named its long-range missile systems.
- These missiles were near-copies of the two-stage, solid-fueled, French MD-620 missile. Some reports claim the first 14 were built in France.
- A number of sources indicate that Israel deployed up to 50 "Jericho I" (YA-1) missiles on mobile launchers in shelters in the hills southwest of Jerusalem, with up to 400 miles range with a 2,200 pound payload, and with possible nuclear warhead storage nearby.
- The current deployment of the "Jericho I" force is unclear. Some sources say it has been phased out for the Jericho II missile.<sup>ii</sup>
- Israel has since gone far beyond the Jericho I in developing long-range missile systems. It has developed and deployed the "Jericho II" (YA-2).
- The "Jericho II" began development in the mid-1970s, and had its first tests in 1986.<sup>iii</sup> Israeli carried out a launch in mid-1986 over the Mediterranean that reached a range of 288 miles (460 kilometers). It seems to have been tested in May 1987. A flight across the Mediterranean reached a range of some 510 miles (820 kilometers), landing south of Crete.<sup>iv</sup> Another test occurred on September 14, 1989.
- Israel launched a missile across the Mediterranean that landed about 250 miles north of Benghazi, Libya. The missile flew over 800 miles, and US experts felt it had a maximum range of up to 900-940 miles (1,450 kilometers) -- which would allow the Jericho II to cover virtually all of the Arab world and even the Southern USSR<sup>v</sup>
- The most recent version of the missile seems to be a two-stage, solid-fueled missile with have a range of up to 900 miles (1,500 kilometers) with a 2,200 pound payload.
- Commercial satellite imaging indicates the Jericho II missile may be 14 meters long and 1.5 meters wide. Its deployment configuration hints that it may have radar area guidance similar to the terminal guidance in the Pershing II and probably has deployed these systems.
- Some Jericho IIs may have been brought to readiness for firing during the Gulf War.
- Israel began work on an updated version of the Jericho 2 no later than 1995 in an effort to stretch its range to 2,000 km. At least part of this work may have begun earlier in cooperation with South Africa.
- Israel is also seeking technology to improve its accuracy, particularly with gyroscopes for the inertial guidance system and associated systems software.
- Israel is actively examining ways to lower the vulnerability of its ballistic missiles and nuclear weapons. These include improved hardening, dispersal, use of air-launched weapons, and possible sea-basing.
- There are also reports that Israel is developing a Jericho III missile, based on a booster it developed with South Africa in the 1980s.

- The tests of a longer-range missile seem to have begun in the mid-1980s.<sup>vi</sup> A major test of such a booster seems to have taken place on September 14, 1989, and resulted in extensive reporting on such cooperation in the press during October 25 and 26, 1989.
- It is possible that both the booster and any Israeli-South African cooperation may have focused on satellite launches.<sup>vii</sup> Since 1994, however, there have been numerous reports among experts that Israel is seeking a missile with a range of at least 4,800 kilometers, and which could fully cover Iran and any other probable threat.
- Jane's estimates that the missile has a range of up to 5,000 kilometers and a 1,000 kilogram warhead. This estimate is based largely on a declassified DIA estimate of the launch capability of the Shavit booster that Israel tested on September 19, 1988.<sup>viii</sup>
- Reports of how Israel deploys its missiles differ.
- Initial reports indicated that 30-50 Jericho I missiles were deployed on mobile launchers in shelters in the cases southwest of Tel Aviv. A source claimed in 1985, that Israel had 50 missiles deployed on mobile erector launchers in the Golan, on launchers on flat cars that could be wheeled out of sheltered cases in the Negev. (This latter report may confuse the rail transporter used to move missiles from a production facility near Be'er Yaakov to a base at Kefar Zeharya, about 15 kilometers south of Be'er Yaakov.)
- More recent reports indicate that Jericho II missiles are located in 50 underground bunkers carved into the limestone hills near a base near Kefar Zeharya. The number that are on alert, command and control and targeting arrangements, and the method of giving them nuclear warheads has never been convincingly reported.<sup>ix</sup>
- *Jane's Intelligence Review* published satellite photos of what it said as a Jericho II missile base at Zachariah (God remembers with a vengeance) several miles southeast of Tel Aviv in September 1997.<sup>x</sup> According to this report, the transport-erector-launcher (TEL) for the Jericho II measures about 16 meters long by 4 meters wide and 3 meters high. The actual missile is about 14 meter long and 1.5 meters wide. The TEL is supported by three support vehicles, including a guidance and power vehicle. The other two vehicles include communications vehicle and a firing control vehicle. This configuration is somewhat similar to that used in the US Pershing II IRBM system, although there are few physical similarities.
- The photos in the article show numerous bunkers near the TEL and launch pad, and the article estimates a force of 50 missiles on the site. It also concludes that the lightly armored TEL would be vulnerable to a first strike, but that the missiles are held in limestone caves behind heavy blast-resistant doors. It estimates that a nuclear-armed M-9 or Scud C could destroy the launch capability of the site.<sup>xi</sup>
- The same article refers to nuclear weapons bunkers at the Tel Nof airbase, a few kilometers to the northwest. The author concludes that the large number of bunkers indicates that Israel may have substantially more nuclear bombers than is normally estimated – perhaps up to 400 weapons with a total yield of 50 megatons.<sup>xii</sup>
  - F-15, F-16, F-4E, and Phantom 2000 fighter-bombers capable of long-range refueling and of carrying nuclear and chemical bombs.
- The same article refers to nuclear weapons bunkers at the Tel Nof airbase, a few kilometers to the northwest. The author concludes that the large number of bunkers indicates that Israel may have substantially more nuclear bombers than is normally estimated – perhaps up to 400 weapons with a total yield of 50 megatons.
  - Israel bought some Lance missile launchers and 160 Lance missiles, with 130 kilometers range, from the US in the 1970s. The US removed them from active duty during 1991-1994. The status of the Israeli missiles is unknown.
- There are reports of the development of a long-range, nuclear armed version of Popeye with GPS guidance and of studies of possible cruise missile designs that could be both surface-ship and submarine based.
  - Variant of the Popeye air-to-surface missile believed to have nuclear warhead.
  - The MAR-290 rocket with 30 kilometers range is believed to be deployed
  - MAR-350 surface-to-surface missile with range of 56 miles and 735 lb. payload believed to have completed development or to be in early deployment.

- Israel seeking super computers for Technion Institute (designing ballistic missile RVs), Hebrew University (may be engaged in hydrogen bomb research), and Israeli Military Industries (maker of "Jericho II" and Shavit booster).
- Israel current review of its military doctrine seems to include a review of its missile basing options, and the study of possible hardening and dispersal systems. There are also reports that Israel will solve its survivability problems by deploying some form of nuclear-armed missile on its new submarines.

### **Chemical Weapons**

- Reports of mustard and nerve gas production facility established in 1982 in the restricted area in the Sinai near Dimona seem incorrect. May have additional facilities. May have capacity to produce other gases. Probable stocks of bombs, rockets, and artillery.
- Extensive laboratory research into gas warfare and defense.
- An El Al 747-200 cargo plane crashed in southern Amsterdam on October 4, 1992, killing 43 people in the apartment complex it hit. This led to extensive examination of the crash and the plane was found to be carrying 50 gallons of dimethyl methylphosphonate, a chemical used to make Sarin nerve gas. The chemical had been purchased from Solkatronic Chemicals in the US and was being shipped to the Israel Institute for Biological Research. It was part of an order of 480 pounds worth of the chemical. Two of the three other chemicals used in making Sarin were shipped on the same flight. Israel at first denied this and then claimed it was only being imported to test gas masks.<sup>xiii</sup>
- Israel may have the contingency capability to produce at least two types of chemical weapons and has certainly studied biological weapons as well as chemical ones. According to one interview with an Israeli source of unknown reliability, Israel has mustard gas, persistent and non-persistent nerve gas, and may have at least one additional agent.
- Development of defensive systems includes Shalon Chemical Industries protection gear, Elbit Computer gas detectors, and Bezal R&D air crew protection system.
- Extensive field exercises in chemical defense.
- Gas masks stockpiled, and distributed to population with other civil defense instructions during Gulf War.
- Warhead delivery capability for bombs, rockets, and missiles, but none now believed to be equipped with chemical agents.

### **Biological Weapons**

- Extensive research into weapons and defense.
- Ready to quickly produce biological weapons, but no reports of active production effort.
- According to some reports, Israel revitalized its chemical warfare facilities south of Dimona in the mid-1980s, after Syria deployed chemical weapons and Iraq began to use these weapons in the Iran-Iraq War.
- Israel has at least one major research facility with sufficient security and capacity to produce both chemical and biological weapons.<sup>xiv</sup> There are extensive reports that Israel has a biological weapons research facility at the Israel Institute for Biological Research at Nes Tona, about 12 miles south of Tel Aviv, and that this same facility also has worked on the development and testing of nerve gas. This facility has created enough public concern in Israel so that the mayor of Nes Tona has asked that it be moved away from populated areas. The facility is reported to have stockpiled Anthrax and to have provided toxins to Israeli intelligence for use in covert operations and assassinations like the attempt on a Hamas leader in Jordan in 1997.<sup>xv</sup>
  - The Israel Institute for Biological Research is located in a 14 acre compound. It has high walls and exceptional security, and is believed to have a staff of around 300, including 120 scientists. A former deputy head, Marcus Kingberg, served 16 years in prison for spying for the FSU.
- US experts privately state that Israel is one of the nations included in US lists of nations with biological and chemical weapons. They believe that Israel has at least some stocks of weaponized nerve gas, although they may be stored in forms that require binary agents to be loaded into binary weapons.

- They believe that Israel has fully developed bombs and warheads capable of effectively disseminating dry, storable biological agents in micropowder form and has agents considerable more advanced than anthrax. Opinion differs over whether such weapons are actively loaded and deployed. Unconfirmed reports by the British *Sunday Times* claimed that IAF F-16s are equipped for strikes using both these weapons and chemical weapons.<sup>xvi</sup>

### Nuclear Weapons

- Director of CIA indicated in May 1989, that Israel may be seeking to construct a thermonuclear weapon.
- Has two significant reactor projects: the 5 megawatt HEU light-water IRR I reactor at Nahal Soreq; and the 40-150 megawatt heavy water, IRR-2 natural uranium reactor used for the production of fissile material at Dimona. Only the IRR-1 is under IAEA safeguards.
- Dimona has conducted experiments in pilot scale laser and centrifuge enrichment, purifies UO<sub>2</sub>, converts UF<sub>6</sub> and fabricates fuel for weapons purpose.
- Uranium phosphate mining in Negev, near Beersheba, and yellow cake is produced at two plants in the Haifa area and one in southern Israel.
- Pilot-scale heavy water plant operating at Rehovot.
- *Jane's Intelligence Review* published an article in September 1997 which refers to nuclear weapons bunkers at the Jericho 2 missile base at Zachariah (God remembers with a vengeance) several miles southeast of Tel Aviv and at Tel Nof airbase, a few kilometers to the northwest. The author concludes that the large number of bunkers indicates that Israel may have substantially more nuclear bombers than is normally estimated – perhaps up to 400 weapons with a total yield of 50 megatons.<sup>xvii</sup>
  - Estimates of numbers and types of weapons differ sharply.
    - Stockpile of at least 60-80 plutonium weapons.
    - May have well over 100 nuclear weapons assemblies, with some weapons with yields over 100 Kilotons.
    - US experts believe Israel has highly advanced implosion weapons. Known to have produced Lithium-6, allowing production of both tritium and lithium deuteride at Dimona. Facility no longer believed to be operating.
    - Some weapons may be ER variants or have variable yields.
    - Stockpile of up to 200-300 weapons is possible.
  - Major weapons facilities include production of weapons grade Plutonium at Dimona, nuclear weapons design facility at Nahal Soreq (south of Tel Aviv), missile test facility at Palmikim, nuclear armed missile storage facility at Kefar Zekharya, nuclear weapons assembly facility at Yodefah, and tactical nuclear weapons storage facility at Eilabun in eastern Galilee.

### Missile Defenses

- Patriot missiles with future PAC-3 upgrade to reflect lessons of the Gulf War.
- Arrow 2 two-stage ATBM with slant intercept ranges at altitudes of 8-10 and 50 kilometers speeds of up to Mach 9, plus possible development of the Rafale AB-10 close in defense missile with ranges of 10-20 kilometers and speeds of up to Mach 4.5. Taas rocket motor, Rafael warhead, and Tadiran BM/C4I system and "Music" phased array radar.
- Israel plans to deploy three batteries of the Arrow to cover Israel, each with four launchers, to protect up to 85% of its population. It seeks to deploy the system early in the 2000s.
- The Arrow program has three phases:
  - Phase I: Validate Defense Concept and Demonstrate Pre-prototype Missile
  - Fixed price contract: \$158 million

- The US pays 80%, Israel pays 20%.
- Completed in December 1982.
- Phase II: Demonstrate Lethality, develop and demonstrate tactical interceptor and launcher.
- Fixed price contract: \$330 million.
- The US pays 72%, Israel pays 28%.
- Began in July 1991.
- Successfully completed.
- Phase III: Develop and integrate tactical system, conduct weapon system tests, and develop and implement interoperability.
- Program cost estimated at: \$616 million.
- The US pays 48%, Israel pays 52%.
- Began in March 1996.
- System integration in progress.
  - The Arrow will be deployed in batteries as a wide area defense system with intercepts normally at reentry or exoatmospheric altitudes. Capable of multi-target tracking and multiple intercepts.
  - Israel has designed the Nautilus laser system for rocket defense in a joint project with the USA. It has developed into the Theater High Energy Laser (THEL). The project has recently been expanded to include interception of not only short-range rockets and artillery, but also medium-range Scuds and longer-range missiles such as Iran's Shahab series.
  - Israel is also examining the possibility of boost-phase defenses. The Rafael Moab UAV forms part of the Israeli Boost-phase Intercept System. This is intended to engage TBMs soon after launch, using weapons fired from a UAV. Moab would launch an improved Rafael Python 4 air-to-air missile. Range is stated as 80-100km depending on altitude of release.

#### **Advanced Intelligence Systems**

- The Shavit I launched Israel's satellite payload on September 19, 1989. It used a three stage booster system capable of launching a 4,000 pound payload over 1,200 miles or a 2,000 pound payload over 1,800 miles. It is doubtful that it had a payload capable of intelligence missions and seems to have been launched, in part, to offset the psychological impact of Iraq's missile launches.
- Ofeq 2 launched in April, 1990 -- one day after Saddam Hussein threatens to destroy Israel with chemical weapons if it should attack Baghdad.
- Launched first intelligence satellite on April 5, 1995, covering Syria, Iran, and Iraq in orbit every 90 minutes. The Ofeq 3 satellite is a 495-pound system launched using the Shavit launch rocket, and is believed to carry an imagery system. Its orbit passes over or near Damascus, Tehran, and Baghdad.
- Agreement signed with the US in April 1996 to provide Israel with missile early warning, launch point, vector, and point of impact data.

## Syria's Search for Weapons of Mass Destruction

### Delivery Systems

- Four SSM brigades: 1 with FROG, 1 with Scud Bs, 1 with Scud Cs, and 1 with SS-21s.
- Has 18 SS-21 launchers and at least 36 SS-21 missiles with 80-100 kilometers range. May be developing chemical warheads.
- Some experts believe some Syrian surface-to-surface missiles armed with chemical weapons began to be stored in concrete shelters in the mountains near Damascus and in the Palmyra region no later than 1986, and that plans have long existed to deploy them forward in an emergency since that date
- Up to 12 Scud B launchers and 200 Scud B missiles with 310 kilometers range. Believed to have chemical warheads. Scud B warhead weighs 985 kilograms. The inventory of Scud B missiles is believed to be approximately 200.
- New long-range North Korean Scud Cs deployed
  - Two brigades of 18 launchers each are said to be deployed in a horseshoe shaped valley. This estimate of 36 launchers is based on the fact there are 36 tunnels into the hillside. The launchers must be for the Scud C since the older Scud Bs would not be within range of most of Israel. Up to 50 missiles are stored in bunkers to north as possible reloads. There is a maintenance building and barracks.
  - Estimates indicate that Syria has 24-36 Scud launchers for a total of 260-300 missiles of all types. The normal ratio of launchers to missiles is 10:1, but Syria is focusing on both survivability and the capability to launch a large preemptive strike.
  - The Scud Cs have ranges of up to 550-600 kilometers. They have a CEP of 1,000-2,600 meters. Nerve gas warheads using VX with cluster bomblets seem to have begun production in early 1997. Syria is believed to have 50-80 Scud C missiles.
  - A training site exists about 6 kilometer south of Hama, with an underground facility where TELs and missiles are stored.
- Syria can now build both the entire Scud B and Scud C. It has sheltered and/or underground missile production/assembly facilities at Aleppo, Hama, and near Damascus have been built with aid from Chinese, Iranian, and North Korean technicians. Possibly some Russian technical aid.
- A missile test site exists 15 kilometers south of Homs where Syria has tested missile modifications and new chemical warheads. It has heavy perimeter defenses, a storage area and bunkers, heavily sheltered bunkers, and a missile storage area just west of the site. According to some reports, Syria has built two missile plants near Hama, about 110 miles north of Damascus, one is for solid fueled rockets and the other is for liquid fueled systems. North Korea may have provided the equipment for the liquid fuel plant, and Syria may now be able to produce the missile.
- Reports of Chinese deliveries of missiles but little hard evidence:
  - Reports of PRC deliveries of missile components by China Precision Machinery Company, maker of the M-11, in July 1996. The M-11 has a 186-mile (280 kilometer) range with a warhead of 1,100 pounds.
  - Some sources believe M-9 missile components, or M-9-like components delivered to Syria. Missile is reported to have a CEP as low as 300 meters.
  - Jane's reported in March 1999 that Syria had created a production facility to build both the M-11 (CSS-7/DF-11) and M-9 missiles with ranges of 280 and 600-800 kilometers respectively. It reports that production of the booster stage of the M-11 began in 1996, and that missile production is expected to start "soon."
- Sheltered or underground missile production/assembly facilities at Aleppo and Hama have been built with aid from Chinese, Iranian, and North Korean technicians. Possibly some Russian technical aid.

- A missile test site exists 15 kilometers south of Homs where Syria has tested missile modifications and new chemical warheads. It has heavy perimeter defenses, a storage area and bunkers, heavily sheltered bunkers, and a missile storage area just west of the site.
  - Syria has shorter range systems:
    - Short range M-1B missiles (up to 60 miles range) seem to be in delivery from PRC.
    - SS-N-3, and SSC-1b cruise missiles.
  - May be converting some long range surface-to-air and naval cruise missiles to use chemical warheads.
  - 20 Su-24 long range strike fighters.
  - 30-60 operational MiG-23BM Flogger F fighter ground attack aircraft.
  - 20 Su-20 fighter ground attack aircraft.
  - 60-70 Su-22 fighter ground attack aircraft.
  - 18 FROG-7 launchers and rockets.
  - Negotiations for PRC-made M-9 missile (185-375 mile range).
  - Multiple rocket launchers and tube artillery.
- Syria has improved its targeting capability in recent years by making extensive direct and indirect use of commercial satellite imagery, much of which now offers 3 meter levels of resolution and comes with coordinate data with near GPS-like levels of accuracy. One meter levels of resolution will become commercially available.
- The CIA estimated in January 1999 that Syria continued work on establishing a solid-propellant rocket motor development and production capability. Foreign equipment and assistance have been and will continue to be essential for this effort.

### **Chemical Weapons**

- First acquired small amounts of chemical weapons from Egypt in 1973.
- Began production of non-persistent nerve gas in 1984. may have had chemical warheads for missiles as early as 1985.
- Experts believe has stockpiled 500 to 1,000 metric tons of chemical agents.
- Believed to have begun deploying VX in late 1996, early 1997.
  - CIA reported in June 1997 that Syria had acquired new chemical weapons technology from Russia and Eastern Europe in 1996.
  - Unconfirmed reports of sheltered Scud missiles with unitary Sarin or Tabun nerve gas warheads, now being replaced by cluster warheads with VX bomblets, deployed in caves and shelters near Damascus.
  - Tested Scuds in manner indicating possible chemical warheads in 1996.
  - Seems to have cluster warheads and bombs.
  - May have VX and Sarin in modified Soviet ZAB-incendiary bombs and PTAB-500 cluster bombs.
- Acquired design for Soviet Scud warhead using VX in 1970s.
- Major nerve gas, and possible other chemical agent production facilities north of Damascus. Two to three plants.
  - One facility is located near Homs and is located next to a major petrochemical plant. It reportedly produces several hundred tons of nerve gas a year.
  - Reports is building new major plant near Aleppo.

