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The Falkland Islands and Lebanon Crises: Impact on Global High-Technology Arms Transfers

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An Intelligence Assessment

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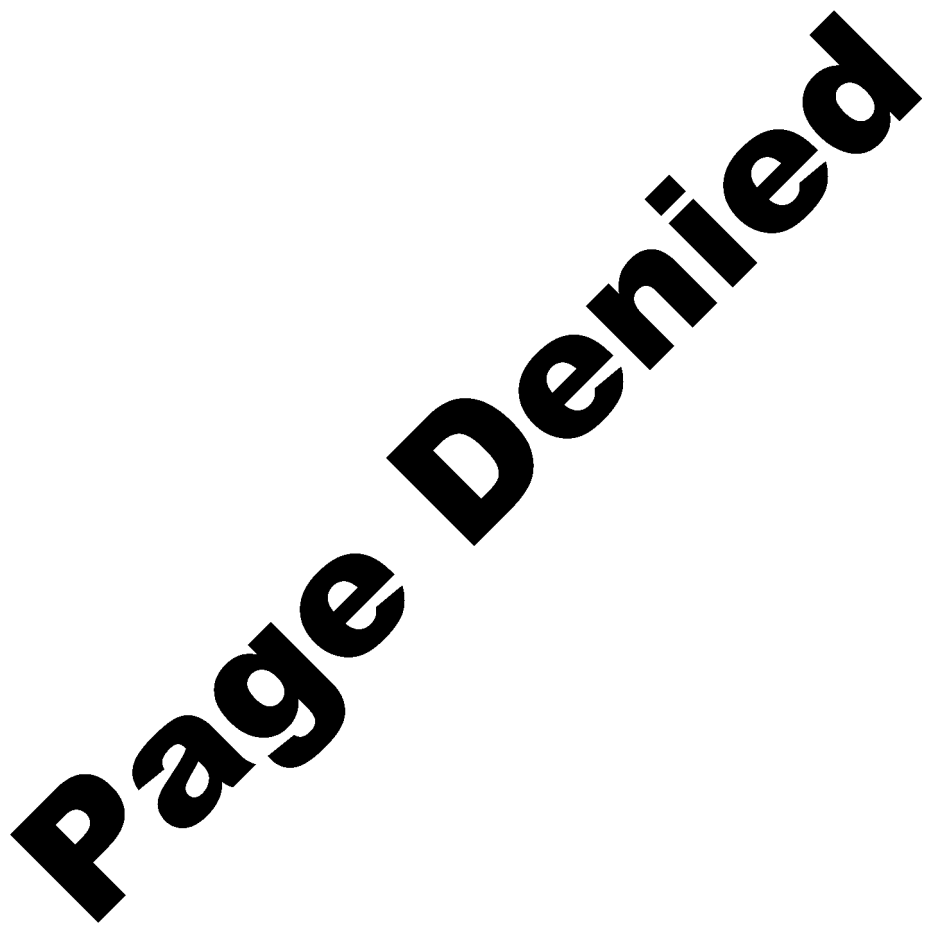

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The Falkland Islands and Lebanon Crises: Impact on Global High-Technology Arms Transfers

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An Intelligence Assessment

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This report has been prepared by the Communist Activities and the Weapons Proliferation Branches, Office of Global Issues, and by the Office of Scientific and Weapons Research, with a contribution from the Defense Intelligence Agency. Comments and queries may be addressed to the Chief, Internal Security Issues Division, OGI,

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The Falkland Islands and Lebanon Crises: Impact on Global High-Technology Arms Transfers

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Key Judgments

The dramatic effectiveness of high-technology weapons in the Falkland Islands conflict and in the recent Israeli experience in Lebanon will have a marked impact on global arsenals, particularly in the Third World. The success of such weapons as the French-produced Exocet missile in the Falklands and the US-supplied and Israeli-built equipment used by Israeli forces in Lebanon will accelerate the Third World race for more sophisticated weapons, increase the need for technical training, and cause many nations to reevaluate their conventional military doctrine and tactics.

The control of arms transfers will be more difficult with increased demand and availability of advanced weapons. We expect that the growing competition among major suppliers—the United States, the USSR, France, Great Britain, and Italy—will further reduce controls on arms transfers since if one country refuses to sell for political reasons, another probably will.