- Reports that a facility co-located with the Center d'Etudes et de Recherche Scientifique (CERS) is developing a warhead with chemical bomblets for the Scud C.
- Many parts of the program are dispersed and compartmented. Missiles, rockets, bombs, and artillery shells are produced/modified and loaded in other facilities. Many may be modified to use VX bomblets.
- Wide range of delivery systems:
  - Extensive testing of chemical warheads for Scud Bs. May have tested chemical warheads for Scud Cs.
  - Shells, bombs, and nerve gas warheads for multiple rocket launchers.
  - FROG warheads may be under development.
  - Reports of SS-21 capability to deliver chemical weapons are not believed by US or Israeli experts.
  - Israeli sources believe Syria has binary weapons and cluster bomb technology suitable for delivering chemical weapons.
- The CIA estimated in January 1999 that Syria continued to seek CW-related precursors from various sources during the reporting period. Damascus already has a stockpile of the nerve agent sarin and may be trying to develop more toxic and persistent nerve agents. Syria remains dependent on foreign sources for key elements of its CW program, including precursor chemicals and key production equipment.
- The CIA stated that Chinese entities sought to supply Iran and Syria with CW-related chemicals during this reporting period.

### **Biological Weapons**

- Signed, but not ratified the 1972 Biological and Toxin Weapons Convention. Extensive research effort.
- ACDA report in August 1996 indicated that, "it is highly probably that Syria is developing an offensive biological capability."
- Extensive research effort. Reports of one underground facility and one near the coast.
- Probable production capability for anthrax and botulism, and possibly other agents.
- Israeli sources claim Syria weaponized Botulin and Ricin toxin in early 1990s, and probably anthrax.
- Limited indications may be developing or testing biological variations on ZAB-incendiary bombs and PTAB-500 cluster bombs and Scud warheads.
- Major questions exist regarding Syria's strike capabilities. Older types of biological weapons using wet agents, and placed in older bomb and warhead designs with limited dissemination capability, can achieve only a small fraction of the potential effectiveness of biological weapons. Dry micropowders using advanced agents – such as the most lethal forms of Anthrax – can have the effectiveness of small theater nuclear weapons. It is difficult to design adequate missile warheads to disseminate such agents, but this is not beyond Syrian capabilities – particularly since much of the technology needed to make effective cluster munitions and bomblets for VX gas can be adapted to the delivery of biological weapons.<sup>xviii</sup>
  - The design of biological bombs and missile warheads with the lethality of small nuclear weapons may now be within Syrian capabilities, as is the design of UAV, helicopter, cruise missile, or aircraft-borne systems to deliver the agent slowly over a long line of flight and taking maximum advantage of wind and weather conditions. US and Soviet texts proved that this kind of "line source" delivery could achieve lethality as high as 50-100 kiloton weapons by the late 1950s, and the technology is well within Syria's grasp. So is the use of proxy or covert delivery.
  - The CIA estimated in January 1999 that Syria continued to seek CW-related precursors from various sources during the reporting period. Damascus already has a stockpile of the nerve agent sarin and may be trying to develop more toxic and persistent nerve agents. Syria remains dependent on foreign sources for key elements of its CW program, including precursor chemicals and key production equipment.

### **Nuclear Weapons**

- Ongoing research effort.

- No evidence of major progress in development effort.
- Announced nuclear reactor purchase plans including 10 megawatt research reactor and six power reactors in 1980s, but never implemented.
- Has miniature 30 kilowatt neutron-source reactor, but unsuitable for weapons production.

**Missile Defenses**

- Seeking Russian S-300 or S-400 surface-to-air missile system with limited anti tactical ballistic missile capability.

## Iran's Search for Weapons of Mass Destruction

### Delivery Systems

- The Soviet-designed Scud B (17E) guided missile currently forms the core of Iran's ballistic missile forces -- largely as a result of the Iran-Iraq War.
- Iran only acquired its Scuds in response to Iraq's invasion. It obtained a limited number from Libya and then obtained larger numbers from North Korea. It deployed these units with a special Khatam ol-Anbya force attached to the air element of the Pasdaran. Iran fired its first Scuds in March, 1985. It fired as many as 14 Scuds in 1985, 8 in 1986, 18 in 1987, and 77 in 1988. Iran fired 77 Scud missiles during a 52 day period in 1988, during what came to be known as the "war of the cities." Sixty-one were fired at Baghdad, nine at Mosul, five at Kirkuk, one at Takrit, and one at Kuwait. Iran fired as many as five missiles on a single day, and once fired three missiles within 30 minutes. This still, however, worked out to an average of only about one missile a day, and Iran was down to only 10-20 Scuds when the war of the cities ended.
- Iran's missile attacks were initially more effective than Iraq's attacks. This was largely a matter of geography. Many of Iraq's major cities were comparatively close to its border with Iran, but Tehran and most of Iran's major cities that had not already been targets in the war were outside the range of Iraqi Scud attacks. Iran's missiles, in contrast, could hit key Iraqi cities like Baghdad. This advantage ended when Iraq deployed extended range Scuds.
- The Scud B is a relatively old Soviet design which first became operational in 1967, designated as the R-17E or R-300E. The Scud B has a range of 290-300 kilometers with its normal conventional payload. The export version of the missile is about 11 meters long, 85-90 centimeters in diameter, and weighs 6,300 kilograms. It has a nominal CEP of 1,000 meters. The Russian versions can be equipped with conventional high explosive, fuel air explosive, runway penetrator, submunition, chemical, and nuclear warheads.
- The export version of the Scud B comes with a conventional high explosive warhead weighing about 1,000 kilograms, of which 800 kilograms are the high explosive payload and 200 are the warhead structure and fusing system. It has a single stage storable liquid rocket engine and is usually deployed on the MAZ-543 eight wheel transporter-erector-launcher (TEL). It has a strap-down inertial guidance, using three gyros to correct its ballistic trajectory, and uses internal graphite jet vane steering. The warhead hits at a velocity above Mach 1.5.
- Most estimates indicate that Iran now has 6-12 Scud launchers and up to 200 Scud B (R-17E) missiles with 230-310 KM range.
- Some estimates give higher figures. They estimate Iran bought 200-300 Scud Bs from North Korea between 1987 and 1992, and may have continued to buy such missiles after that time. Israeli experts estimate that Iran had at least 250-300 Scud B missiles, and at least 8-15 launchers on hand in 1997.
- US experts also believe that Iran can now manufacture virtually all of the Scud B, with the possible exception of the most sophisticated components of its guidance system and rocket motors. This makes it difficult to estimate how many missiles Iran has in inventory and can acquire over time, as well as to estimate the precise performance characteristics of Iran's missiles, since it can alter the weight of the warhead and adjust the burn time and improve the efficiency of the rocket motors
- Iran has new long range North Korean Scuds - with ranges near 500 kilometers.
  - The North Korean missile system is often referred to as a "Scud C." Typically, Iran formally denied the fact it had such systems long after the transfer of these missiles became a reality. Hassan Taherian, an Iranian foreign ministry official, stated in February, 1995, "There is no missile cooperation between Iran and North Korea whatsoever. We deny this."
  - In fact, a senior North Korean delegation traveled to Tehran to close the deal on November 29, 1990, and met with Mohsen Rezaei, the former commander of the IRGC. Iran either bought the missile then, or placed its order shortly thereafter. North Korea then exported the missile through its Lyongaksan

- Import Corporation. Iran imported some of these North Korean missile assemblies using its B-747s, and seems to have used ships to import others.
- Iran probably had more than 60 of the longer range North Korean missiles by 1998, although other sources report 100, and one source reports 170.
  - Iran may have 5-10 Scud C launchers, each with several missiles. This total seems likely to include four new North Korean TELs received in 1995.
  - Iran seems to want enough missiles and launchers to make its missile force highly dispersible.
  - Iran has begun to test its new North Korean missiles. There are reports it has fired them from mobile launchers at a test site near Qom about 310 miles (500 kilometers) to a target area south of Shahroud. There are also reports that units equipped with such missiles have been deployed as part of Iranian exercises like the Saeqer-3 (Thunderbolt 3) exercise in late October, 1993.
  - The missile is more advanced than the Scud B, although many aspects of its performance are unclear. North Korea seems to have completed development of the missile in 1987, after obtaining technical support from the People's Republic of China. While it is often called a "Scud C," it seems to differ substantially in detail from the original Soviet Scud B. It seems to be based more on the Chinese-made DF-61 than on a direct copy of the Soviet weapon.
  - Experts estimate that the North Korean missiles have a range of around 310 miles (500 kilometers), a warhead with a high explosive payload of 700 kilograms, and relatively good accuracy and reliability. While this payload is a bit limited for the effective delivery of chemical agents, Iran might modify the warhead to increase payload at the expense of range and restrict the using of chemical munitions to the most lethal agents such as persistent nerve gas. It might also concentrate its development efforts on arming its Scud C forces with more lethal biological agents. In any case, such missiles are likely to have enough range-payload to give Iran the ability to strike all targets on the southern coast of the Gulf and all of the populated areas in Iraq, although not the West. Iran could also reach targets in part of eastern Syria, the eastern third of Turkey, and cover targets in the border area of the former Soviet Union, western Afghanistan, and western Pakistan.
  - Accuracy and reliability remain major uncertainties, as does operational CEP. Much would also depend on the precise level of technology Iran deployed in the warhead. Neither Russia nor the People's Republic of China seem to have transferred the warhead technology for biological and chemical weapons to Iran or Iraq when they sold them the Scud B missile and CSS-8. However, North Korea may have sold Iran such technology as part of the Scud C sale. If it did so, such a technology transfer would save Iran years of development and testing in obtaining highly lethal biological and chemical warheads. In fact, Iran would probably be able to deploy far more effective biological and chemical warheads than Iraq had at the time of the Gulf War.
  - Iran may be working with Syria in such development efforts, although Middle Eastern nations rarely cooperate in such sensitive areas. Iran served as a transshipment point for North Korean missile deliveries during 1992 and 1993. Some of this transshipment took place using the same Iranian B-747s that brought missile parts to Iran. Others moved by sea. For example, a North Korean vessel called the *Des Hung Ho*, bringing missile parts for Syria, docked at Bandar Abbas in May, 1992. Iran then flew these parts to Syria. An Iranian ship coming from North Korea and a second North Korean ship followed, carrying missiles and machine tools for both Syria and Iran. At least 20 of the North Korean missiles have gone to Syria from Iran, and production equipment seems to have been transferred to Iran and to Syrian plants near Hama and Aleppo.
  - Iran has created shelters and tunnels in its coastal areas which it could use to store Scud and other missiles in hardened sites and reduce their vulnerability to air attack.
  - Iran can now assemble Scud and Scud C missiles using foreign-made components. It may soon be able to make entire missile systems and warhead packages in Iran.
  - Iran is developing an indigenous missile production capability with both solid and liquid fueled missiles. Seems to be seeking capability to produce MRBMs.

- The present scale of Iran's production and assembly efforts is unclear. Iran seems to have a design center, at least two rocket and missile assembly plants, a missile test range and monitoring complex, and a wide range of smaller design and refit facilities.
- The design center is said to be located at the Defense Technology and Science Research Center, which is a branch of Iran's Defense Industry Organization, and located outside Karaj -- near Tehran. This center directs a number of other research efforts. Some experts believe it has support from Russian and Chinese scientists.
- Iran's largest missile assembly and production plant is said to be a North Korean-built facility near Isfahan, although this plant may use Chinese equipment and technology. There are no confirmations of these reports, but this region is the center of much of Iran's advanced defense industry, including plants for munitions, tank overhaul, and helicopter and fixed wing aircraft maintenance. Some reports say the local industrial complex can produce liquid fuels and missile parts from a local steel mill.
- A second missile plant is said to be located 175 kilometers east of Tehran, near Semnan. Some sources indicate this plant is Chinese-built and began rocket production as early as 1987. It is supposed to be able to build 600-1,000 Oghab rockets per year, if Iran can import key ingredients for solid fuel motors like ammonium perchlorate. The plant is also supposed to produce the Iran-130.
- Another facility may exist near Bandar Abbas for the assembly of the Seersucker. China is said to have built this facility in 1987, and is believed to be helping the naval branch of the Guards to modify the Seersucker to extend its range to 400 kilometers. It is possible that China is also helping Iran develop solid fuel rocket motors and produce or assemble missiles like the CS-801 and CS-802. There have, however, been reports that Iran is developing extended range Scuds with the support of Russian experts, and of a missile called the Tondar 68, with a range of 700 kilometers.
- Still other reports claim that Iran has split its manufacturing facilities into plants near Pairzan, Seman, Shiraz, Maghdad, and Islaker. These reports indicate that the companies involved in building the Scuds are also involved in Iran's production of poison gas and include Defense Industries, Shahid, Bagheri Industrial Group, and Shahid Hemat Industrial Group.
- Iran's main missile test range is said to be further east, near Shahroud, along the Tehran-Mashhad railway. A telemetry station is supposed to be 350 kilometers to the south at Taba, along the Mashhad-Isfahan road. All of these facilities are reportedly under the control of the Islamic Revolutionary Guards Corps.
- There were many reports during the late 1980s and early 1990s that Iran had ordered the North Korean No Dong missile, which was planned to have the capability to carry nuclear and biological missile warheads of up to 900 kilograms. This range would allow the missile to reach virtually any target in the Gulf, Turkey, and Israel. The status of the No Dong program has since become increasingly uncertain, although North Korea deployed some developmental types at test facilities in 1997.
  - The No-Dong underwent flight tests at ranges of 310 miles (500 kilometers) on May 29, 1993. Some sources indicate that Iranians were present at these tests. Extensive further propulsion tests began in August 1994, and some reports indicate operational training began for test crews in May 1995. Missile storage facilities began to be built in July 1995, and four launch sites were completed in October 1995.
  - The progress of the program has been slow since that time, and may reflect development problems. However, mobile launchers were seen deployed in northeast North Korea on March 24, 1997. According to some reports, a further seven launcher units were seen at a facility about 100 kilometers from Pyongyang.
  - The No-Dong 1 is a single-stage liquid-fueled missile, with a range of up to 1,000 to 1,300 kilometers (810 miles), although longer ranges may be possible with a reduced warhead and maximum burn. There are also indications that there may be a No-Dong 2, using the same rocket motor, but with an improved fuel supply system that allows the fuel to burn for a longer period.

- The missile is about 15.2 meters long -- four meters longer than the Scud B -- and 1.2 meters in diameter. The warhead is estimated to weigh 770 kilograms (1,200-1,750 pounds) and a warhead manufacturing facility exists near Pyongyang. The No-Dong has an estimated theoretical CEP of 700 meters at maximum range, versus 900 meters for the Scud B, although its practical accuracy could be as wide as 3,000-4,000 meters. It has an estimated terminal velocity of Mach 3.5, versus 2.5 for the Scud B, which presents added problems for tactical missile defense. The missile is transportable on a modified copy of the MAZ-543P TEL that has been lengthened with a fifth axle and which is roughly 40 meters long. The added support stand for the vertical launch modes brings the overall length to 60 meters, and some experts questioned whether a unit this big is practical.
- Other reports during the later 1980s and early 1990s indicated that Iran was also interested in two developmental North Korean IRBMs called the Tapeo Dong 1 and Tapeo Dong 2
  - The Tapeo Dong 1 missile has an estimated maximum range of 2,000 kilometers, and the Tapeo Dong 2 may have a range up to 3,500 kilometers.
  - Both Tapeo Dongs are liquid fueled missiles which seem to have two stages.
  - Unlike the No-Dong, the Tapeo Dongs must be carried to a site in stages and then assembled at a fixed site. The No-Dong transporter may be able to carry both stages of the Tapeo Dong 1, but some experts believe that a special transporter is needed for the first stage of the Tapeo Dong 1, and for both stages of the Tapeo Dong 2.
- Since the early 1990s, the focus of reports on Iran's missile efforts have shifted, and it has since become clear that Iran is developing its own longer-range variants of the No Dong for indigenous production with substantial Russian and some Chinese aid:
  - As early as 1992, one such missile was reported to have a range of 800-930 miles and a 1,650 pound warhead. Reports differ sharply on its size. Jane's estimates a launch weight up to 16,000 kilograms, provided the system is derived from the No Dong. It could have a launch weight of 15,000 kilograms, a payload of 600 kilograms, and a range of 1,700-1,800 kilometers if it is based on a system similar to the Chinese CSS-5 (DF-21) and CSS-N3 ((JL-1). These systems entered service in 1983 and 1987.
  - A longer-range missile was said to have improved guidance components, a range of up to 1,240 miles and a warhead of up to 2,200 pounds.
  - IOC dates were then estimated to be 1999-2001.
  - Russia agreed in 1994 that it would adhere to the terms of the Missile Technology Control Regime and would place suitable limits on the sale or transfer of rocket engines and technology. Nevertheless, the CIA has identified Russia as a leading source of Iranian missile technology, and the State Department has indicated that President Clinton expressed US concerns over this cooperation to President Yeltsin. This transfer is one reason the President appointed former Ambassador Frank Wisner, and then Robert Galluci, as his special representatives to try to persuade Russia to put a firm halt to aid support of the Iran.
  - These programs are reported to have continuing support from North Korea, and from Russian and Chinese firms and technicians. One such Chinese firm is Great Wall Industries. The Russian firms include the Russian Central Aerohydrodynamic Institute, which has provided Iran's Shahid Hemmat Industrial Group (SHIG) with wind tunnels for missile design, equipment for manufacturing missile models, and the software for testing launch and reentry performance. They may also include Rosvoorouzhnie, a major Russian arms-export agency; NPO Trud, a rocket motor manufacturer; a leading research center called the Bauman Institute, and Polyus (Northstar), a major laser test and manufacturing equipment firm.
  - The CIA reported in June 1997 that Iran obtained major new transfers of new long-range missile technology from Russian and Chinese firms during 1996. Since that time, there have been many additional reports of technology transfer from Russia.

- The reports on Chinese technology transfers involve the least detail:
  - There have been past reports that Iran placed orders for PRC-made M-9 (CSS-6/DF-15) missile (280-620 kilometers range, launch weight of 6,000 kilograms).
  - It is more likely, however, that PRC firms are giving assistance in developing indigenous missile R&D and production facilities for the production of an Iranian solid fueled missile.
  - The US offered to provide China with added missile technology if it would agree to fully implement an end of technology transfer to Iran and Pakistan during meetings in Beijing on March 25-26, 1998.
- Recent reports and tests have provided more detail on the Shahab system:
- Some US experts believe that Iran tested booster engines in 1997 capable of driving a missile ranges of 1,500 kilometers. Virtually all US experts believe that Iran is rapidly approaching the point where it will be able to manufacture missiles with much longer ranges than the Scud B.
  - It is less clear when Iran will be able to bring such programs to the final development stage, carry out a full range of suitable test firings, develop highly lethal warheads, and deploy actual units. Much may still depends on the level of foreign assistance.
  - Eitan Ben Eliyahu -- the commander of the Israeli Air Force -- reported on April 14, 1997 that Iran had tested a missile capable of reaching Israel. The background briefings to his statement implied that Russia was assisting Iran in developing two missiles -- with ranges of 620 and 780 miles. Follow-on intelligence briefings that Israel provided in September, 1997, indicated that Russia was helping Iran develop four missiles. US intelligence reports indicate that China has also been helping Iran with some aspects of these missile efforts.
  - These missiles included the Shahab (“meteor”) missiles, with performance similar to those previously identified with Iranian missiles adapted from North Korean designs.
  - The Israeli reports indicated that the Shahab 3 was a liquid-fueled missile with a range of 810 miles (1,200-1,500 kilometers) and a payload of 1550 pounds (700 kilograms).
  - Israel claimed the Shahab might be ready for deployment as early as 1999.
- Iran tested the Sahab 3 on July, 21 1998, claiming that it was a defensive action to deal with potential threats from Israel.
  - The missile flew for a distance of up to 620 miles, before it exploded about 100 seconds after launch. US intelligence sources could not confirm whether the explosion was deliberate, but indicated that the final system might have a range of 800-940 miles (a maximum of 1,240 kilometers), depending on its payload. The test confirmed the fact the missile was a liquid fueled system.
  - Gen. Mohammad Bagher Qalibaf, head of the Islamic Revolutionary Guards Corps' air wing publicly reported on August 2, 1998 that the Shahab-3 is 53-foot-long ballistic missile that can travel at 4,300 mph and carry a one-ton warhead at an altitude of nearly 82,000 feet. He claimed that the weapon was guided by an Iranian-made system that gives it great accuracy: “The final test of every weapon is in a real war situation but, given its warhead and size, the Shahab-3 is a very accurate weapon.”
  - Other Iranian sources reported that the missile had a range of 800 miles. President Mohammad Khatami on August 1, 1998 stated that Iran was determined to continue to strengthen its armed forces, regardless of international concerns: “Iran will not seek permission from anyone for strengthening its defense capability.”
  - Martin Indyck, the US Assistant Secretary for Near East Affairs testified on July 28, that the US estimated that the system needed further refinement but might be deployed in its initial operational form between September, 1998 and March, 1999.

- Iran publicly displayed the Shahab 3 on its launcher during a parade on September 25, 1998. The missile carrier bore signs saying, “The US can do nothing” and “Israel would be wiped from the map.”
- There are some reports of a Shahab-3B missile with extended range and a larger booster.
- The resulting system seems to be close to both the No-Dong and Pakistani Ghauri or Haff-5 missile, first tested in April 1998, raising questions about Iranian-North Korean-Pakistani cooperation.
- North Korean parades exhibiting the Tapeo Dong in September 1999 exhibited a missile with rocket motor and nozzle characteristics similar to those of the Sahab 3.
- In September 1999, the Revolutionary Guard exhibited another missile called the Zelzal, which it stated was “now in mass production.” The missile was said to have taken four and one-half years to develop and to be derived from the Zelzal 2, which the IRGC had exhibited earlier. Some estimates indicate that it can carry a warhead of 500 kilograms for up to 900 kilometers. However, the missile exhibited in Tehran was a rocket on a truck-mounted launch rail that seemed more likely to have a range of 150-200 kilometers.
- There have been growing reports that Iran might be using Russian technology to develop long-range missiles with ranges from 2,000 to 6,250 kilometers.
- Israeli and US intelligence sources have reported that that Iran is developing the Shahab 4, with a range of 2,000 kilometers (1,250 miles), a payload of around 2,000 pounds, and a CEP of around 2,400 meters. Some estimates indicate that this system could be operational in 2-5 years. US Assistant Secretary for Near East Affairs testified on July 28, 1998, that the US estimated that the system still needed added foreign assistance to improve its motors and guidance system.
  - Some reports indicate that the Shahab 4 is based on the Soviet SS-4 missile. Others that there is a longer range Shahab 5, based on the SS-4 or Tapeo Dong missile. Reports saying the Shahab is based on the SS-4 say it has a range of up to 4,000 kilometers and a payload in excess of one ton.)
  - Iran may have two other missile programs include longer-range systems, variously reported as having maximum ranges of 3,650, 4,500-5,000, 6,250, or 10,000 kilometers.
    - It seems clear that Iran has obtained some of the technology and design details of the Russian SS-4. The SS-4 (also known as the R-12 or “Sandal”) is an aging Russian liquid fuel designed that first went into service in 1959, and which was supposedly destroyed as part of the IRBM Treaty. It is a very large missile, with technology dating back to the early 1950s, although it was evidently updated at least twice during the period between 1959 and 1980. It has a CEP of 2-4 kilometers and a maximum range 2,000 kilometers, which means it can only be lethal with a nuclear warhead or a biological weapon with near-nuclear lethality.
    - At the same time, the SS-4’s overall technology is relatively simple and it has a throwweight of nearly 1,400 kilograms (3,000 pounds). It is one of the few missile designs that a nation with a limited technology base could hope to manufacture or adapt, and its throwweight and range would allow Iran to use a relatively unsophisticated nuclear device or biological warhead. As a result, an updated version of the SS-4 might be a suitable design for a developing country.
- Iran is reported to have carried out the test of a sea-launched ballistic missile in 1998.
  - Russia has been a key supplier of missile technology.
    - Some sources have indicated that Russian military industries have signed contracts with Iran to help produce liquid fueled missiles and provide specialized wind tunnels, manufacture model missiles, and develop specialized computer software. For example, these reports indicate that the Russian Central Aerohydrodynamic Institute is cooperating with Iran’s Defense Industries Organization (DIO) and the DIO’s Shahid Hemmat Industrial Group (SHIG). The Russian State Corporation for Export and Import of Armament and Military Equipment (Rosvoorouzhnie) and Infor are also reported to be involved in deals with the SHIG. These deals are also said to include

specialized laser equipment, mirrors, tungsten-coast graphite material, and maraging steel for missile development and production. They could play a major role in help Iran develop long range versions of the Scud B and C, and more accurate variations of a missile similar to the No Dong.

- The Israeli press reported in August, 1997 that Israeli had evidence that Iran was receiving Russian support. In September, 1997, Israel urged the US to step up its pressure on Iran, and leaked reported indicating that private and state-owned Russian firms had provided gyroscopes, electronic components, wind tunnels, guidance and propulsion systems, and the components needed to build such systems to Iran.
- President Yeltsin and the Russian Foreign Ministry initially categorically denied that such charges were true. Following a meeting with Vice President Gore, President Yeltsin stated on September 26, 1997 that, “We are being accused of supplying Iran with nuclear or ballistic missile technologies. There is nothing further from the truth. I again and again categorically deny such rumors.”
- Russia agreed, however, that Ambassador Wisner and Yuri Koptev, the head of the Russian space program, should jointly examine the US intelligence and draft a report on Russian transfers to Iran. This report reached a very different conclusion from President Yeltsin and concluded that Russia had provided such aid to Iran. Further, on October 1, 1997 -- roughly a week after Yeltsin issued his denial -- the Russian security service issued a statement that it had “thwarted” an Iranian attempt to have parts for liquid fuel rocket motors manufactured in Russia, disguised as gas compressors and pumps.
- Russian firms said to be helping Iran included the Russian Central Aerohydrodynamic Institute which developed a special wind tunnel; Rosvoorouzhenie, a major Russian arms-export agency; Kutznetzov (formerly NPO Trud) a rocket motor manufacturer in Samara; a leading research center called the Bauman National Technical University in Moscow, involved in developing rocket propulsion systems; the Tsagi Research Institute for rocket propulsion development; and the Polyus (Northstar) Research Institute in Moscow, a major laser test and manufacturing equipment firm. Iranians were also found to be studying rocket engineering at the Baltic State University in St. Petersburg and the Bauman State University.
- Russia was also found to have sold Iran high strength steel and special foil for its long-range missile program. The Russian Scientific and Production Center Inor concluded an agreement as late as September, 1997 to sell Iran a factory to produce four special metal alloys used in long-range missiles. Inor’s director, L. P Chromova worked out a deal with A. Asgharzadeh, the director of an Iranian factory, to sell 620 kilograms of special alloy called 21HKMT, and provide Iran with the capability to thermally treat the alloy for missile bodies. Iran had previously bought 240 kilograms of the alloy. Inor was also selling alloy foils called 49K2F, CUBE2, and 50N in sheets 0.2-0.4 millimeters thick for the outer body of missiles. The alloy 21HKMT was particularly interesting because North Korea also uses it in missile designs. Inor had previously brokered deals with the Shahid Hemat Industrial Group in Iran to supply maraging steel for missile cases, composite graphite-tungsten material, laser equipment, and special mirrors used in missile tests.
- The result was a new and often tense set of conversations between the US and Russia in January, 1998. The US again sent Ambassador Frank Wisner to Moscow, Vice President Gore called Prime Minister Viktor Chernomyrdin, and Secretary of State Madeline Albright made an indirect threat that the Congress might apply sanctions. Sergi Yastrzhembsky, a Kremlin spokesman, initially responded by denying that any transfer of technology had taken place.
- This Russian denial was too categorical to have much credibility. Russia had previously announced the arrest of an Iranian diplomat on November 14, 1997, that it caught attempting to buy missile technology. The Iranian was seeking to buy blueprints and recruit Russian scientists to go to Iran. Yuri Koptev, the head of the Russian Space Agency, explained this, however, by stating that that, “There have been several cases where some Russian organizations, desperately struggling to make ends meet and lacking responsibility, have embarked on some ambiguous projects...they were stopped long before they got to the point where any technology got out.”

- The end result of these talks was an agreement by Gore and Chernomyrdin to strengthen controls over transfer technology, but it was scarcely clear that it put an end to the problem. As Koptev has said, “There have been several cases where some Russian organizations, desperately struggling to make ends meet and lacking responsibility, have embarked on some ambiguous projects.” Conditions in Russia are getting worse, not better, and the desperation that drives sales has scarcely diminished.
- Prime Minister Chernomyrdin again promised to strengthen his efforts to restrict technology transfer to Iran in a meeting with Gore on March 12, 1998. The US informed Russia of 13 cases of possible Russian aid to Iran at the meeting and offered to increase the number of Russian commercial satellite launches it would license for US firms as an incentive.
- New arrests of smugglers took place on April 9, 1998. The smugglers had attempted to ship 22 tons of specialized steel to Iran via Azerbaijan, using several Russia shell corporations as a cover.
- On April 16, 1998, the State Department declared 20 Russian agencies and research facilities were ineligible to receive US aid because of their role in transferring missile technology to Iran.
- A US examination of Iran’s dispersal, sheltering, and hardening programs for its anti-ship missiles and other missile systems indicate that Iran has developed effective programs to ensure that they would survive a limited number of air strikes and that Iran had reason to believe that the limited number of preemptive strikes Israel could conduct against targets in the lower Gulf could not be effective in denying Iran the capability to deploy its missiles.
- Iran has shorter missile range systems:
  - In 1990, Iran bought CSS-8 surface-to-surface missiles (converted SA-2s) from China with ranges of 130-150 kilometers.
  - Has Chinese sea and land-based anti-ship cruise missiles. Iran fired 10 such missiles at Kuwait during Iran-Iraq War, hitting one US-flagged tanker.
- Iran has acquired much of the technology necessary build long-range cruise missile systems from China:
  - Such missiles would cost only 10% to 25% as much as ballistic missiles of similar range, and both the HY-2 Seersucker and CS-802 could be modified relatively quickly for land attacks against area targets.
  - Iran reported in December, 1995 that it had already fired a domestically built anti-ship missile called the Saeqe-4 (Thunderbolt) during exercises in the Strait of Hormuz and Gulf of Oman. Other reports indicate that China is helping Iran build copies of the Chinese CS-801/CS-802 and the Chinese FL-2 or F-7 anti-ship cruise missiles. These missiles have relatively limited range. The range of the CS-801 is 8-40 kilometers, the range of the CS-802 is 15-120 kilometers, the maximum range of the F-7 is 30 kilometers, and the maximum range of the FL-10 is 50 kilometers. Even a range of 120 kilometers would barely cover targets in the Southern Gulf from launch points on Iran’s Gulf coast. These missiles also have relatively small high explosive warheads. As a result, Iran may well be seeking anti-ship capabilities, rather than platforms for delivering weapons of mass destruction.
  - A platform like the CS-802 might, however, provide enough design data to develop a scaled-up, longer-range cruise missile for other purposes, and the Gulf is a relatively small area where most urban areas and critical facilities are near the coast. Aircraft or ships could launch cruise missiles with chemical or biological warheads from outside the normal defense perimeter of the Southern Gulf states, and it is at least possible that Iran might modify anti-ship missiles with chemical weapons to attack tankers -- ships which are too large for most regular anti-ship missiles to be highly lethal.
  - Building an entire cruise missile would be more difficult. The technology for fusing CBW and cluster warheads would be within Iran's grasp. Navigation systems and jet engines, however, would still be a major potential problem. Current inertial navigation systems (INS) would introduce errors of at least several kilometers at ranges of 1,000 kilometers and would carry a severe risk of total guidance failure -- probably exceeding two-thirds of the missiles fired. A differential global positioning system (GPS) integrated with the inertial navigation system (INS) and a radar altimeter, however, might produce an accuracy of 15 meters. Some existing remotely piloted vehicles (RPVs), such as the South African

Skua claim such performance. Commercial technology is becoming available for differential global positioning system (GPS) guidance with accuracies of 2 to 5 meters.

- There are commercially available reciprocating and gas turbine engines that Iran could adapt for use in a cruise missile, although finding a reliable and efficient turbofan engine for a specific design application might be difficult. An extremely efficient engine would have to be matched to a specific airframe. It is doubtful that Iran could design and build such an engine, but there are over 20 other countries with the necessary design and manufacturing skills.
- While airframe-engine-warhead integration and testing would present a challenge and might be beyond Iran's manufacturing skills, it is inherently easier to integrate and test a cruise missile than a long-range ballistic missile. Further, such developments would be far less detectable than developing a ballistic system if the program used coded or low altitude directional telemetry.
- Iran could bypass much of the problems inherent in developing its own cruise missile by modifying the HY-2 Seersucker for use as a land attack weapon and extending its range beyond 80 kilometers, or by modifying and improving the CS-801 (Ying Jai-1) anti-ship missile. There are reports that the Revolutionary Guards are working on such developments at a facility near Bandar Abbas.
- Su-24 long-range strike fighters with range-payloads roughly equivalent to US F-111 and superior to older Soviet medium bombers.
- F-4D/E fighter bombers with capability to carry extensive payloads to ranges of 450 miles.
- Can modify HY-2 Silkworm missiles and SA-2 surface-to-air missiles to deliver weapons of mass destruction.
- Iran has made several indigenous-long range rockets.
  - The Iran-130, or Nazeat, since the end of the Iran-Iraq War. The full details of this system remain unclear, but it seems to use commercially available components, a solid fuel rocket, and a simple inertial guidance system to reach ranges of about 90-120 kilometers. It is 355 mm in diameter, 5.9 meters long, weighs 950 kilograms, and has a 150 kilogram warhead. It seems to have poor reliability and accuracy, and its payload only seems to be several hundred kilograms.
  - The Shahin 2. It too has a 355 mm diameter, but is only 3.87 meters long, and weighs only 580 kilograms. It evidently can be equipped with three types of warheads: A 180 kilogram high explosive warhead, another warhead using high explosive submunitions, and a warhead that uses chemical weapons.
  - Iranian Oghab (Eagle) rocket with 40+ kilometers range.
  - New SSM with 125 mile range may be in production, but could be modified FROG.
- Large numbers of multiple rocket launchers and tube artillery for short range delivery of chemical weapons.
- The CIA reported in January 1999 that entities in Russia and China continue to supply missile-related goods and technology to Iran. Tehran is using these goods and technologies to achieve its goal of becoming self-sufficient in the production of MRBMs. The July flight test of the Shahab-3 MRBM demonstrates the success Iran has achieved in realizing that goal. Iran already is producing Scud SRBMs with North Korean help and has begun production of the Shahab-3. In addition, Iran's Defense Minister has publicly acknowledged the development of the Shahab-4 ballistic missile, with a "longer range and heavier payload than the 1,300-km Shahab-3."
- Iran's earlier success in gaining technology and materials from Russian companies accelerated Iranian development of the Shahab-3 MRBM, which was first flight tested in July 1998.
- The CIA report on missile proliferation in September 1999 estimated that Iran is the next hostile country most capable of testing an ICBM capable of delivering a weapon to the United States during the next 15 years.
- Iran *could test* an ICBM that could deliver a several-hundred kilogram payload to many parts of the United States in the latter half of the next decade, using Russian technology and assistance.

- Iran *could pursue* a Taepo Dong-type ICBM. Most analysts believe it could test a three-stage ICBM patterned after the Taepo Dong-1 SLV or a three-stage Taepo Dong-2-type ICBM, possibly with North Korean assistance, in the next few years.
- Iran is *likely to test* an SLV by 2010 that—once developed—could be converted into an ICBM capable of delivering a several-hundred kilogram payload to the United States.
- Analysts differ on the likely timing of Iran's first flight test of an ICBM that could threaten the United States. Assessments include:
  - *likely* before 2010 and *very likely* before 2015 (noting that an SLV with ICBM capabilities will *probably be tested within the next few years*);
  - no more than an *even chance* by 2010 and a *better than even chance* by 2015;
  - and less than an even chance by 2015.

### Chemical Weapons

- Iran purchased large amounts of chemical defense gear from the mid-1980s onwards. Iran also obtained stocks of non-lethal CS gas, although it quickly found such agents had very limited military impact since they could only be used effectively in closed areas or very small open areas.
- Acquiring poisonous chemical agents was more difficult. Iran did not have any internal capacity to manufacture poisonous chemical agents when Iraq first launched its attacks with such weapons. While Iran seems to have made limited use of chemical mortar and artillery rounds as early as 1985 -- and possibly as early as 1984 -- these rounds were almost certainly captured from Iraq.
- Iran had to covertly import the necessary equipment and supplies, and it took several years to get substantial amounts of production equipment, and the necessary feedstocks. Iran sought aid from European firms like Lurgi to produce large "pesticide" plants, and began to try to obtain the needed feedstock from a wide range of sources, relying heavily on its Embassy in Bonn to manage the necessary deals. While Lurgi did not provide the pesticide plant Iran sought, Iran did obtain substantial support from other European firms and feedstocks from many other Western sources.
- By 1986-1987, Iran developed the capability to produce enough lethal agents to load its own weapons. The Director of the CIA, and informed observers in the Gulf, made it clear that Iran could produce blood agents like hydrogen cyanide, phosgene gas, and/or chlorine gas. Iran was also able to weaponize limited quantities of blister (sulfur mustard) and blood (cyanide) agents beginning in 1987, and had some capability to weaponize phosgene gas, and/or chlorine gas. These chemical agents were produced in small batches, and evidently under laboratory scale conditions, which enabled Iran to load small numbers of weapons before any of its new major production plants went into full operation.
- These gas agents were loaded into bombs and artillery shells, and were used sporadically against Iraq in 1987 and 1988.
- Reports regarding Iran's production and research facilities are highly uncertain:
  - Iran seems to have completed completion of a major poison gas plant at Qazvin, about 150 kilometers west of Tehran. This plant is reported to have been completed between November, 1987 and January, 1988. While supposedly a pesticide plant, the facility's true purpose seems to have been poison gas production using organophosphorous compounds.
  - It is impossible to trace all the sources of the major components and technology Iran used in its chemical weapons program during this period. Mujahideen sources claim Iran also set up a chemical bomb and warhead plant operated by the Zakaria Al-Razi chemical company near Mahshar in southern Iran, but it is unclear whether these reports are true.
  - Reports that Iran had chemical weapons plants at Damghan and Parchin that began operation as early as March, 1988, and may have begun to test fire Scuds with chemical warheads as early as 1988-1989, are equally uncertain.
  - Iran established at least one large research and development center under the control of the Engineering Research Centre of the Construction Crusade (Jahad e-Sazandegi), had established a significant chemical weapons production capability by mid-1989,

- Debates took place in the Iranian parliament or Majlis in late 1988 over the safety of Pasdaran gas plants located near Iranian towns, and that Rafsanjani described chemical weapons as follows: "Chemical and biological weapons are poor man's atomic bombs and can easily be produced. We should at least consider them for our defense. Although the use of such weapons is inhuman, the war taught us that international laws are only scraps of paper."
- Post Iran-Iraq War estimates of Iran chemical weapons production are extremely uncertain:
  - US experts believe Iran was beginning to produce significant mustard gas and nerve gas by the time of the August, 1988 cease-fire in the Iran-Iraq War, although its use of chemical weapons remained limited and had little impact on the fighting
  - Iran's efforts to equip plants to produce V-agent nerve gases seem to have been delayed by US, British, and German efforts to limit technology transfers to Iran, but Iran may have acquired the capability to produce persistent nerve gas during the mid 1990s.
  - Production of nerve gas weapons started no later than 1994.
  - Began to stockpile of cyanide (cyanogen chloride), phosgene, and mustard gas weapons after 1985. Recent CIA testimony indicates that production capacity may approach 1,000 tons annually.
- Weapons include bombs and artillery. Shells include 155 mm artillery and mortar rounds. Iran also has chemical bombs and mines. It may have developmental chemical warheads for its Scuds, and may have a chemical package for its 22006 RPV (doubtful).
- There are reports that Iran has deployed chemical weapons on some of its ships.
- Iran has increased chemical defensive and offensive warfare training since 1993.
- Iran is seeking to buy more advanced chemical defense equipment, and has sought to buy specialized equipment on world market to develop indigenous capability to produce advanced feedstocks for nerve weapons.
  - CIA sources indicated in late 1996, that China might have supplied Iran with up to 400 tons of chemicals for the production of nerve gas.
  - One report indicated in 1996, that Iran obtained 400 metric tons of chemical for use in nerve gas weapons from China -- including carbon sulfide.
  - Another report indicated that China supplied Iran with roughly two tons of calcium-hypochlorate in 1996, and loaded another 40,000 barrels in January or February of 1997. Calcium-hypochlorate is used for decontamination in chemical warfare.
  - Iran placed several significant orders from China that were not delivered. Razak Industries in Tehran, and Chemical and Pharmaceutical Industries in Tabriz ordered 49 metric tons of alkyl dimethylamine, a chemical used in making detergents, and 17 tons of sodium sulfide, a chemical used in making mustard gas. The orders were never delivered, but they were brokered by Iran's International Movalled Industries Corporation (Imaco) and China's North Chemical Industries Co. (Nocinco). Both brokers have been linked to other transactions affecting Iran's chemical weapons program since early 1995, and Nocinco has supplied Iran with several hundred tons of carbon disulfide, a chemical uses in nerve gas.
  - Another Chinese firm, only publicly identified as Q. Chen, seems to have supplied glass vessels for chemical weapons.
  - The US imposed sanctions on seven Chinese firms in May, 1997, for selling precursors for nerve gas and equipment for making nerve gas -- although the US made it clear that it had, "no evidence that the Chinese government was involved." The Chinese firms were the Nanjing Chemical Industries Group and Jiangsu Yongli Chemical Engineering and Import/Export Corporation. Cheong Yee Ltd., a Hong Kong firm, was also involved. The precursors included tionyl chloride, dimethylamine, and ethylene chlorohydril. The equipment included special glass lined vessels, and Nanjing Chemical and Industrial Group completed construction of a production plant to manufacture such vessels in Iran in June, 1997.