The prestige of US military hardware and support systems has been further boosted by the demonstrated effectiveness of such weapons in the Israeli and British arsenals, and foreign demand for advanced US arms should rise markedly over the next few years. Budgetary constraints and the greatly increased need for technical training and support are likely to stretch out Third World purchases of firstline equipment, except in the Middle East.

Some Third World countries will probably reconsider their military supply relationships with the USSR in light of the poor showing of Soviet equipment in the Middle East. Jordan, for example, may reduce follow-on orders for the surface-to-air missile system it recently purchased from Moscow. Most Soviet client states, however, will not be able to shift to Western suppliers because of political or financial constraints.

It is too soon to assess the full effects of the reevaluation of military doctrine and tactics inspired by these conflicts. It is already clear, however, that the increasing availability of sophisticated weapons, particularly

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fighter aircraft and missiles, will have some effect on the deployment and potential use of conventional military force by the United States and other major powers in the Third World. Moreover, the spread of such weapons will probably be uneven thus causing a significant impact on regional power balances in the Middle East, Latin America, and South Asia.

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Lessons of the Falklands and Lebanon

The Falkland Islands conflict and Israel's recent push into Lebanon have demonstrated the value of sophisticated missiles and high-technology weapon systems [1] against conventional surface combatants as well as the effectiveness of superior tactics, training, and equipment. The success of the French-built Exocet missile, as well as the effectiveness of US-supplied jet fighters, Sidewinder (AIM-9L) air-to-air missiles, and Standard antiradiation missiles, and British surface-to-air missiles are forcing a number of nations to reevaluate arms supply requirements and the mix of weapons in their orders of battle.

The Falklands: Missiles Highlighted

Guided missiles have attracted the greatest amount of attention as a result of the Falklands crisis.[2] A number of navies are reexamining the offensive capabilities of antiship missiles while others are assessing what equipment and tactics are needed to defeat them several navies are already revising their naval modernization plans, training programs, and tactics.

The British have noted that their lack of an effective air defense system—including airborne early warning aircraft, integrated detection and fire-control systems, and adequate numbers of long-range interceptor aircraft with lookdown radars—made possible the successful Exocet and bombing attacks. Others, such as India and Brazil, believe that with additional Exocet missiles, Argentina could have inflicted far greater losses on the UK fleet.

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The Israeli Incursion: Training and Technology Key Factors

The combined use of drones and air-launched US Standard and Shrike antiradiation missiles enabled Israel to destroy Syria's Soviet-provided air defense system. In addition, US-built F-15 and F-16 jet fighters armed with Sidewinder (AIM-9L) air-to-air missiles and flown by highly trained pilots enabled Israel to destroy more than 80 Syrian MIG jet fighter aircraft in air-to-air combat with virtually no losses. Heavy Syrian tank losses resulted from Israeli attack helicopters equipped with TOW antitank missiles and from Israeli armored task forces, including M-60s, Centurions, and indigenous Merkava tanks.

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Other key factors in the Israeli victory were advanced planning, good tactics, well-trained forces, and a knowledge of modern electronic warfare. The Israelis have demonstrated once again that it is as important to have a highly motivated, well-trained armed force as it is to have large quantities of modern equipment. Israel devotes far more time to basic and technical training than almost any other country.

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[1] The term "high-technology weapon" is used in this paper to refer to a wide variety of modern weapon systems that for the most part are produced only by the more highly industrialized nations.

[2] Surface-to-surface cruise missiles have been successfully employed in other conflicts—the 1967 and 1973 Middle Eastern wars—but never before have several large surface vessels been sunk or damaged by missile fire in a single campaign. Even the most advanced Third World country is at least five years away from developing an effective surface-to-surface ballistic missile.

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Effects on Demand for Arms

The lessons drawn from these recent conflicts will have far-reaching implications both for Third World arms buyers and for Western and Soviet arms sellers. In the short run it is clear that:

- Many countries will reevaluate their need for sophisticated weapons, both for offensive and defensive systems. Demand will increase for weapon systems, like the Exocet antiship missile, that offer an effective, relatively cheap military capability.
- Orders for large new "blue-water" ships are likely to be reconsidered; more emphasis will be placed on state-of-the-art shipboard radars and defensive weapons as well as on airborne early warning systems.
- Key clients of the USSR will probably closely examine their military supply relationship with Moscow in light of Syria's poor performance against Israel. This will put additional pressure on Moscow to sell more modern weapons and promise better training programs.
- Countries will reevaluate the competence of their forces in the use of high-technology weapons.