- Iran sought to obtain impregnated Alumina, which is used to make phosphorous-oxychloride -- a major component of VX and GB -- from the US.
- It has obtained some equipment from Israelis. Nahum Manbar, an Israeli national living in France, was convicted in an Israeli court in May 1997 for providing Iran with \$16 million worth of production equipment for mustard and nerve gas during the period from 1990 to 1995.
- CIA reported in June 1997 that Iran had obtained new chemical weapons equipment technology from China and India in 1996.
- India is assisting in the construction of a major new plant at Qazvim, near Tehran, to manufacture phosphorous pentasulfide, a major precursor for nerve gas. The plant is fronted by Meli Agrochemicals, and the program was negotiated by Dr. Mejid Tehrani Abbaspour, a chief security advisor to Rafsanjani.
- A recent report by German intelligence indicates that Iran has made major efforts to acquire the equipment necessary to produce Sarin and Tabun, using the same cover of purchasing equipment for pesticide plants that Iraq used for its Sa'ad 16 plant in the 1980s. German sources note that three Indian companies -- Tata Consulting Engineering, Transpek, and Rallis India -- have approached German pharmaceutical and engineering concerns for such equipment and technology under conditions where German intelligence was able to trace the end user to Iran
- Iran ratified the Chemical Weapons Convention in June 1997.
  - It submitted a statement in Farsi to the CWC secretariat in 1998, but this consisted only of questions in Farsi as to the nature of the required compliance.
  - It has not provided the CWC with any data on its chemical weapons program.
- The CIA estimated in January 1999 that Iran obtained material related to chemical warfare (CW) from various sources during the first half of 1998. It already has manufactured and stockpiled chemical weapons, including blister, blood, and choking agents and the bombs and artillery shells for delivering them. However, Tehran is seeking foreign equipment and expertise to create a more advanced and self-sufficient CW infrastructure.
  - The CIA stated that Chinese entities sought to supply Iran with CW-related chemicals during 1997-1998 period. The US sanctions imposed in May 1997 on seven Chinese entities for knowingly and materially contributing to Iran's CW program remain in effect.

### **Biological Weapons**

- Extensive laboratory and research capability.
- Weapons effort documented as early as 1982. Reports surfaced that Iran had imported suitable type cultures from Europe and was working on the production of Mycotoxins -- a relatively simple family of biological agents that require only limited laboratory facilities for small scale production.
- US intelligence sources reported in August, 1989, that Iran was trying to buy two new strains of fungus from Canada and the Netherlands that can be used to produce Mycotoxins. German sources indicated that Iran had successfully purchased such cultures several years earlier.
- The Imam Reza Medical Center at Mashhad Medical Sciences University and the Iranian Research Organization for Science and Technology were identified as the end users for this purchasing effort, but it is likely that the true end user was an Iranian government agency specializing in biological warfare.
- Many experts believe that the Iranian biological weapons effort was placed under the control of the Islamic Revolutionary Guards Corps, which is known to have tried to purchase suitable production equipment for such weapons.
- Since the Iran-Iraq War, Iran has conducted research on more lethal active agents like Anthrax, hoof and mouth disease, and biotoxins. In addition, Iranian groups have repeatedly approached various European firms for the equipment and technology necessary to work with these diseases and toxins.

- Unclassified sources of uncertain reliability have identified a facility at Damghan as working on both biological and chemical weapons research and production, and believe that Iran may be producing biological weapons at a pesticide facility near Tehran.
- Some universities and research centers may be linked to biological weapons program.
- Reports surfaced in the spring of 1993 that Iran had succeeded in obtaining advanced biological weapons technology in Switzerland and containment equipment and technology from Germany. According to these reports, this led to serious damage to computer facilities in a Swiss biological research facility by unidentified agents. Similar reports indicated that agents had destroyed German bio-containment equipment destined for Iran.
- More credible reports by US experts indicate that Iran has begun to stockpile anthrax and Botulinum in a facility near Tabriz, can now mass manufacture such agents, and has them in an aerosol form. None of these reports, however, can be verified.
- The CIA has reported that Iran has, “sought dual-use biotech equipment from Europe and Asia, ostensibly for civilian use.” It also reported in 1996 that Iran might be ready to deploy biological weapons. Beyond this point, little unclassified information exists regarding the details of Iran's effort to “weaponize” and produce biological weapons.
- Iran may have the production technology to make dry storable and aerosol weapons. This would allow it to develop suitable missile warheads and bombs and covert devices.
- Iran may have begun active weapons production in 1996, but probably only at limited scale suitable for advanced testing and development.
- CIA testimony indicates that Iran is believed to have weaponized both live agents and toxins for artillery and bombs and may be pursuing biological warheads for its missiles. The CIA reported in 1996 that, “We believe that Iran holds some stocks of biological agents and weapons. Tehran probably has investigated both toxins and live organisms as biological warfare agents. Iran has the technical infrastructure to support a significant biological weapons program with little foreign assistance.
- CIA reported in June 1997 that Iran had obtained new dual use technology from China and India during 1996.
- Iran announced in June 1997 that it would not produce or employ chemical weapons including toxins.
- The CIA estimated in January 1999 that Iran continued to pursue purchasing dual-use biotechnical equipment from Russia and other countries, ostensibly for civilian uses. Its biological warfare (BW) program began during the Iran-Iraq war, and Iran may have some limited capability for BW deployment. Outside assistance is both important and difficult to prevent, given the dual-use nature of the materials and equipment being sought and the many legitimate end uses for these items.
- Russia remains a key source of biotechnology for Iran. Russia's world-leading expertise in biological weapons makes it an attractive target for Iranians seeking technical information and training on BW agent production processes.

### **Nuclear Weapons**

- The Shah established the Atomic Energy Organization of Iran in 1974, and rapidly began to negotiate for nuclear power plants.
  - He concluded an extendible ten year nuclear fuel contract with the US in 1974, with Germany in 1976, and France in 1977.
  - In 1975, he purchased a 10% share in a Eurodif uranium enrichment plant being built at Tricastin in France that was part of a French, Belgian, Spanish, and Italian consortium. Under the agreement the Shah signed, Iran was to have full access to the enrichment technology Eurodif developed, and agreed to buy a quota of enriched uranium from the new plant.

- He created an ambitious plan calling for a network of 23 power reactors throughout Iran that was to be operating by the mid-1990s, and sought to buy nuclear power plants from Germany and France.
- By the time the Shah fell in January, 1979, he had six reactors under contract, and was attempting to purchase a total of 12 nuclear power plants from Germany, France, and the US. Two 1,300 megawatt German nuclear power plants at Bushehr were already 60% and 75% completed, and site preparation work had begun on the first of two 935 megawatt French plants at Darkhouin that were to be supplied by Framatome.
- The Shah also started a nuclear weapons program in the early to mid-1970s, building upon his major reactor projects, investment in URENCO, and smuggling of nuclear enrichment and weapons related technology from US and Europe.
  - 5 megawatt light-water research reactor operating in Tehran.
  - 27 kilowatt neutron-source reactor operating in Isfahan.
  - Started two massive 1300 megawatt reactor complexes.
  - The Shah attempted to covertly import controlled technology from the US/.
- US experts believe that Shah began a low-level nuclear weapons research program, centered at the Amirabad Nuclear Research Center. This research effort included studies of weapons designs and plutonium recovery from spent reactor fuel.
  - It also involved a laser enrichment program which began in 1975, and led to a complex and highly illegal effort to obtain laser separation technology from the US. This latter effort, which does not seem to have had any success, continued from 1976 until the Shah's fall, and four lasers operating in the critical 16 micron band were shipped to Iran in October, 1978.
  - At the same time, Iran worked on other ways to obtain plutonium, created a secret reprocessing research effort to use enriched uranium, and set up a small nuclear weapons design team.
  - In 1976, Iran signed a secret contract to buy \$700 million worth of yellow cake from South Africa, and appears to have reached an agreement to buy up to 1,000 metric tons a year. It is unclear how much of this ore South Africa shipped before it agreed to adopt IAEA export restrictions in 1984, and whether South Africa really honored such export restrictions. Some sources indicate that South Africa still made major deliveries as late as 1988-1989.
  - Iran also tried to purchase 26.2 kilograms of highly enriched uranium; the application to the US for this purchase was pending when the Shah fell
  - The Shah did eventually accept full IAEA safeguards but their value is uncertain .
- In 1984, Khomeini revived nuclear weapons program begun under Shah.
  - Received significant West German and Argentine corporate support in some aspects of nuclear technology during the Iran-Iraq War.
  - Limited transfers of centrifuge and other weapons related technology from PRC, possibly Pakistan.
  - It has a Chinese-supplied heavy-water, zero-power research reactor at Isfahan Nuclear Research Center, and two-Chinese supplied sub-critical assemblies -- a light water and graphite design.
  - It has stockpiles of uranium and mines in Yazd area. It may have had a uranium-ore concentration facility at University of Tehran, but status unclear.
  - Some experts feel that the IRGC moved experts and equipment from the Amirabad Nuclear Research Center to a new nuclear weapons research facility near Isfahan in the mid-1980s, and formed a new nuclear research center at the University of Isfahan in 1984 -- with French assistance. Unlike many Iranian facilities, the center at Isfahan was not declared to the IAEA until February 1992, when the IAEA was allowed to make a cursory inspection of six sites that various reports had claimed were the location of Iran's nuclear weapons efforts.

- (Bushehr I & II), on the Gulf Coast just southwest of Isfahan, were partially completed at the time of the Shah's fall. Iran attempted to revive the program and sought German and Argentine support, but the reactors were damaged by Iraqi air strikes in 1987 and 1988.
- Iran may also have opened a new uranium ore processing plant close to its Shagand uranium mine in March, 1990, and it seems to have extended its search for uranium ore into three additional areas. Iran may have also begun to exploit stocks of yellow cake that the Shah had obtained from South Africa in the late 1970s while obtaining uranium dioxide from Argentina by purchasing it through Algeria.
- Iran began to show a renewed interest in laser isotope separation (LIS) in the mid-1980s, and held a conference on LIS in September, 1987.
- Iran opened a new nuclear research center in Isfahan in 1984, located about four kilometers outside the city and between the villages of Shahrida and Fulashans. This facility was built at a scale far beyond the needs of peaceful research, and Iran sought French and Pakistani help for a new research reactor for this center.
- The Khomeini government may also have obtained several thousand pounds of uranium dioxide from Argentina by purchasing it through Algeria. Uranium dioxide is considerably more refined than yellow cake, and is easier to use in irradiating material in a reactor to produce plutonium.
- The status of Iran's nuclear program since the Iran-Iraq War is highly controversial, and Iran has denied the existence of such a program.
  - On February 7, 1990, the speaker of the Majlis publicly toured the Atomic Energy Organization of Iran and opened the new Jabir Ibn al Hayyan laboratory to train Iranian nuclear technicians. Reports then surfaced that Iran had at least 200 scientists and a work force of about 2,000 devoted to nuclear research
  - Iran's Deputy President Ayatollah Mohajerani stated in October, 1991, that Iran should work with other Islamic states to create an "Islamic bomb."
  - The Iranian government has repeatedly made proposals to create a nuclear-free zone in the Middle East. For example, President Rafsanjani was asked if Iran had a nuclear weapons program in an interview in the CBS program *60 Minutes* in February 1997. He replied, "Definitely not. I hate this weapon."
  - Other senior Iranian leaders, including President Khatami have made similar categorical denials. Iran's new Foreign Minister, Kamal Kharrazi, stated on October 5, 1997, that, "We are certainly not developing an atomic bomb, because we do not believe in nuclear weapons... We believe in and promote the idea of the Middle East as a region free of nuclear weapons and other weapons of mass destruction. But why are we interested to develop nuclear technology? We need to diversify our energy sources. In a matter of a few decades, our oil and gas reserves would be finished and therefore, we need access to other sources of energy...Furthermore, nuclear technology has many other utilities in medicine and agriculture. The case of the United States in terms of oil reserve is not different from Iran's The United States also has large oil resources, but at the same time they have nuclear power plants. So there is nothing wrong with having access to nuclear technology if it is for peaceful purposes..."
- The IAEA reports that Iran has fully complied with its present requirements, and that it has found no indications of nuclear weapons effort, but IAEA only inspects Iran's small research reactors.
  - The IAEA visits to other Iranian sites are not inspections, and do not use instruments, cameras, seals, etc. They are informal walk-throughs.
  - The IAEA visited five suspect Iranian facilities in 1992 and 1993 in this manner, but did not conduct full inspections.
  - Iran has not had any 93+2 inspections and its position on improved inspections is that it will not be either the first or the last to have them.
  - Iranian officials have repeatedly complained that the West tolerated Iraqi use of chemical weapons and its nuclear and biological build-up during the Iran-Iraq War, and has a dual standard where it does not demand inspections of Israel or that Israel sign the NPT.

- These are reasons to assume that Iran still has a nuclear program:
  - Iran attempted to buy highly enriched fissile material from Khazakstan. The US paid between \$20 million and \$30 million to buy 1,300 pounds of highly enriched uranium from the Ust-Kamenogorsk facility in Khazakstan that Iran may have sought to acquire in 1992. A total of 120 pounds of the material -- enough for two bombs -- cannot be fully accounted for.
  - Iran has imported maraging steel, sometimes used for centrifuges, by smuggling it in through dummy fronts. Britain intercepted 110 pound (50 kilo) shipment in August, 1996. Seems to have centrifuge research program at Sharif University of Technology in Tehran. IAEA “visit” did not confirm.
  - Those aspects of Iran's program that are visible indicate that Iran has had only uncertain success. Argentina agreed to train Iranian technicians at its Jose Balaseiro Nuclear Institute, and sold Iran \$5.5 million worth of uranium for its small Amirabad Nuclear Research Center reactor in May 1987. A CENA team visited Iran in late 1987 and early 1988, and seems to have discussed selling sell Iran the technology necessary to operate its reactor with 20% enriched uranium as a substitute for the highly enriched core provided by the US, and possibly uranium enrichment and plutonium reprocessing technology as well. Changes in Argentina's government, however, made it much less willing to support proliferation. The Argentine government announced in February, 1992, that it was canceling an \$18 million nuclear technology sale to Iran because it had not signed a nuclear safeguards arrangement. Argentine press sources suggested, however, that Argentina was reacting to US pressure.
  - In February, 1990 a Spanish paper reported that Associated Enterprises of Spain was negotiating the completion of the two nuclear power plants at Bushehr. Another Spanish firm called ENUSA (National Uranium Enterprises) was to provide the fuel, and Kraftwerke Union (KWU) would be involved. Later reports indicated that a 10 man delegation from Iran's Ministry of Industry was in Madrid negotiating with the Director of Associated Enterprises, Adolfo Garcia Rodriguez.
  - Iran negotiated with Kraftwerke Union and CENA of Germany in the late 1980s and early 1990s. Iran attempted to import reactor parts from Siemens in Germany and Skoda in Czechoslovakia. None of these efforts solved Iran's problems in rebuilding its reactor program, but all demonstrate the depth of its interest.
  - Iran took other measures to strengthen its nuclear program during the early 1990s. It installed a cyclotron from Ion Beam Applications in Belgium at a facility in Karzaj in 1991.
  - Iran conducted experiments in uranium enrichment and centrifuge technology at its Sharif University of Technology in Tehran. Sharif University was also linked to efforts to import cylinders of fluorine suitable for processing enriched material, and attempts to import specialized magnets that can be used for centrifuges, from Thyssen in Germany in 1991.
  - In 1992, Iran attempted to buy beryllium from a storage site in Kazakhstan that also was storing 600 kilograms of highly enriched uranium. These contacts then seem to have expanded to an attempt to try the material. In 1994, they helped lead the US to buy the enriched material and fly it out of the country.
  - It is clear from Iran's imports that it has sought centrifuge technology ever since. Although many of Iran's efforts have never been made public, British customs officials seized 110 pounds of maraging steel being shipped to Iran in July 1996.
  - Iran seems to have conducted research into plutonium separation and Iranians published research on uses of tritium that had applications to nuclear weapons boosting. Iran also obtained a wide range of US and other nuclear literature with applications for weapons designs. Italian inspectors seized eight steam condensers bound for Iran that could be used in a covert reactor program in 1993, and high technology ultrasound equipment suitable for reactor testing at the port of Bari in January, 1994.
  - Other aspects of Iran's nuclear research effort had potential weapons applications. Iran continued to operate an Argentine-fueled five megawatt light water highly enriched uranium reactor at the University of Tehran. It is operated by a Chinese-supplied neutron source research reactor, and subcritical assemblies with 900 grams of highly enriched uranium, at its Isfahan Nuclear Research Center. This Center has experimented with a heavy water zero-power reactor, a light water sub-critical reactor, and a graphite sub-critical reactor. In addition, it may have experimented with some aspects of nuclear weapons design.