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Over the longer term, the 10-year-old trend toward introducing modern weapons throughout the world will probably accelerate:

- The poorer, less developed countries with no security threats will likely continue their current buying patterns, which heavily favor ground forces equipment, combat patrol boats, and light aircraft.
- The more affluent arms clients, like those in the Middle East and possibly the larger Latin American countries, will purchase the more sophisticated weapons not already in their inventories.
- The increased emphasis on training and logistic support will substantially raise the demand for foreign military technicians and advisers.

Shifts in Demand

Given the long leadtime normally associated with the acquisition and integration of modern military systems, Third World military planners will feel pressure to quickly reassess military missions and equipment priorities.[3] Suppliers of naval combatants may suffer the most from the sea losses incurred by the British. Over the last decade, billions of dollars of "blue-water" ship orders were placed by developing countries (table 1). Since many of these combatants have yet to be delivered, it is likely that some orders will be canceled.

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Other buyers will undoubtedly add expensive air and seaborne early warning packages to protect their fleets.

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Some Third World countries may conclude, on the basis of the recent conflicts, that the purchase of high-technology weapons will quickly solve their defense

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Table 1

Third World Purchases of Naval Surface Combatants, 1972-81 [a]

	Value [b] (million US $)	Units Delivered	Units in Pipeline [c]
Total	**11,210**	**115**	**62**
Asia	600	12	Unknown
Latin America	2,650	52	17
Middle East/North Africa	7,560	44	45
Sub-Saharan Africa	400	7	

[a] Includes guided missile surface combatants, minesweepers, frigates, and larger surface warships. Data exclude US naval combatant sales, which comprise only a small share of Third World orders.
[b] Values are minimum estimates and often do not reflect costs for naval weapons and other expensive shipboard systems such as sonar and sophisticated communications gear.

[3] Precedents for this reaction are seen in the 1967 Arab-Israeli war. The success of the French-manufactured Mirage jet fighter against the Soviet-supplied Egyptian and Syrian MIGs produced a dramatic jump in orders for the Mirage. In subsequent years, the Mirage family of jet aircraft represented the cutting edge of France's arms export drive.

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needs. Initial demand will be in four general areas: (1) the so-called fire-and-forget ground- and air-launched missiles and "smart" munitions, (2) fighter aircraft with advanced avionics, (3) "black box" electronic countermeasures, and (4) sophisticated communications links. Much of the desired equipment and technology in these categories has been on the market for five years or more and is available from a large and growing array of producers and secondary sources (see appendixes A and B).

In some instances, LDCs have been forced to purchase downgraded or stripped export versions of advanced weapon systems, especially from the Soviet Union. Because Soviet fighters, armor, and air defense weapons have given poor showings recently, Moscow presumably will be pressed harder for the delivery of later generation hardware as well as for improved training and technical support follow-on programs. Western suppliers can also expect pressure for more advanced systems.

Apart from Middle Eastern countries, the ability to pay will remain an effective constraint on major arms purchases by the developing countries. As many financially hard-pressed LDCs have discovered, initial acquisitions of modern arms soon require even larger follow-on expenditures for additional hardware, support facilities, infrastructure, and technical training. Costs will be less of a problem for certain Soviet clients such as Cuba, India, and Ethiopia, where Moscow's geopolitical interests outweigh its need for hard currency.

Arms prices have increased rapidly in recent years and high-technology equipment prices have risen even faster. Western-produced, high-performance fighters, for example, have more than doubled in price over the past five years, as have prices for most guided missiles. The Mirage F-1 now costs up to $13 million, and the Mirage 2000 is selling at more than $20 million. The manufacturer's price for an Exocet missile has risen from $325,000 to $500,000. These prices exclude support and training packages that can add another 50 percent.

Thus, the surge of interest in technically advanced weapons will not translate automatically into orders. While such sales are expected to climb, Third World enthusiasm will be tempered by other economic and political factors. These include:

- Conflicting service requirements.
- The need to maintain a balanced force structure.
- Civilian demands on country budgets.
- Concern for becoming overly dependent on superpower arms suppliers.
- Fear that rapid infusion of high-technology systems will disproportionately increase the presence of foreign technicians in traditional societies.