- The German Ministry of Economics has circulated a wide list of such Iranian fronts which are known to have imported or attempted to import controlled items. These fronts include the:
  - Bonyad e-Mostazafan;
  - Defense Industries Organization (Sazemane Sanaye Defa);
  - Pars Garma Company, the Sadadja Industrial Group (Sadadja Sanaye Daryae);
  - Iran Telecommunications Industry (Sanaye Mokhaberet Iran);
  - Shahid Hemat Industrial Group, the State Purchasing Organization, Education Research Institute (ERI);
  - Iran Aircraft Manufacturing Industries (IAI);
  - Iran Fair Deal Company, Iran Group of Surveyors;
  - Iran Helicopter Support and Renewal Industries (IHI);
  - Iran Navy Technical Supply Center;
  - Iran Tehran Kohakd Daftar Nezarat, Industrial Development Group;
  - Ministry of Defense (Vezerate Defa).
- Iran claims it eventually needs to build enough nuclear reactors to provide 20% of its electric power. This Iranian nuclear power program presents serious problems in terms of proliferation. Although the reactors are scarcely ideal for irradiating material to produce Plutonium or cannibalizing the core, they do provide Iran with the technology base to make its own reactors, have involved other technology transfer helpful to Iran in proliferating and can be used to produce weapons if Iran rejects IAEA safeguards.
- Russian has agreed to build up to four reactors, beginning with a complex at Bushehr -- with two 1,000-1,200 megawatt reactors and two 465 megawatt reactors, and provide significant nuclear technology.
  - Russia has consistently claimed the light water reactor designs for Bushehr cannot be used to produce weapons grade Plutonium and are similar to the reactors the US is providing to North Korea.
  - The US has claimed, however, that Victor Mikhailiov, the head of Russia's Atomic Energy Ministry, proposed the sale of a centrifuge plant in April, 1995. The US also indicated that it had persuaded Russia not to sell Iran centrifuge technology as part of the reactor deal during the summit meeting between President's Clinton and Yeltsin in May, 1995.
  - It was only after US pressure that Russia publicly stated that it never planned to sell centrifuge and advanced enrichment technology to Iran, and Iran denied that it had ever been interested in such technology. For example, the statement of Mohammed Sadegh Ayatollahi, Iran's representative to the IAEA, stated that, "We've had contracts before for the Bushehr plant in which we agreed that the spent fuel would go back to the supplier. For our contract with the Russians and Chinese, it is the same." According to some reports, Russia was to reprocess the fuel at its Mayak plant near Chelyabinsk in the Urals, and could store it at an existing facility, at Krasnoyarsk-26 in southern Siberia.
  - The CIA reported in June 1997 that Iran had obtained new nuclear technology from Russia during 1996.
  - A nuclear accident at plant at Rasht, six miles north of Gilan, exposed about 50 people to radiation in July, 1996.
  - Russian Nuclear Energy Minister Yevgeny Adamov and Russian Deputy Prime Minister Vladimir Bulgak visited in March, 1998. and Iran and dismissed US complaints about the risk the reactors would be used to proliferate.
    - Russia indicated that it would go ahead with selling two more reactors for construction at Bushehr within the next five years.
  - The first 1,000 megawatt reactor at Bushehr has experienced serious construction delays. In March, 1998, Russia and Iran agreed to turn the construction project into a turn key plant because the Iranian firms working on infrastructure had fallen well behind schedule. In February, Iran had agreed to fund improved safety systems. The reactor is reported to be on a 30- month completion cycle.

- The US persuaded the Ukraine not to sell Iran \$45 million worth of turbines for its nuclear plant in early March, 1998, and to strengthen its controls on Ukrainian missile technology under the MTCR.
- The CIA reported in January 1999 that Russia remained a key supplier for civilian nuclear programs in Iran and, to a lesser extent, India. With respect to Iran's nuclear infrastructure, Russian assistance would enhance Iran's ability to support a nuclear weapons development effort. Such assistance is less likely to significantly advance India's effort, given that India's nuclear weapons program is more mature. By its very nature, even the transfer of civilian technology may be of use in the nuclear weapons programs of these countries.
- Following intense and continuing engagement with the United States, Russian officials have taken some positive steps. Russia has committed to observe certain limits on its nuclear cooperation with Iran, such as not providing militarily useful nuclear technology.
- In January 1998, the Russian Government issued a broad decree prohibiting Russian companies from exporting items known or believed to be used for developing WMD or related delivery systems, whether or not these items are on Russia's export control list. In May 1998, Russia announced a decree intended to strengthen compliance of Russian businesses with existing export controls on proliferation-related items. These actions, if enforced, could help to counter the proliferation of WMD and their delivery systems.
- However, there are signs that Russian entities have continued to engage in behavior inconsistent with these steps. Monitoring Russian proliferation behavior, therefore, will have to remain a very high priority for some time to come.
- On January 14, 2000, Russia's Minister of Defense Igor Ivanavov met with Hassan Rowhani, the secretary of Iran's Supreme National Security Council, and promised that Russia would maintain defense cooperation, and that Russia, "intends to fulfill its obligations under the agreements made in 1989-1990."
- The same day, Vice Minister Ilya Klebanov met with Hassan Rowhani, and announced that Iran might order three additional Russian reactors.
- The CIA warned in January 2000 that Russia might have sold Iran heavy water and graphite technology.
- China is reported to have agreed to provide significant nuclear technology transfer and possible sale of two 300 megawatt pressurized water reactors in the early 1990s, but then to have agreed to halt nuclear assistance to Iran after pressure from the US.
- Iran signed an agreement with China's Commission on Science, Technology, and Industry for National Defense on January 21, 1991, to build a small 27-kilowatt research reactor at Iran's nuclear weapons research facility at Isfahan. On November 4, 1991, China stated that it had signed commercial cooperation agreements with Iran in 1989 and 1991, and that it would transfer an electromagnetic isotope separator (Calutron) and a smaller nuclear reactor, for "peaceful and commercial" purposes.
- The Chinese reactor and Calutron were small research-scale systems and had no direct value in producing fissile material. They did, however, give Iran more knowledge of reactor and enrichment technology, and US experts believe that China provided Iran with additional data on chemical separation, other enrichment technology, the design for facilities to convert uranium to uranium hexafluoride to make reactor fuel, and help in processing yellowcake.
- The US put intense pressure on China to halt such transfers. President Clinton and Chinese President Jiang Zemin reached an agreement at an October, 1997 summit. China strengthened this pledge in negotiations with the US in February, 1998.
- In March, 1998, the US found that the China Nuclear Energy Corporation was negotiating to sell Iran several hundred tons of anhydrous hydrogen fluoride (AHF) to Isfahan Nuclear Research Corporation in central Iran, a site where some experts believe Iran is working on the development of nuclear weapons. AHF can be used to separate plutonium, help refine yellow cake into uranium hexafluoride to produce U-235, and as a feedstock for Sarin. It is on two nuclear control lists. China agreed to halt the sale.
- Iran denied that China had halted nuclear cooperation on March 15, 1998.
- Even so, the US acting Under Secretary of State for Arms Control and International Security Affairs stated that China was keeping its pledge not to aid Iran on March 26, 1998.
- The CIA reported in January 1999 that During the first half of 1998, China continued to take steps to strengthen its control over nuclear exports. China promulgated new export control regulations in June 1998

that cover the sale of dual-use nuclear equipment. This follows on the heels of the September 1997 promulgation of controls covering the export of equipment and materials associated exclusively with nuclear applications. These export controls should give the Chinese Government greater accounting and control of the transfer of equipment, materials, and technology to nuclear programs in countries of concern.

- China pledged in late 1997 not to engage in any new nuclear cooperation with Iran and to complete work on two remaining nuclear projects—a small research reactor and a zirconium production facility—in a relatively short period of time. During the first half of 1998, Beijing appears to have implemented this pledge. The Intelligence Community will continue to monitor carefully Chinese nuclear cooperation with Iran.
- During the reporting period, Chinese entities provided a variety of missile-related items and assistance to several countries of proliferation concern. China also was an important supplier of ACW to Iran through the first half of 1998.
- The control of fissile material in the FSU remains a major problem:
  - US estimates indicate the FSU left a legacy of some 1,485 tons of nuclear material. This include 770 tons in some 27,000 weapons, including 816 strategic bombs, 5,434 missile warheads, and about 20,000 theater and tactical weapons. In addition, there were 715 tons of fissile or near-fissile material in eight countries of the FSU in over 50 sites: enough to make 35,000-40,000 bombs.
  - There are large numbers of experienced FSU technicians, including those at the Russian weapons design center at Arzamas, and at nuclear production complexes at Chelyabinsk, Krasnoyarsk, and Tomsk.
  - These factors led the US to conduct Operation Sapphire in 1994, where the US removed 600 kilograms of highly enriched uranium from the Ulba Metallurgy Plant in Kazakhstan at a time Iran was negotiating for the material.
  - They also led to Britain and the US cooperating in Auburn Endeavor, and airlifting fissile material out of a nuclear research facility in Tbilisi, Georgia. There were 10 pounds of material at the institute, and 8.8 pounds were HEU. (It takes about 35 pounds to make a bomb.) This operation was reported in the New York Times on April 21, 1998. The British government confirmed it took place, but would not give the date.
- The Jerusalem Post reported on April 9, 1998 that Iran had purchased four tactical nuclear weapons from Russian smugglers for \$25 million in the early 1990s, that the weapons had been obtained from Kazakhstan in 1991, and that Argentine technicians were helping to activate the weapon.
  - It quoted what it claimed was an Iranian report, dated December 26, 1991, of a meeting between Brigadier General Rahim Safavi, the Deputy Commander of the Revolutionary Guards and Reza Amrohalli, then head of the Iranian atomic energy organization.
  - It also quoted a second document -- dated January 2, 1992 --- saying the Iranians were awaiting the arrival of Russian technicians to show them how to disarm the protection systems that would otherwise inactivate the weapons if anyone attempted to use them.
  - The documents implied the weapons were flawed by did not indicate whether Iran had succeeded in activating them.
  - The US intelligence community denied any evidence that such a transfer had taken place.
- The most detailed reports of Iran's nuclear weapons program are the least reliable, and come from the People's Mujahideen, a violent, anti-regime, terrorist group. Such claims are very doubtful, but the People's Mujahideen has reported that:
  - Iran's facilities include a weapons site called Ma'allem Kelayah, near Qazvin on the Caspian. This is said to be an IRGC-run facility established in 1987, which has involved an Iranian investment of \$300 million. Supposedly, the site was to house the 10 megawatt reactor Iran tried to buy from India.
  - Two Soviet reactors were to be installed at a large site at Gorgan on the Caspian, under the direction of Russian physicists.
  - The People's Republic of China provided uranium enrichment equipment and technicians for the site at Darkhouin, where Iran once planned to build a French reactor.

- A nuclear reactor was being constructed at Karaj; and that another nuclear weapons facility exists in the south central part of Iran, near the Iraqi border.
- The ammonia and urea plant that the British firm M. W. Kellogg was building at Borujerd in Khorassan province, near the border with Turkestan, might be adapted to produce heavy water.
- The Amir Kabir Technical University, the Atomic Energy Organization of Iran (AEOI) (also known as the Organization for Atomic Energy of Iran or AEOI), Dor Argham Ltd., the Education and Research Institute, GAM Iranian Communications, Ghods Research Center, Iran Argham Co., Iran Electronic Industries, Iranian Research Organization, Ministry of Sepah, Research and Development Group, Sezemane Sanaye Defa, the Sharif University of Technology, Taradis Iran Computer Company, and Zakaria Al-Razi Chemical Company are all participants in the Iranian nuclear weapons effort.
- Other sources based on opposition data have listed the Atomic Energy Organization of Iran, the Laser Research Center and Ibn-e Heysam Research and Laboratory Complex, the Bonab Atomic Energy Research Center (East Azerbaijan), the Imam Hussein University of the Revolutionary Guards, the Jabit bin al-Hayyan Laboratory, the Khoshomi uranium mine (Yazd), a possible site at Moallem Kalayeh, the Nuclear Research Center at Tehran University, the Nuclear Research Center for Agriculture and Medicine (Karaj), the Nuclear Research Center of Technology (Isfahan), the Saghand Uranium mine (Yazd), the Sharif University (Tehran) and its Physics Research Center.
- The CIA estimated in January 1999 that, Iran remains one of the most active countries seeking to acquire WMD technology and ACW. During the reporting period, Iran focused its efforts to acquire WMD-related equipment, materials, and technology primarily on two countries: Russia and China. Iran is seeking to develop an indigenous capability to produce various types of nuclear, chemical, and biological weapons and their delivery systems.
- Iran actively sought relevant production technology to lessen its dependence on foreign sources.
- Russian entities continued to market and support a variety of nuclear-related projects in Iran during the first half of 1998, ranging from the sale of laboratory equipment for nuclear research institutes to the construction of a 1,000-megawatt nuclear power reactor in Bushehr, Iran, that will be subject to International Atomic Energy Agency (IAEA) safeguards. These projects, along with other nuclear-related purchases, will help Iran augment its nuclear technology infrastructure, which in turn would be useful in supporting nuclear weapons research and development.
- Russia has committed to observe certain limits on its nuclear cooperation with Iran. For example, President Yel'tsin has stated publicly that Russia will not provide militarily useful nuclear technology to Iran. Beginning in January this year, the Russian Government has taken a number of steps. For example, in May 1998, Russia announced a decree intended to strengthen compliance of Russian businesses with existing export controls on proliferation-related items.
- China continued to work on one of its two remaining projects—to supply Iran's civil nuclear program with a zirconium production facility. This facility will be used by Iran to produce cladding for reactor fuel. As a party to the Nuclear Nonproliferation Treaty, Iran is required to apply IAEA safeguards to nuclear fuel, but safeguards are not required for the zirconium plant or its products. During the US-China October 1997 Summit, China pledged not to engage in any new nuclear cooperation with Iran and to complete cooperation on two ongoing nuclear projects in a relatively short time. This pledge appears to be holding. In addition, China promulgated new export regulations in June 1998 that cover the sale of dual-use nuclear equipment. The regulations took effect immediately and were intended to strengthen control over equipment and material that would contribute to proliferation. Promulgation of these regulations fulfills Jiang Zemin's commitment to the United States last fall to implement such controls by the middle of 1998.
- Iran claims to desire the establishment of a complete nuclear fuel cycle for its civilian energy program. In that guise, it seeks to obtain whole facilities, such as a uranium conversion facility, that, in fact, could be used in any number of ways in support of efforts to produce fissile material needed for a nuclear weapon. Despite outside efforts to curtail the flow of critical technologies and equipment, Tehran continues to seek fissile material and technology for weapons development and has set up an elaborate system of military and civilian organizations to support its effort.
- US estimates of Iran's progress in acquiring nuclear weapons have changed over time.
  - In 1992, the CIA estimated that Iran would have the bomb by the year 2000. In 1995, John Holum testified that Iran could have the bomb by 2003.

- In 1997, after two years in which Iran might have made progress, he testified that Iran could have the bomb by 2005-2007.
- In 1999, the NIE on proliferation estimated that Iran could test a missile that could reach the US by 2010, but did not change the 1997 estimate or when Iran might acquire a bomb.
- In early 2000, the New York Time reported that the CIA had warned that Iran might now be able to make a nuclear weapon. The assessment stated that the CIA could not monitor Iran closely enough to be certain whether Iran had acquired fissile material from an outside source.
- US experts increasingly refer to Iran's efforts as "creeping proliferation" and there is no way to tell when or if Iranian current efforts will produce a weapon, and unclassified lists of potential facilities have little credibility..
- Timing of weapons acquisition depends heavily on whether Iran can buy fissile material -- if so it has the design capability and can produce weapons in 1-2 years -- or must develop the capability to process Plutonium or enrich Uranium -- in which case, it is likely to be 5-10 years.

**Missile Defenses**

- Seeking Russian S-300 or S-400 surface-to-air missile system with limited anti tactical ballistic missile capability.

## Iraq's Search for Weapons of Mass Destruction

### Delivery Systems

- Prior to the Gulf War Iraq had extensive delivery systems incorporating long-range strike aircraft with refueling capabilities and several hundred regular and improved, longer-range Scud missiles, some with chemical warheads. These systems included:
  - Tu-16 and Tu-22 bombers.
  - MiG-29 fighters.
  - Mirage F-1, MiG-23BM, and Su-22 fighter attack aircraft.
  - A Scud force with a minimum of 819 missiles.
  - Extended range Al Husayn Scud variants (600 kilometer range) extensively deployed throughout Iraq, and at three fixed sites in northern, western, and southern Iraq.
  - Developing Al-Abbas missiles (900 kilometer range), which could reach targets in Iran, the Persian Gulf, Israel, Turkey, and Cyprus.
  - Long-range super guns with ranges of up to 600 kilometers.
- Iraq also engaged in efforts aimed at developing the Tamuz liquid fueled missile with a range of over 2,000 kilometers, and a solid fueled missile with a similar range. Clear evidence indicates that at least one design was to have a nuclear warhead.
- Iraq attempted to conceal a plant making missile engines from the UN inspectors. It only admitted this plant existed in 1995, raising new questions about how many of its missiles have been destroyed.
- Iraq had design work underway for a nuclear warhead for its long-range missiles.
- The Gulf War deprived Iraq of some of its MiG-29s, Mirage F-1s, MiG-23BMs, and Su-22s.
- Since the end of the war, the UN inspection regime has also destroyed many of Iraq's long-range missiles:
  - UNSCOM has directly supervised the destruction of 48 Scud-type missiles.
  - It has verified the Iraqi unilateral destruction of 83 more missiles and 9 mobile launchers.
- A State Department summary issued on November 16, 1998, indicates that UNSCOM has supervised the destruction of:
  - 48 operational missiles;
  - 14 conventional missile warheads;
  - six operational mobile launchers; 28 operational fixed launch pads;
  - 32 fixed launch pads;
  - 30 missile chemical warheads;
  - other missile support equipment and materials, and a variety of assembled and non-assembled supergun components.
  - 38,537 filled and empty chemical munitions;
  - 90 metric tons of chemical weapons agent;
  - more than 3,000 metric tons of precursor chemicals;
  - 426 pieces of chemical weapons production equipment; and,
  - 91 pieces of related analytical instruments.
- The entire al-Hakam biological weapons production facility and a variety of production equipment and materials.

- The UN estimates that it is able to account for 817 of the 819 long-range missiles that Iraq imported in the period ending in 1988:
  - Pre-1980 expenditures, such as training 8
  - Expenditures during the Iran-Iraq War (1980-1981), including the war
  - of the cities in February-April 1988 516
  - Testing activities for the development of Iraq's modifications of
  - imported missiles and other experimental activities (1985-1990) 69
  - Expenditures during the Gulf War (January-March 1991) 93
  - Destruction under the supervision of UNSCOM 48
  - Unilateral destruction by Iraq (mid-July and October 1991) 83
  - UNSCOM's analysis has shown that Iraq had destroyed 83 of the 85 missiles it had claimed were destroyed. at the same time, it stated that Iraq had not given an adequate account of its proscribed missile assets, including launchers, warheads, and propellants.
  - UNSCOM also reports that it supervised the destruction of 10 mobile launchers, 30 chemical warheads, and 18 conventional warheads.
- Iraq maintains a significant delivery capability consisting of:
  - HY-2, SS-N-2, and C-601 cruise missiles, which are unaffected by UN cease-fire terms.
  - FROG-7 rockets with 70 kilometer ranges, also allowed under UN resolutions.
  - Multiple rocket launchers and tube artillery.
  - Experimental conversions such as the SA-2.
- Iraq claims to have manufactured only 80 missile assemblies, 53 of which were unusable. UNSCOM claims that 10 are unaccounted for.
  - US experts believe Iraq may still have components for several dozen extended-range Scud missiles.
- In addition, Iraq has admitted to:
  - Hiding its capability to manufacture its own Scuds.
  - Developing an extended range variant of the FROG-7 called the Laith. The UN claims to have tagged all existing FROG-7s to prevent any extension of their range beyond the UN imposed limit of 150 kilometers for Iraqi missiles.
  - Experimenting with cruise missile technology and ballistic missile designs with ranges up to 3,000 kilometers.
  - Flight testing Al Husayn missiles with chemical warheads in April 1990.
  - Developing biological warheads for the Al Husayn missile as part of Project 144 at Taji.
  - Initiating a research and development program for a nuclear warhead missile delivery system.
  - Successfully developing and testing a warhead separation system.
  - Indigenously developing, testing, and manufacturing advanced rocket engines to include liquid-propellant designs.
  - Conducting research into the development of Remotely Piloted Vehicles (RPVs) for the dissemination of biological agents.
  - Attempting to expand its Ababil-100 program designed to build surface-to-surface missiles with ranges beyond the permitted 100-150 kilometers.
  - Importing parts from Britain, Switzerland, and other countries for a 350 mm "super gun," as well as starting an indigenous 600 mm supergun design effort.

- Iraq initially claimed that it had 45 missile warheads filled with chemical weapons in 1992. It then stated that it had 20 chemical and 25 biological warheads in 1995. UNSCOM established that it had a minimum of 75 operational warheads and 5 used for trials. It has evidence of the existence of additional warheads. It can only verify that 16 warheads were filled with Sarin, and 34 with chemical warfare binary components, and that 30 were destroyed under its supervision -- 16 with Sarin and 14 with binary components.
- US and UN officials conclude further that:
  - Iraq is trying to rebuild its ballistic missile program using a clandestine network of front companies to obtain the necessary materials and technology from European and Russian firms.
  - This equipment is then concealed and stockpiled for assembly concomitant with the end of the UN inspection regime.
  - The equipment clandestinely sought by Iraq includes advanced missile guidance components, such as accelerometers and gyroscopes, specialty metals, special machine tools, and a high-tech, French-made, million-dollar furnace designed to fabricate engine parts for missiles.
- Recent major violations and smuggling efforts:
  - In November, 1995, Iraq was found to have concealed an SS-21 missile it had smuggled in from Yemen.
  - Jordan found that Iraq was smuggling missile components through Jordan in early December, 1995. These included 115 gyroscopes in 10 crates, and material for making chemical weapons. The shipment was worth an estimated \$25 million. Iraq claimed the gyroscopes were for oil exploration but they are similar to those used in the Soviet SS-N-18 SLBM. UNSCOM also found some gyroscopes dumped in the Tigris.
- Iraq retains the technology it acquired before the war and evidence clearly indicates an ongoing research and development effort, in spite of the UN sanctions regime.
- The fact the agreement allows Iraq to continue producing and testing short-range missiles (less than 150 kilometers range) means it can retain significant missile development effort.
  - The SA-2 is a possible test bed, but UNSCOM has tagged all missiles and monitors all high apogee tests.
  - Iraq's Al-Samoud and Ababil-100 programs are similar test beds. The Al-Samoud is a scaled-down Scud which Iraq seems to have tested.
  - Iraq continues to expand its missile production facility at Ibn Al Haytham, which has two new buildings large enough to make much longer-range missiles.
  - US satellite photographs reveal that Iraq has rebuilt its Al-Kindi missile research facility.
- Ekeus reported on December 18, 1996 that Iraq retained missiles, rocket launchers, fuel, and command system to "make a missile force of significance". UNSCOM reporting as of October, 1997 is more optimistic, but notes that Iraq, "continued to conceal documents describing its missile propellants, and the material evidence relating to its claims to have destroyed its indigenous missile production capabilities indicated in might has destroyed less than a tenth of what it claimed"
  - The CIA reported in January 1999 that Iraq is developing two ballistic missiles that fall within the UN-allowed 150-km range restriction. The Al Samoud liquid-propellant missile—described as a scaled-down Scud—began flight-testing in 1997.
  - Technicians for Iraq's pre-war Scud missiles are working on the Al Samoud program and, although under UNSCOM supervision, are developing technological improvements that could be applied to future longer-range missile programs. The Ababil-100 solid-propellant missile is also under development, although progress on this system lags the Al Samoud. After economic sanctions are lifted and UN inspections cease, Iraq could utilize expertise from these programs in the development of longer-range missile systems.

A State Department report in September 1999 noted that:

Iraq has refused to credibly account for 500 tons of SCUD propellant, over 40 SCUD biological and conventional warheads, 7 Iraqi-produced SCUDs, and truckloads of SCUD components.

Iraq refuses to allow inspection of thousands of Ministry of Defense and Military Industries Commission documents relating to biological and chemical weapons and long-range missiles.

The CIA estimated in September 1999 that although the Gulf war and subsequent United Nations activities destroyed much of Iraq's missile infrastructure, Iraq could test an ICBM capable of reaching the United States during the next 15 years.

- After observing North Korean activities, Iraq *most likely would pursue* a three-stage Taepo Dong-2 approach to an ICBM (or SLV), which could deliver a several-hundred kilogram payload to parts of the United States. If Iraq could buy a Taepo Dong-2 from North Korea, it *could have a launch capability* within months of the purchase; if it bought Taepo Dong engines, it *could test* an ICBM by the middle of the next decade. Iraq probably would take until the end of the next decade to develop the system domestically.
- Although much less likely, most analysts believe that if Iraq were to begin development today, it *could test* a much less capable ICBM in a few years using Scud components and based on its prior SLV experience or on the Taepo Dong-1.
- If it could acquire No Dongs from North Korea, Iraq *could test* a more capable ICBM along the same lines within a few years of the No Dong acquisition.
- Analysts differ on the likely timing of Iraq's first flight test of an ICBM that could threaten the United States. Assessments include *unlikely* before 2015; and *likely* before 2015, possibly before 2010—foreign assistance would affect the capability and timing.

### Chemical Weapons

- Iraq is the only major recent user of weapons of mass destruction. US intelligence sources report the following Iraqi uses of chemical weapons:

<u>Date</u> <u>Target</u>	<u>Area</u>	<u>Type of Gas</u>	<u>Approximate</u> <u>Casualties</u>
August 1983	Haij Umran	Mustard	Less than 100 Iranians/Kurds
October-November 1983	Panjwin	Mustard	3,000 Iranians/Kurds
February-March 1984	Majnoon Island	Mustard	2,500 Iranians
March 1984	Al Basrah	Tabun	50- 100 Iranians
March 1985	Hawizah Marsh	Mustard/Tabun	3,000 Iranians
February 1996	Al Faw	Mustard/Tabun	8,000-10,000 Iranians
December 1986	Umm ar Rasas	Mustard	1,000s Iranians
April 1987	Al Basrah	Mustard/Tabun	5,000 Iranians
October 1987	Sumar/Mehran	Mustard/Nerve Agents	3,000 Iranians
March 1988	Halabjah	Mustard/Nerve Agents	Hundreds Iranians/Kurds

Note: Iranians also used poison gas at Halabjah and may have caused some of the casualties.

- In revelations to the UN, Iraq admitted that, prior to the Gulf War, it:

- Procured more than 1,000 key pieces of specialized production and support equipment for its chemical warfare program.
- Maintained large stockpiles of mustard gas, and the nerve agents Sarin and Tabun.
- Produced binary Sarin filled artillery shells, 122 mm rockets, and aerial bombs.
- Manufactured enough precursors to produce 70 tons (70,000 kilograms) of the nerve agent VX. These precursors included 65 tons of choline and 200 tons of phosphorous pentasulfide and di-isopropylamine
- Tested Ricin, a deadly nerve agent, for use in artillery shells.
- Had three flight tests of long-range Scuds with chemical warheads.
- Had a large VX production effort underway at the time of the Gulf War. The destruction of the related weapons and feedstocks has been claimed by Iraq, but not verified by UNSCOM. Iraq seems to have had at least 3,800 kilograms of V-agents by time the of the Gulf War, and 12-16 missile warheads.
- The majority of Iraq's chemical agents were manufactured at a supposed pesticide plant located at Muthanna. Various other production facilities were also used, including those at Salman Pak, Samara, and Habbiniyah. Though severely damaged during the war, the physical plant for many of these facilities has been rebuilt.
- Iraq possessed the technology to produce a variety of other persistent and non-persistent agents.
- The Gulf War and the subsequent UN inspection regime may have largely eliminated some of stockpiles and reduced production capability.
- During 191-1994, UNSCOM supervised the destruction of:
  - 38,537 filled and unfilled chemical munitions.
  - 690 tons of chemical warfare agents.
  - More than 3,000 tons of precursor chemicals.
  - Over 100 pieces of remaining production equipment at the Muthan State Establishment, Iraq's primary CW research, production, filling and storage site.
- Since that time, UNSCOM has forced new disclosures from Iraq that have led to:
  - The destruction of 325 newly identified production equipment, 120 of which were only disclosed in August, 1997.
  - The destruction of 275 tons of additional precursors.
  - The destruction of 125 analytic instruments.
  - The return of 91 analytic pieces of equipment to Kuwait.
- As of February, 1998, UNSCOM had supervised the destruction of a total of:
  - 40,000 munitions, 28,000 filled and 12,000 empty.
  - 480,000 liters of chemical munitions
  - 1,800,000 liters of chemical precursors.
  - eight types of delivery systems including missile warheads.
- US and UN experts believe Iraq has concealed significant stocks of precursors. Iraq also appears to retain significant amounts of production equipment dispersed before, or during, Desert Storm and not recovered by the UN.
- UNSCOM reports that Iraq has failed to account for
  - Special missile warheads intended for filling with chemical or biological warfare agent.
  - The material balance of some 550 155 mm mustard gas shells, the extent of VX programs, and the rationale for the acquisition of various types of chemical weapons

- 130 tons of chemical warfare agents.
- Some 4,000 tons of declared precursors for chemical weapons,
- The production of several hundred tons of additional chemical warfare agents, the consumption of chemical precursors,
- 107,500 empty casings for chemical weapons,
- Whether several thousand additional chemical weapons were filled with agents,
- The unilateral destruction of 15, 620 weapons, and the fate of 16,038 additional weapons Iraq claimed it had discarded. “The margin of error” in the accounting presented by Iraq is in the neighborhood of 200 munitions.”
- Iraq systematically lied about the existence of its production facilities for VX gas until 1995, and made “significant efforts” to conceal its production capabilities after that date. Uncertainties affecting the destruction of its VX gas still affect some 750 tons of imported precursor chemicals, and 55 tons of domestically produced precursors. Iraq has made unverifiable claims that 460 tons were destroyed by Coalition air attacks, and that it unilaterally destroyed 212 tons. UNSCOM has only been able to verify the destruction of 155 tons and destroy a further 36 tons on its own.
- Iraq has developed basic chemical warhead designs for Scud missiles, rockets, bombs, and shells. Iraq also has spray dispersal systems.
- Iraq maintains extensive stocks of defensive equipment.
- The UN feels that Iraq is not currently producing chemical agents, but Iraq has offered no evidence that it has destroyed its VX production capability and/or stockpile. Further, Iraq retains the technology it acquired before the war and evidence clearly indicates an ongoing research and development effort, in spite of the UN sanctions regime.
- Recent UNSCOM work confirms that Iraq did deploy gas-filled 155 mm artillery and 122 mm multiple rocket rounds into the rear areas of the KTO during the Gulf War.
- Iraq’s chemical weapons had no special visible markings, and were often stored in the same area as conventional weapons.
- Iraq has the technology to produce stable, highly lethal VX gas with long storage times.
- May have developed improved binary and more stable weapons since the Gulf War.
- Since 1992, Iraq attempted to covertly import precursors and production equipment for chemical weapons through Qatar, Saudi Arabia, and Jordan since the Gulf War.
- The current status of the Iraqi program is as follows (according to US intelligence as of February 19, 1998 and corrected by the National Intelligence Council on November 16, 1998):

<u>Agent</u>	<u>Declared</u>	Potential Unaccounted <u>For</u>	<u>Comments</u>
<u>Chemical Agents</u>	(Metric Tons)	(Metric Tons)	
VX Nerve Gas	3	300	Iraq lied about the program until 1995
G Agents (Sarin)	100-150	200	Figures include weaponized and bulk agents
Mustard Gas	500-600	200	Figures include weaponized and bulk agents
<u>Delivery Systems</u>	(Number)	(Number)	
Missile Warheads	75-100	2-25	UNSCOM supervised destruction of 30
Rockets	100,000	15,000-25,000	UNSCOM supervised destruction of 40,000, 28,000 of which were filled.
Aerial Bombs	16,000	2,000-8,000	High estimate reflects the data found in an Iraqi Air Force document in July, 1998.
Artillery shells	30,000	15,000	

## Aerial Spray Tanks                   ?                   ?

- A US State Department spokesman reported on November 16, 1998 that Iraq has reported making 8,800 pounds (four tons) of VX nerve gas, 220,000 pounds (100 tons) to 330,000 pounds (150 tons) of nerve agents such as Sarin and 1.1 million pounds (500 tons) to 1.32 million pounds (600 tons) of mustard gas. Data from UN weapons inspectors indicates that Iraq may have produced an additional 1.32 million pounds (600-tons) of these agents, divided evenly among the three. “In other words, these are the differences between what they say they have and what we have reason to believe they have.”
- The CIA reported in January 1999 that Iraq has purchased numerous dual-use items for legitimate civilian projects—in principle subject to UN scrutiny—that also could be diverted for WMD purposes. Since the Gulf war, Baghdad has rebuilt key portions of its chemical production infrastructure for industrial and commercial use. Some of these facilities could be converted fairly quickly for production of CW agents. The recent discovery that Iraq had weaponized the advanced nerve agent VX and the convincing evidence that fewer CW munitions were consumed during the Iran-Iraq war than Iraq had declared provide strong indications that Iraq retains a CW capability and intends to reconstitute its pre-Gulf war capability as rapidly as possible once sanctions are lifted.

A State Department report in September 1999 noted that:

- In July 1998, Iraq seized from the hands of UNSCOM inspectors an Iraqi Air Force document indicating that Iraq had misrepresented the expenditure of over 6,000 bombs which may have contained over 700 tons of chemical agent. Iraq continues to refuse to provide this document to the UN.
- Iraq continues to deny weaponizing VX nerve agent, despite the fact that UNSCOM found VX nerve agent residues on Iraqi SCUD missile warhead fragments. Based on its investigations, international experts concluded that “Iraq has the know-how and process equipment, and may possess precursors to manufacture as much as 200 tons of VX ... The retention of a VX capability by Iraq cannot be excluded by the UNSCOM international expert team.”

### **Biological Weapons**

- Had highly compartmented “black” program with far tighter security regulations than chemical program.
- Had 18 major sites for some aspect of biological weapons effort before the Gulf War. Most were nondescript and had no guards or visible indications they were a military facility.
- The US targeted only one site during the Gulf War. It struck two sites, one for other reasons. It also struck at least two targets with no biological facilities that it misidentified.
- Systematically lied about biological weapons effort until 1995. First stated that had small defensive efforts, but no offensive effort. In July, 1995, admitted had a major defensive effort. In October, 1995, finally admitted major weaponization effort.
- Iraq has continued to lie about its biological weapons effort since October, 1995. It has claimed the effort was headed by Dr. Taha, a woman who only headed a subordinate effort. It has not admitted to any help by foreign personnel or contractors. It has claimed to have destroyed its weapons, but the one site UNSCOM inspectors visited showed no signs of such destruction and was later said to be the wrong site. It has claimed only 50 people were employed full time, but the scale of the effort would have required several hundred.
- Since July 1995, Iraq has presented three versions of FFCDs and four “drafts.”
  - The most recent FFCD was presented by Iraq on 11 September 1997. This submission followed the UNSCOM’s rejection, of the FFCD of June 1996. In the period since receiving that report, UNSCOM conducted eight inspections in an attempt to investigate critical areas of Iraq’s proscribed activities such as warfare agent production and destruction, biological munitions manufacturing, filling and destruction, and military involvement in and support to the proscribed program. Those investigations, confirmed the assessment that the June 1996 declaration was deeply deficient. The UNSCOM concluded that the new FFCD, it received on 11 September 1997, contains no significant changes from the June 1996 FFCD

- Iraq has not admitted to the production of 8,500 liters of anthrax, 19,000 liters of Botulinum toxin, 2,200 liters of Aflatoxin,
- Reports indicate that Iraq tested at least 7 principal biological agents for use against humans.
  - Anthrax, Botulinum, and Aflatoxin are known to be weaponized.
  - Looked at viruses, bacteria, and fungi. Examined the possibility of weaponizing gas gangrene and Mycotoxins. Some field trials were held of these agents.
  - Examined foot and mouth disease, haemorrhagic conjunctivitis virus, rotavirus, and camel pox virus.
  - Conducted research on a “wheat pathogen” and a Mycotoxin similar to “yellow rain” defoliant.
  - The “wheat smut” was first produced at Al Salman, and then put in major production during 1987-1988 at a plant near Mosul. Iraq claims the program was abandoned.
- The August 1995 defection of Lieutenant general Husayn Kamel Majid, formerly in charge of Iraq’s weapons of mass destruction, revealed the extent of this biological weapons program. Lt. General Kamel’s defection prompted Iraq to admit that it:
  - Imported 39 tons of growth media (31,000 kilograms or 68,200 pounds) for biological agents obtained from three European firms. According to UNSCOM, 3,500 kilograms or 7,700 pounds) remains unaccounted for. Some estimates go as high as 17 tons. Each ton can be used to produce 10 tons of bacteriological weapons.
  - Imported type cultures from the US which can be modified to develop biological weapons.
  - Had a laboratory- and industrial-scale capability to manufacture various biological agents including the bacteria which cause Anthrax and botulism; Aflatoxin, a naturally occurring carcinogen; clostridium perfringens, a gangrene-causing agent; the protein toxin Ricin; tricothecene Mycotoxins, such as T-2 and DAS; and an anti-wheat fungus known as wheat cover smut. Iraq also conducted research into the rotavirus, the camel pox virus and the virus which causes haemorrhagic conjunctivitis.
  - Created at least seven primary production facilities including the Sepp Institute at Muthanna, the Ghazi Research Institute at Amaria, the Daura Foot and Mouth Disease Institute, and facilities at Al-Hakim, Salman Pak Taji, and Fudaliyah. According to UNSCOM, weaponization occurred primarily at Muthanna through May, 1987 (largely Botulinum), and then moved to Al Salman. (Anthrax). In March, 1988 a plant was open at Al Hakim, and in 1989 an Aflatoxin plant was set up at Fudaliyah.
  - Had test site about 200 kilometers west of Baghdad, used animals in cages and tested artillery and rocket rounds against live targets at ranges up to 16 kilometers.
  - Took fermenters and other equipment from Kuwait to improve effort during the Gulf War.
  - Iraq had least 79 civilian facilities capable of playing some role in biological weapons production still in existence in 1997.
- The Iraqi program involving Aflatoxin leaves many questions unanswered.
  - Iraqi research on Aflatoxin began in May 1988 at Al Salman, where the toxin was produced by the growth of fungus aspergillus in 5.3 quart flasks.
  - The motives behind Iraq’s research on Aflatoxin remain one of the most speculative aspects of its program. Aflatoxin is associated with fungal-contaminated food grains, and is considered non-lethal. It normally can produce liver cancer, but only after a period of months to years and in intense concentrations. There is speculation, however, that a weaponized form might cause death within days and some speculation that it can be used as an incapacitating agent.
  - Iraq moved its production of Aflatoxin to Fudaliyah in 1989, and produced 481 gallons of toxin in solution between November, 1988 and May, 1990.
  - It developed 16 R-400 Aflatoxin bombs and two Scud warheads. Conducted trials with Aflatoxin in 122 mm rockets and R-400 bombs in November 1989 and May and August 1990. Produced a total of 572 gallons of toxin and loaded 410.8 gallons into munitions.

- UNSCOM concluded in October, 1997, that Iraq's accounting for its Aflatoxin production was not credible.
- Total Iraqi production of more orthodox biological weapons reached at least 19,000 liters of concentrated Botulinum (10,000 liters filled into munitions); 8,500 liters of concentrated Anthrax (6,500 liters filled into munitions); and 2,500 liters of concentrated Aflatoxin (1,850 liters filled into munitions).
  - It manufactured 6,000 liters of concentrated Botulinum toxin and 8,425 liters of Anthrax at Al-Hakim during 1990; 5400 liters of concentrated Botulinum toxin at the Daura Foot and Mouth Disease Institute from November 1990 to January 15, 1991; 400 liters of concentrated Botulinum toxin at Taji; and 150 liters of concentrated Anthrax at Salman Pak.
  - Iraq is also known to have produced at least:
    - 1,850 liters of Aflatoxin in solution at Fudaliyah.
    - 340 liters of concentrated clostridium perfringens, a gangrene-causing biological agent, beginning in August 1990.
    - 10 liters of concentrated Ricin at Al Salam. Claim abandoned work after tests failed.
- Iraq weaponized at least three biological agents for use in the Gulf War. The weaponization consisted of at least:
  - 100 bombs and 16 missile warheads loaded with Botulinum.
  - 50 R-400 air-delivered bombs and 5 missile warheads loaded with anthrax; and
  - 4 missile warheads and 7 R-400 bombs loaded with Aflatoxin, a natural carcinogen.
  - The warheads were designed for operability with the Al Husayn Scud variant.
- Iraq had other weaponization activities:
  - Armed 155 mm artillery shells and 122 mm rockets with biological agents.
  - Conducted field trials, weaponization tests, and live firings of 122 mm rockets armed with Anthrax and Botulinum toxin from March 1988 to May 1990.
  - Tested Ricin, a deadly protein toxin, for use in artillery shells.
  - Iraq produced at least 191 bombs and 25 missile warheads with biological agents.
  - Developed and deployed 250 pound aluminum bombs coverage in fiberglass. Bombs were designed so they could be mounted on both Soviet and French-made aircraft. They were rigged with parachutes for low altitudes drops to allow efficient slow delivery and aircraft to fly under radar coverage. Some debate over whether bombs had cluster munitions or simply dispersed agent like LD-400 chemical bomb.
  - Deployed at least 166 R-400 bombs with 85 liters of biological agents each during the Gulf War. Deployed them at two sites. One was near an abandoned runway where it could fly in aircraft, arm them quickly, and disperse with no prior indication of activity and no reason for the UN to target the runway.
  - Filled at least 25 Scud missile warheads, and 157 bombs and aerial dispensers, with biological agents during the Gulf War.
- Developed and stored drop tanks ready for use for three aircraft or RPV s with the capability of dispersing 2,000 liters of anthrax. Development took place in December 1990. Claimed later that tests showed the systems were ineffective.
  - The UN found, however, that Iraq equipped crop spraying helicopters for biological warfare and held exercises and tests simulating the spraying of Anthrax spores.
  - Iraqi Mirages were given spray tanks to disperse biological agents.
    - Held trials as late as January 13, 1991.

- The Mirages were chosen because they have large 2,200 liter belly tanks and could be refueled by air, giving them a longer endurance and greater strike range.
- The tanks had electric valves to allow the agent to be released and the system was tested by releasing simulated agent into desert areas with scattered petri dishes to detect the biological agent. UNSCOM has video tapes of the aircraft.
- Project 144 at Taji produced at least 25 operational Al Husayn warheads. Ten of these were hidden deep in a railway tunnel, and 15 in holes dug in an unmanned hide site along the Tigris.
- Biological weapons were only distinguished from regular weapons by a black stripe.
- The UN claims that Iraq has offered no evidence to corroborate its claims that it destroyed its stockpile of biological agents after the Gulf War. Further, Iraq retains the technology it acquired before the war and evidence clearly indicates an ongoing research and development effort, in spite of the UN sanctions regime.
- UNSCOM reported in October 1997 that:
  - Iraq has never provided a clear picture of the role of its military in its biological warfare program, and has claimed it only played a token role.
  - It has never accounted for its disposal of growth media. The unaccounted for media is sufficient, in quantity, for the production of over three times more of the biological agent -- Anthrax -- Iraq claims to have been produced.
  - Bulk warfare agent production appears to be vastly understated by Iraq. Expert calculations of possible agent production quantities, either by equipment capacity or growth media amounts, far exceed Iraq's stated results
  - Significant periods when Iraq claims its fermenters were not utilized are unexplained
  - Biological warfare field trials are underreported and inadequately described.
  - Claims regarding field trials of chemical and biological weapons using R400 bombs are contradictory and indicate that, "more munitions were destroyed than were produced.
  - The Commission is unable to verify that the unilateral destruction of the BW-filled Al Hussein warheads has taken place."
  - There is no way to confirm whether Iraq destroyed 157 bombs of the R400 type, some of which were filled with Botulin or anthrax spores.
  - "The September 1997 FFCD fails to give a remotely credible account of Iraq's biological program. This opinion has been endorsed by an international panel of experts."
- The current status of the Iraqi program is as follows (according to US intelligence as of February 19, 1998):

<u>Agent</u>	<u>Declared Concentrated Amount</u>		<u>Declared Total Amount</u>		<u>Uncertainty</u>
	<u>Liters</u>	<u>Gallons</u>	<u>Liters</u>	<u>Gallons</u>	
Anthrax	8500	12,245	85000	22457	Could be 3-4 times declared amount
Botulinum toxin	19,400	NA	380,000	NA	Probably twice declared amount. Some extremely concentrated.
Gas Gangrene Clostridium Perfringens	340	90	3,400	900	Amounts could be higher
Aflatoxin	NA	NA	2,200	581	Major uncertainties
Ricin	NA	NA	10	2.7	Major uncertainties

- UNSCOM cannot confirm the unilateral destruction of 25 warheads. It can confirm the destruction of 23 of at least 157 bombs. Iraq may have more aerosol tanks.
- UN currently inspects 79 sites -- 5 used to make weapons before war; 5 vaccine or pharmaceutical sites; 35 research and university sites; thirteen breweries, distilleries, and dairies with dual-purpose capabilities; eight diagnostic laboratories.
- Iraq retains laboratory capability to manufacture various biological agents including the bacteria which cause anthrax, botulism, tularemia and typhoid.
- Many additional civilian facilities are capable of playing some role in biological weapons production.
- A State Department spokesman reported on November 16, 1998 that there is a large discrepancy between the amount of biological growth media -procured and the amount of agents that were or could have been produced. Baghdad has not adequately explained where some 8,000 pounds (3,500 kg) of the material went out of some 68,000 pounds (31,000 kg) of biological growth media it imported. Iraq's accounting of the amount of the agent it produced and the number of failed batches is seriously flawed and cannot be reconciled on the basis of this full disclosure Iraq has made.
- The CIA reported in January 1999 that Iraq continues to refuse to disclose fully the extent of its BW program. After four years of denials, Iraq admitted to an offensive program resulting in the destruction of Al Hakam-a large BW production facility Iraq was trying to hide as a legitimate biological plant. Iraq still has not accounted for over a hundred BW bombs and over 80 percent of imported growth media-directly related to past and future Iraqi production of thousands of gallons of biological agent. This lack of cooperation is an indication that Baghdad intends to reconstitute its BW capability when possible.

A State Department report in September 1999 noted that:

- Iraq refuses to allow inspection of thousands of Ministry of Defense and Military Industries Commission documents relating to biological and chemical weapons and long-range missiles.
- In 1995, Iraqis who conducted field trials of R-400 bombs filled with biological agents described the tests to UNSCOM experts in considerable detail, including the use of many animals. These field trials were reflected in Iraq's June 1996 biological weapons declaration. Yet, amazingly, Iraq now denies that any such trials were conducted at all.
- In September 1995, Iraq finally declared the existence of two projects to disseminate biological agents from Mirage F-1 and MiG-21 aircraft, yet there is no evidence that the prototype weapons and aircraft were ever destroyed. There is also no evidence that the 12 Iraqi helicopter-borne aerosol generators for biological weapon delivery were ever destroyed.
- Apart from one document referring to a single year, no Iraqi biological weapon production records have been given to the UN—no records of storage, of filling into munitions, or of destruction. This is why UNSCOM refers to Iraq's biological weapons program—which deployed SCUD missile warheads filled with anthrax and botulinum toxin to be ready for use against Coalition forces—as a “black hole.”
- The Iraqis have repeatedly changed their story about their biological weapons warheads. Iraq has revised several times its declarations regarding the precise locations of warhead destruction and the fill of warheads. The movements of concealed warheads prior to unilateral destruction, claimed by Iraq, have been proven to be false.

### **Nuclear Weapons**

- Inspections by UN teams have found evidence of two successful weapons designs, a neutron initiator, explosives and triggering technology needed for production of bombs, plutonium processing technology,

centrifuge technology, Calutron enrichment technology, and experiments with chemical separation technology. Iraq had some expert technical support, including at least one German scientist who provided the technical plans for the URENCO TC-11 centrifuge.

- Iraq's main nuclear weapons related facilities were:
  - Al Atheer - center of nuclear weapons program. Uranium metallurgy; production of shaped charges for bombs, remote controlled facilities for high explosives manufacture.
  - Al Tuwaitha - triggering systems, neutron initiators, uranium metallurgy, and hot cells for plutonium separation. Laboratory production of UO<sub>2</sub>, UCL<sub>4</sub>, UF<sub>6</sub>, and fuel fabrication facility. Prototype-scale gas centrifuge, prototype EMIS facility, and testing of laser isotope separation technology.
  - Al Qa Qa - high explosives storage, testing of detonators for high explosive component of implosion nuclear weapons.
  - Al Musaiyib/Al Hatteen - high explosive testing, hydrodynamic studies of bombs.
  - Al Hadre - firing range for high explosive devices, including FAE.
  - Ash Sharqat - designed for mass production of weapons grade material using EMIS.
  - Al Furat - designed for mass production of weapons grade material using centrifuge method.
  - Al Jesira (Mosul) - mass production of UCL<sub>4</sub>.
  - Al Qaim - phosphate plant for production of U308.
  - Akashat uranium mine.
- Iraq had three reactor programs:
  - Osiraq/Tammuz I 40 megawatt light-water reactor destroyed by Israeli air attack in 1981.
  - Isis/Tammuz II 800 kilowatt light water reactor destroyed by Coalition air attack in 1991.
  - IRT-5000 5 megawatt light water reactor damaged by Coalition air attack in 1991.
- Iraq used Calutron (EMIS), centrifuges, plutonium processing, chemical defusion and foreign purchases to create new production capability after Israel destroyed most of Osiraq.
- Iraq established a centrifuge enrichment system in Rashidya and conducted research into the nuclear fuel cycle to facilitate development of a nuclear device.
- After invading Kuwait, Iraq attempted to accelerate its program to develop a nuclear weapon by using radioactive fuel from French and Russian-built reactors. It made a crash effort in September, 1990 to recover enriched fuel from its supposedly safe-guarded French and Russian reactors, with the goal of producing a nuclear weapon by April, 1991. The program was only halted after Coalition air raids destroyed key facilities on January 17, 1991.
- Iraq conducted research into the production of a radiological weapon, which disperses lethal radioactive material without initiating a nuclear explosion.
  - Orders were given in 1987 to explore the use of radiological weapons for area denial in the Iran-Iraq War.
  - Three prototype bombs were detonated at test sites -- one as a ground level static test and two others were dropped from aircraft.
  - Iraq claims the results were disappointing and the project was shelved but has no records or evidence to prove this.
- UN teams have found and destroyed, or secured, new stockpiles of illegal enriched material, major production and R&D facilities, and equipment-- including Calutron enriching equipment.
- UNSCOM believes that Iraq's nuclear program has been largely disabled and remains incapacitated, but warns that Iraq retains substantial technology and established a clandestine purchasing system in 1990 that it has used to import forbidden components since the Gulf War.

- The major remaining uncertainties are:
  - Iraq still retains the technology developed before the Gulf War and US experts believe an ongoing research and development effort continues, in spite of the UN sanctions regime.
  - Did Iraq conceal an effective high speed centrifuge program.
  - Are there elements for radiological weapons.
  - Is it actively seeking to clandestinely buy components for nuclear weapons and examining the purchase of fissile material from outside Iraq.
  - Is it continuing with the development of a missile warhead suited to the use of a nuclear device.
  - A substantial number of declared nuclear weapons components and research equipment has never been recovered. There is no reason to assume that Iraqi declarations were comprehensive.
- The CIA reported in January 1999 that Iraq continues to hide documentation, and probably some equipment, relating to key aspects of past nuclear activities. After years of Iraqi denials, the IAEA was able to get Iraq to admit to a far more advanced nuclear weapons program and a project based on advanced uranium enrichment technology. However, Baghdad continues to withhold significant information about enrichment techniques, foreign procurement, and weapons design.

Source: Prepared by Anthony H. Cordesman, Co-Director, Middle East Program, CSIS.

## **The Sudan's Search for Weapons of Mass Destruction**

### **Delivery Systems**

- No evidence of a program.
- The Sudan does have F-5, MiG-21, and MiG-23 attack fighters.

### **Chemical Weapons**

- The CIA estimated in January 1999 that the Sudan has been developing the capability to produce chemical weapons for many years. In this pursuit, Sudan obtained help from other countries, principally Iraq. Given its history in developing CW and its close relationship with Iraq, Sudan may be interested in a BW program as well.
- The US has claimed that Khartoum served as the site of a VX nerve gas production facility at the Shifa Pharmaceutical Plant, which was linked to the terrorist Osama Bin Laden. It was destroyed by US cruise missiles on August 20, 1998.

### **Biological Weapons**

- The CIA estimated in January 1999 that the Sudan may be interested in a BW program, given its history in developing CW and its close relationship with Iraq,.
- May be some early research activity related to terrorist groups.
- No evidence of production capability.

### **Nuclear Weapons**

- No evidence of any program.

Source: Prepared by Anthony H. Cordesman, Co-Director, Middle East Program, CSIS.

## **The Sudan's Search for Weapons of Mass Destruction**

### **Delivery Systems**

- No evidence of a program.
- The Sudan does have F-5, MiG-21, and MiG-23 attack fighters.

### **Chemical Weapons**

- The CIA estimated in January 1999 that the Sudan has been developing the capability to produce chemical weapons for many years. In this pursuit, Sudan obtained help from other countries, principally Iraq. Given its history in developing CW and its close relationship with Iraq, Sudan may be interested in a BW program as well.
- The US has claimed that Khartoum served as the site of a VX nerve gas production facility at the Shifa Pharmaceutical Plant, which was linked to the terrorist Osama Bin Laden. It was destroyed by US cruise missiles on August 20, 1998.

### **Biological Weapons**

- The CIA estimated in January 1999 that the Sudan may be interested in a BW program, given its history in developing CW and its close relationship with Iraq,.
- May be some early research activity related to terrorist groups.
- No evidence of production capability.

### **Nuclear Weapons**

- No evidence of any program.

Source: Prepared by Anthony H. Cordesman, Co-Director, Middle East Program, CSIS.

## India's Search for Weapons of Mass Destruction

### Delivery Systems

- India has two main delivery options: aircraft and missiles.
- India possesses several different aircraft capable of nuclear delivery, including the Jaguar, Mirage 2000, MiG-27 and MiG-29.
- India is upgrading 150 MiG-21Bis fighters. It has 88 Jaguars, 147 MiG-27s, and 53 MiG-23 BN/UM configured in the strike/attack mode.
- India has 36-38 Mirage-2000Hs strike aircraft with a significant nuclear strike capability, and is considering buying and deploying 18 Mirage 2000Ds. It has 64 MiG-29s.
- India is acquiring 40 long-range Su-30 strike aircraft; 8 have been delivered. The Su-30 has a strike range of 5,000 kilometers with in-flight refueling.
- It can also mount a weapon on a ballistic missile. The Carnegie Endowment estimates that India has developed nuclear warheads for this purpose, but is not known to have tested such a warhead.
- India has two major families of missile systems: The Prithvi and Agni.
- Prithvi, which can carry a 1000 kg payload to approximately 150 km, or a 500 kg payload to 250 km; and possibly 350 kilometers, depending on configuration.
- The Prithvi SS-150 is a liquid fueled missile with a 150-kilometer range and a 1,000-kg. payload.
- The Prithvi SS-150 is a liquid fueled missile with a 250-kilometer range and a 500-750 kg. payload.
- The Prithvi SS-1350 is a liquid fueled missile with a 350-kilometer range and a 700-1,000 kg. payload.
- The Prithvi was tested extensively during 1995-1997, with publicly announced tests on January 27, 1996 and February 23, 1997.
- 3
- Reports in 1997 indicated that India had possibly deployed, or at least was storing, conventionally armed Prithvi missiles in Punjab, very near the Pakistani border. India began test-firing the Prithvi II, the Air Force version capable of targeting nearly all of Pakistan, in early 1996. In June 1997, Prithvi I mobile missile systems were moved from factories in the south into Punjab, bringing many Pakistani cities within direct range of the missile.
- India has claimed the Prithvi only has a conventional warhead. This claim seems unlikely to be true.
- Agni, a two-stage medium-range missile, which can conceivably carry a 1000-kg. payload to as far as 1500 – 2000-km. It has been tested several times. India suspended tests after 1994.
- The original Agni I was a liquid and solid-fueled missile with a 1,500-kilometer range with a 1,000-kg. warhead.
- In July 1997, the Indian defense ministry announced the revival of the Agni medium-range missile program.
- Testing of the Agni II resumed on April 11 1999 and reached a range near 2,000 kilometers. The maximum range of the missile is stated to be 2,500 kilometers. It is a solid fueled missile and can be launched quickly without waiting for arming or fueling. India stated in August 1999 that it was deploying the Agni II. Indian sources have said that 20 will be deployed by the end of 2001.
- India is believed to be developing the Agni III with a range of 3,700 kilometers, and possibly an Agni IV with a range of 4,000-5,000 kilometers.
- The CIA reported in February 1999 that India's ballistic missile programs still benefited from the acquisition of foreign equipment and technology. India sought items for these programs during the reporting period from a variety of sources worldwide, including many countries in Europe and the former Soviet Union.
- India seems to be considering nuclear submarines and cruise missiles as a possible future basing mode.

**Chemical Weapons**

- India has long been involved in the development of chemical weapons; possibly since the early 1980s.
- It has probably reached the point of final development and weaponization for a number of agents.
- No evidence of production of weapons, but India seems to have covertly sold chemical weapons precursors to Iran and Iraq.

**Biological Weapons**

- India has long been involved in the development of biological weapons; possibly since the early 1980s.
- It has probably reached the point of final development and weaponization for a number of agents.
- No evidence of production capability.

**Nuclear Weapons**

- India exploited the Atoms for Peace program the US began in 1953, and bought a heavy water reactor from Canada in 1955 that it later used to provide the Plutonium for a nuclear test in 1974. It has since developed a massive indigenous civil and military nuclear program, all of which is free from IAEA safeguards.
- The Bahaba Atomic Research Center is the key nuclear weapons facility.
- Three Plutonium reprocessing facilities at Tarapur, Trombay, and Kalpakkum. Can use output from Madras 1 & 2, Kakrapur 1 & 2, and Narora 1 & 2 reactors.
- Two unsafeguarded heavy water reactors – Cirus with 40 megawatts and Dhruva with 100 megawatts at the Bahaba Atomic Research Center.
- Mines Uranium in the area around Jaduguda.
- Nuclear test site at Pokaran.
- India first demonstrated its nuclear capability when it conducted a “peaceful nuclear experiment” in May 1974.
- India relies largely on Plutonium weapons, but is experimenting with systems that could be used to make U-235. Some U-235 is useful in producing thermonuclear weapons. A pilot scale Uranium enrichment plant is located at Rattehalli in southern India, and a laser enrichment center at the Center for Advanced Technology near Indore.
- India is experimenting with fast breeder reactors at the Indira Ghandi Atomic Research Center south of Madras.
- India conducted its second series of tests 24 years later on May 11, 1998. It exploded five nuclear devices in underground tests between May 11 and May 13, 1998.
- According to Indian Prime Minister Vajpayee, the weapons included:
  - A “fission device,
  - A low-yield device, and a
  - Thermonuclear device.”
- These tests broke breaks an international moratorium on nuclear tests; China had conducted its last test in 1996. India deliberate scheduled activity around the test site to avoid coverage by US surveillance satellites.
- The Carnegie Endowment estimates that India has built steadily larger-scale plutonium production reactors, and facilities to separate the material for weapons use, and has approximately 400 kg of weapons-usable plutonium today. It takes about 6 kg of plutonium to construct a basic plutonium bomb, this amount would be sufficient for 65 bombs. With more sophisticated designs, it is possible that this estimate could go as high as 90 bombs.
- India officials stated in May 1998, however, that India had enough material for 125 nuclear weapons.
- The CIA reported in February 1999 that India continued to seek nuclear-related equipment, materials, and technology during the first half of 1998, some of which could be used in nuclear weapons applications. The most sought-after goods were of Russian- and UK-origin. India continues to pursue the development of advanced nuclear weapons, as evidenced by the underground nuclear tests that it conducted in May 1998. The acquisition of foreign equipment could benefit India in its efforts to develop and produce more sophisticated nuclear weapons.

Source: Prepared by Anthony H. Cordesman, Co-Director, Middle East Program, CSIS.

## **Pakistan's Search for Weapons of Mass Destruction**

### **Delivery Systems**

- Pakistan can deliver weapons with strike aircraft or ballistic missiles.
- Pakistan has several nuclear-capable aircraft, including the F-16 and Mirage.
- Pakistan has 32 F-16A/B and 56 Mirage 5s.
- Its other aircraft are aging Mirage IIIEPs ( 15), 30 Mirage 1110s, and low-grade Chinese-made fighters.
- It is developing several different ballistic missile systems:
  - The Chinese M-11 (CSS-7), with a range of 280 km.
    - China exported 30 M-11 missiles to Pakistan in 1992.
  - The Carnegie Endowment reports that in 1996, a U.S. National Intelligence Estimate (NIE) estimated, Pakistan had roughly three dozen M-11 missiles. The NIE reportedly stated that these were stored in canisters at the Sargodha Air Force Base, along with maintenance facilities and missile launchers; that the missiles could be launched in as little as 48 hours, even though the missiles had not been used in actual training exercises; and that two teams of Chinese technicians had been sent to Pakistan to provide training and to help unpack and assemble the missiles. In addition, the document reportedly surmised that Pakistan probably had designed a nuclear warhead for the system, based on evidence that Pakistan had been working on such an effort for a number of years. As noted earlier, however, Pakistan had not conducted a full-scale test of any nuclear explosive device, nor had it flight-tested a prototype nuclear warhead with the M-11.
  - The Carnegie Endowment reports that in late August 1996, a U.S. intelligence finding was leaked to the press: Using blueprints and equipment supplied by China, Pakistan reportedly had in late 1995 begun construction of a factory to produce short-range missiles based on the Chinese-designed M-11. The factory, located near Rawalpindi, was expected to be operational in one or two years. It was not clear whether the facility would be able to build complete missiles, or whether it would manufacture some components and use imported parts to produce complete systems.
    - The missile uses a solid propellant and has a 700 kilogram payload.
- The Hatf series.
  - The Hatf 2 is a solid propellant missile with a range of 80 kilometers with a 500 kilogram payload.
  - The Hatf 2 is a solid propellant missile with a range of 350 kilometers with a 500 kilogram payload.
  - The Hatf 3 is a solid propellant missile with a range of 550 kilometers. Some experts believe it is based on the Chinese M-9 design. Others that it is an indigenous two-stage missile similar to the earlier Haft 2, but with a large first-stage solid fuel assembly.
  - In July 1997, Pakistan reportedly tested the Haft-3 ballistic missile, as a riposte to India's semi-deployment of the Prithvi missile in Punjab. The launch location showed it could strike Lahore.
  - The Haft-4, or Shaheen, is believed to be a solid-propellant missile with a 750 kilometer range based upon the Chinese M-9. It has a 1,000 kilogram payload.
  - Ground tests of the Haft-4 were made in 1997 and 1998. It was flight tested on April 15, 1999.
  - The intermediate-range missile Ghauri (Haft 5), with a range of 1,300-1500 km with a 500-700 kg payload, is capable of reaching most cities in India.
  - Development began in 1993, with North Korean assistance.
  - The initial test version of the missile was the Ghauri I (Haft V) with a maximum range of 1,500 kilometers and a 500-750 kilogram payload.
  - Various statements indicate that it is similar to the North Korean No Dong and Iranian Shahab 3. Some analyst feel it is similar to the Chinese M-9, but the Ghauri is a 16,000 kg. missile and the M-9 is only a 6,000 kg. system.
  - It had its first test flight on April 6, 1998, and flew 1,100 kilometers (900 miles). It was fired from a site near Jhelum in the northeast to an area near Quetta in the southwest. It uses a TEL launcher – a system Pakistan had not previously demonstrated.
  - It is believed to have been deployed in May 1998, with 5-10 missiles in the 47<sup>th</sup> artillery brigade.
  - It is believed to have both "conventional" (BCW?) warheads and a 30-40 KT nuclear payload.
  - A version for a satellite booster may be in development.
  - Pakistan stated in late May 1998 that it was ready to equip the Ghauri with nuclear weapons.
  - The Ghauri was tested again on April 14, 1999. Territorial limits mean that Pakistan can only test to a maximum range of 1,165 kilometers on its own soil. This time, Pakistan seems to have tested the Ghauri II with a range of 2,000-2,300 kilometers and a 750-1,000 kg. payload.

- The Ghauri II(Haft-VI) is believed to have a maximum range of 2,300 kilometers, but only 2,000 kilometers with its present nuclear warhead. It is a liquid fueled missile and takes sometime to prepare, possibly making it vulnerable to Indian strikes.
  - The Carnegie Endowment reports that China is reported to be constructing a factory to build similar missiles.
  - Pakistan recovered a US cruise missile that went astray during the US attack on Afghanistan in late August 1998.
  - The CIA reported in February 1999 that Chinese and North Korean entities continued to provide assistance to Pakistan's ballistic missile program. Such assistance is critical for Islamabad's efforts to produce ballistic missiles.
  - In April 1998, the United States imposed sanctions against Pakistani and North Korean entities for their role in transferring Missile Technology Control Regime Category I ballistic missile-related technology.

### **Chemical Weapons**

- Pakistan has long been involved in the development of chemical weapons; possibly since the early 1980s.
- It has probably reached the point of final development and weaponization for a number of agents.
- No evidence of production capability.

### **Biological Weapons**

- Pakistan has long been involved in the development of biological weapons; possibly since the early 1980s.
- It has probably reached the point of final development and weaponization for a number of agents.
- No evidence of production capability.

### **Nuclear Weapons**

- According to the Carnegie Endowment, Pakistan began its nuclear weapons program in 1972, in the aftermath of the 1971 war with India. The program accelerated after India's nuclear test in May 1974, and made substantial progress by the early 1980s.
- Carnegie reports that the program was expedited by the return to Pakistan in 1975 of Dr. Abdul Qadeer Khan, a German-trained metallurgist, who was employed at the classified URENCO uranium-enrichment plant at Anselmo in the Netherlands in the early 1970s. Dr. Khan brought to Pakistan personal knowledge of gas-centrifuge equipment and industrial suppliers, especially in Europe, and was put in charge of building, equipping, and operating Pakistan's Kahuta enrichment facility.
- Pakistan halted further production of weapons-grade uranium in 1991, temporarily placing a ceiling on the size of its stockpile of highly enriched uranium (HEU). It has made efforts to expand other elements of its nuclear weapons program, however, including work on weapons design, on unsafeguarded facilities to produce plutonium and, possibly, on facilities to increase the production capacity for weapons-grade uranium.
- The United States terminated economic and military aid to Pakistan in 1977 and 1979 in an effort to force it to halt its nuclear weapons program.
  - There is a 50-70 megawatt research and Plutonium production reactor at Khushab.
  - The main Plutonium extraction plant is at Chasma, and is not under IAEA inspection. Pakistani Institute of Nuclear Science and Technology has pilot plants for plutonium extraction that are not under IAEA control.
  - The Khan Research Laboratory at Kahuta is a large-scale Uranium enrichment plant not under IAEA control.
  - The Carnegie Endowment reports that Pakistan has continued work on its 40-MWt, heavy-water research reactor at Khushab, with Chinese assistance, Pakistan reported completed its Khushab reactor in 1996, but it has not been fueled, apparently because of Pakistan's inability to procure (or produce) a sufficient supply of unsafeguarded heavy water.
    - Khushab has not been placed under IAEA controls. It is estimated to be capable of generating enough plutonium for between one and two nuclear weapons annually. Once operational, it could provide
    - Pakistan with the country's first source of plutonium-bearing spent fuel free from IAEA controls. Not only would this increase Pakistan's overall weapons production capabilities by perhaps 20-30 percent (assuming that the Kahuta enrichment plant can produce enough weapons-grade uranium for three to four weapons per year), but the availability of plutonium would permit Pakistan to develop smaller and lighter nuclear warheads. This in turn might facilitate Pakistan's development of warheads for ballistic

- missiles. In addition, Pakistan might employ the Khushab reactor to irradiate lithium-6 to produce tritium, a material used to "boost" nuclear weapons so as to improve their yield-to-weight efficiency.
- Weapons-grade plutonium from the Khushab reactor's spent fuel could be extracted at the nearby Chasma reprocessing plant, if that facility becomes operational, or at the pilot-scale New Labs reprocessing facility at the Pakistani Institute of Nuclear Science and Technology (PINSTECH) in Rawalpindi—both facilities being outside IAEA purview.
    - China was also reported to be assisting Pakistan with completing a facility linked to the Khushab reactor and thought to be either a fuel fabrication plant or a plutonium separation (reprocessing) plant. Pakistan previously was not thought to have a fuel fabrication facility to manufacture fuel for the new reactor.
    - The status of Pakistan's reprocessing capabilities at New Labs in Rawalpindi and at the Chasma site has not been clear from published sources. A classified U.S. State Department analysis prepared in 1983 said that the New Labs facility was "nearing completion" at that time; thus the facility could well be available for use today. Reports on the Chasma reprocessing facility in the early 1990s suggested that it was progressing, but probably still several years from completion. According to an analysis by the CIA quoted in the press, as of April 1996, China was providing technicians and equipment to help finish the facility. According to reports of August 1997, however, U.S. officials believe that, while some Chinese assistance and equipment may have trickled into the Chasma reprocessing project, the reprocessing complex at Chasma "is an empty shell." If this description is correct, Pakistan may have only the laboratory-scale reprocessing capability at New Labs and may be further from major plutonium reprocessing activities than once thought.
    - Pakistani specialists also pursued efforts to improve the Kahuta enrichment plant and, possibly, to expand the country's capacity to enrich uranium.
    - A uranium weapon needs roughly 15 kilograms of U-235 with 93% enrichment.
    - The best-publicized episode was Pakistan's purchase from China of 5,000 custom-made ring magnets, a key component of the bearings that support high-speed rotation of centrifuges. Shipments of the magnets, which were sized to fit the specific type of centrifuge used at the Kahuta plant, were apparently made between December 1994 and mid-1995. It was not clear whether the ring magnets were intended for Kahuta as a "future reserve supply," or whether they were intended to permit Pakistan to increase the number of uranium-enrichment centrifuges, either at Kahuta or at another location.
    - The Carnegie Endowment estimates that Pakistan has over 200 kg of weapons-grade highly-enriched uranium — enough to construct fifteen to twenty-five nuclear weapons (India could build about seventy). Pakistan is thought to have received a workable nuclear bomb design from China in the early 1980s, and to have conducted a "cold test" — a full test, but without a core of weapons-grade material — of this design in 1986.
    - Pakistan tested nuclear weapons in May 1998, and the Foreign Minister announced on May 29, 1999 that Pakistan was a nuclear power.
    - He stated that "Our nuclear weapons capability is solely meant for national self defense. It will never be used for offensive purposes." He also stated, however, that "We have nuclear weapons, we are a nuclear power...we have an advanced missile program" and that Pakistan would retaliate "with vengeance and devastating effect" against any attack by India.
    - He claimed that Pakistan had tested five nuclear devices in the Chagi Hills in Western Pakistan on May 28, 1998.. It is not clear that Pakistan tested this many, and it may simply have claimed to have tested as many as India had earlier.
    - Pakistani scientists (Dr. Abdul Qadeer and Samar Mubrik) said at the time that Pakistan would need 60-70 warheads to have a credible deterrent.
    - The CIA reported in February 1999 that Pakistan sought a wide variety of dual-use nuclear-related equipment and materials from sources throughout the world during the first half of 1998. Islamabad has a well-developed nuclear weapons program, as evidenced by its first nuclear weapons tests in late May 1998. (The United States imposed sanctions against Pakistan as a result of these tests.) Acquisition of nuclear-related goods from foreign sources will be important for the development and production of more advanced nuclear weapons.
    - The CIA reported in February 1999 that Pakistan China had provided extensive support in the past to Pakistan's WMD programs, and some assistance continues.

Source: Prepared by Anthony H. Cordesman, Co-Director, Middle East Program, CSIS.

## Iraqi Covert Break Out Capabilities

- UNSCOM and the IAEA's success have created new priorities for Iraqi proliferation. The UN's success in destroying the large facilities Iraq needs to produce fissile materials already may well have led Iraq to focus on covert cell-like activities to manufacture highly lethal biological weapons as a substitute for nuclear weapons.
- All of the biological agents Iraq had at the time of the Gulf War seem to have been "wet" agents with limited storage life and limited operational lethality. Iraq may have clandestinely carried out all of the research necessarily to develop a production capability for dry, storage micro-power weapons which would be far easier to clandestinely stockpile, and have much more operational lethality.
- Iraq did not have advanced binary chemical weapons and most of its chemical weapons used unstable ingredients. Iraq has illegally imported specialized glassware since the Gulf War, and may well have developed advanced binary weapons and tested them in small numbers. It may be able to use a wider range of precursors and have developed plans to produce precursors in Iraq. It may have improved its technology for the production of VX gas.
- Iraq is likely to covertly exploit Western analyses and critiques of its pre-war proliferation efforts to correct many of the problems in the organization of its proliferation efforts, its weapons design, and its organization for their use.
- Iraq bombs and warheads were relatively crude designs which did not store chemical and biological agents well and which did a poor job of dispersing them. Fusing and detonation systems did a poor job of ensuring detonation at the right height and Iraq made little use of remote sensors and weather models for long-range targeting and strike planning. Iraq could clandestinely design and test greatly improved shells, bombs, and warheads. The key tests could be conducted using towers, simulated agents, and even indoors. Improved targeting, weather sensors, and other aids to strike planning are dual-use or civil technologies that are not controlled by UNSCOM. The net impact would be weapons that could be 5-10 times more effective than the relatively crude designs Iraq had rushed into service under the pressure of the Iran-Iraq War.
- UNSCOM and the IAEA's success give Iraq an equally high priority to explore ways of obtaining fissile material from the FSU or other potential supplier country and prepare for a major purchase effort the moment sanctions and inspections are lifted and Iraq has the hard currency to buy its way into the nuclear club. Iraq could probably clandestinely assemble all of the components of a large nuclear device except the fissile material, hoping to find some illegal source of such material.
- The components for cruise missiles are becoming steadily more available on the commercial market, and Iraq has every incentive to create a covert program to examine the possibility of manufacturing or assembling cruise missiles in Iraq.
- UN inspections and sanctions may also drive Iraq to adopt new delivery methods ranging from clandestine delivery and the use of proxies to sheltered launch-on-warning capabilities designed to counter the US advantage in airpower.
- Iraq can legally maintain and test missiles with ranges up to 150 kilometers. This allows for exoatmospheric reentry testing and some testing of improved guidance systems. Computer simulation, wind tunnel models, and production engineering tests can all be carried out clandestinely under the present inspection regime. It is possible that Iraq could develop dummy or operational high explosive warheads with shapes and weight distribution of a kind that would allow it to test concepts for improving its warheads for weapons of mass destruction. The testing of improved bombs using simulated agents would be almost impossible to detect as would the testing of improved spray systems for biological warfare.
- Iraq has had half a decade in which to improve its decoys, dispersal concepts, dedicated command and control links, targeting methods, and strike plans. This kind of passive warfare planning is impossible to forbid and monitor, but ultimately is as important and lethal as any improvement in hardware.
- There is no evidence that Iraq made an effort to develop specialized chemical and biological devices for covert operations, proxy warfare, or terrorist use. It would be simple to do so clandestinely and they would be simple to manufacture.

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<sup>i</sup> Jane's Defense Weekly, October 14, 1998.

<sup>ii</sup> Some reports give the range as 500 kilometers; Jane's Defense Weekly, March 10, 1999, p. 50-64.

<sup>iii</sup> Baltimore Sun, November 23, 1988; Washington Post, September 16, 1989.

<sup>iv</sup> Tass International, 1216 GMT, September 15, 1989; Washington Post, September 16, 1989; Jane's Defense Weekly, November 19, 1988, September 23, 1989, p. 549; Washington Times, July 22, 1987, p. D-4; International Defense Review, 7/1987, p. 857, and New York Times, July 22, 1987, p. A-6, July 29, 1987; Mideast Markets, November 23, 1987, p. 11; in Harold Hough, "Israel's Nuclear Infrastructure, Jane's Intelligence Weekly, November, 1994, pp. 505-511.

<sup>v</sup> BBC and ITV reporting efforts seem to give more credibility to the idea that Israel has some form of relatively short-range nuclear armed missile. Ranges of anywhere from 750-930 NM have been reported, with accuracy's of anywhere from 0.1 Km to radar correlator guidance packages capable of CEPs of 100 meters. Bulletin of Atomic Scientists, Vol. 46, Jan/Feb. 1990, p. 48; Washington Post, September 16, 1989, p. A-17, November 15, 1989, p. A-14; Economist, August 1, 1987, p. 41; Washington Times, July 22, 1987, p. D-4; July 24, 1987, p. A-9 and April 4, 1988, p. 17; International Defense Review, 7/1987, p. 857, and New York Times, July 29, 1987, p. A-10.

<sup>vi</sup> Tass International, 1216 GMT, September 15, 1989; Washington Post, September 16, 1989; Jane's Defense Weekly, November 19, 1988, September 23, 1989, p. 549; Washington Times, July 22, 1987, p. D-4; International Defense Review, 7/1987, p. 857, and New York Times, July 22, 1987, p. A-6, July 29, 1987; Mideast Markets, November 23, 1987, p. 11; in Harold Hough, "Israel's Nuclear Infrastructure, Jane's Intelligence Weekly, November, 1994, pp. 505-511.

<sup>vii</sup> Washington Post, October 26, 1989, p. A-36; Boston Globe, October 30, 1989, p. 2; Newsweek, November 6, 1989, p. 52.

<sup>viii</sup> Jane's Intelligence Review, September, 1997, pp. 407-410; Jane's Defense Weekly, March 10, 1999, p. 50-64; International Defence Review, Extra, 2/1997, p. 2.

<sup>ix</sup> It is also possible that Israel may have deployed nuclear warheads for its MGM-55C Lance missiles. Israel has 12 Lance transporter-erector-launchers, and at least 36 missiles. The Lance is a stored liquid fueled missile with inertial guidance and a range of 5-125 kilometers. It has a warhead weight of 251 kilograms, and a CEP of 375 meters. It was deployed in US forces with the W-70 nuclear warhead. International Defense Review, 7/1987, p. 857; Economist, May 4, 1968, pp. 67-68; New York Times, July 22, 1987, p. A-6; Washington Times, July 22, 1987, p. D-4; Defense and Foreign Affairs, June, 1985, p. 1; Aerospace Daily, May 1, 1985, p. 5 and May 17, 1985, p. 100; Aerospace Daily, May 1, 1985, May 7, 1985; Shuey, et al, Missile Proliferation: Survey of Emerging Missile Forces, p. 56; CIA, "Prospects for Further Proliferation of Nuclear Weapons, " DCI NIO 1945/74, September 4, 1974; NBC Nightly News, July 30, 1985; New York Times, April 1, 1986; US Arms Control and Disarmament Agency, World Military

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Expenditures and Arms Transfers, Washington, GPO, 1989, p. 18; Michael A. Ottenberg, "Israel and the Atom," American Sentinel, August 16, 1992, p. 1.

<sup>x</sup> Harold Hough, "Could Israel's Nuclear Assets Survive a First Strike?," Jane's Intelligence Review, September, 1997, pp. 407-410.

<sup>xi</sup> Harold Hough, "Could Israel's Nuclear Assets Survive a First Strike?," Jane's Intelligence Review, September, 1997, pp. 407-410.

<sup>xii</sup> Harold Hough, "Could Israel's Nuclear Assets Survive a First Strike?," Jane's Intelligence Review, September, 1997, pp. 407-410.

<sup>xiii</sup> Associated Press, October 5, 1998, 0316, October 8, 1998, 1350; Philadelphia Inquirer, November 1, 1998, p. A-7.

<sup>xiv</sup> This information is unconfirmed, and based on only one source. Israel does, however, have excellent research facilities, laboratory production of poison gas is essential to test protection devices as is the production of biological weapons to test countermeasures and antidotes.

<sup>xv</sup> Philadelphia Inquirer, November 1, 1998, p. A-7; Associated Press, October 8, 1998, 1350.

<sup>xvi</sup> Washington Times, October 7, 1998, p. A-14.

<sup>xvii</sup> Harold Hough, "Could Israel's Nuclear Assets Survive a First Strike?," Jane's Intelligence Review, September, 1997, pp. 407-410.

<sup>xviii</sup> Jane's Defense Weekly, September 3, 1997. P. 3