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In addition, the low technical base in many countries will limit the type of equipment purchased and its effectiveness in a country's inventory. Brazil, a relatively sophisticated Third World country, was unable during a military exercise in 1981 to successfully employ the Exocet missile system or its new torpedoes.

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Supply Trends

Since the mid-1970s the availability of modern, high-technology weapon systems has increased significantly. For example, some 1,700 advanced fighters, more than 250 other high-technology aircraft, 130 modern naval vessels, and some 135,000 missiles of various types were added to the inventories of LDCs, Cuba, and Vietnam in 1976-81. Stepped-up purchases of such equipment by Third World countries have resulted in a growing pool of weapons that could be transferred, especially in crisis situations, if the price or political motivation proved right.

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Not only are the major producers expanding sales of such equipment, but a number of other countries can now, through licensing agreements, provide similar equipment. For example, India just signed a purchase agreement for the French Mirage 2000 and produces under license a French antitank guided missile and Soviet fighters and air-to-air and surface-to-air missiles. South Korea is assembling the F-5 aircraft and developing a surface-to-air missile (similar to the US

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Nike-Hercules) and a surface-to-surface missile. Other countries such as Taiwan, Egypt, Israel, Argentina, and Brazil are active in similar endeavors.[4]

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Current Supply Patterns and Policies

The primary suppliers of high-technology weapons are the United States, USSR, France, Italy, West Germany, and the United Kingdom (see appendix D). Each offers a wide variety of sophisticated aircraft, naval vessels, and missiles, as well as radars, electronic countermeasure devices, and other support equipment.

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Key producers of advanced weapon systems have adopted varied export policies. The USSR and France have been most willing to provide developing countries with sophisticated arms and support equipment, although their export versions generally possess lower capabilities. Even though the United States, Britain, and West Germany (for different reasons) generally have been more restrained in introducing high-technology weapons, they have competed with the more assertive suppliers. This proliferation of weapons sales has been justified economically by the lower unit costs of production that result from such sales, especially of advanced fighter aircraft and missiles.

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Regionally, nations in the Middle East and North Africa possess the largest inventories of high-technology weapons, mainly because of deep-seated American and Soviet security commitments to the individual countries and, to a lesser extent, because of France's aggressive sales effort which capitalizes on regional tensions. Iraq, Libya, and Syria, Moscow's largest clients, account for nearly 50 percent of the advanced fighters and other aircraft, 20 percent of high-technology naval vessels, and 25 percent of the surface-to-air and antitank missiles exported to LDCs in the past five years. Israel, Iran, and Saudi Arabia, reflecting mainly US exports, accounted for about 50 percent of the antitank missiles delivered to LDCs, and Israel and Saudi Arabia are the only foreign recipients of the advanced F-15 fighter.

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[4] In addition, the smaller producers sell a limited amount of hardware, including small arms, artillery, APCs, and ammunition, often as a result of licensing agreements.

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Other countries with significant inventories of high-technology weapons (mostly established clients) include India (Jaguar aircraft, Nanuchka guided missile boats, and air-to-air and antitank missiles), South Korea (F-5 aircraft and air-to-surface missiles), and Algeria (surface-to-air and surface-to-surface missiles). Most of the newer clients, by contrast, have acquired smaller quanities of arms, many of which are not classified as high technology. Ethiopia, which has taken delivery of about 50 advanced aircraft and several hundred missiles from the USSR, is an exception.

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Missiles and supporting electronic hardware are the most likely items to be traded, since they can be used on outdated delivery platforms and can be easily shipped. In crisis situations, however, fighter aircraft might also be transferred, especially if recipient and supplier inventories are compatible.

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The introduction of high-technology weapons over the past decade into some 50 LDCs has resulted in shifts in the balance of power in some regions. Moscow's support of Cuba has made that country a major regional power, and the large-scale infusion of Soviet weapons, including high-technology items, into Ethiopia was instrumental in making Addis Ababa the leading power in the Horn of Africa. As demonstrated in the Lebanon crisis, Israeli acquisition of advanced US hardware broadened Tel Aviv's existing superiority over the Arabs. Advanced Soviet weapons such as the MIG-25 have given India a further advantage over Pakistan, although Islamabad's scheduled acquisition of US F-16s will reduce New Delhi's superiority.

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As buyers attach greater importance to the acquisition of high-technology weapon systems, key suppliers are likely to gain additional influence over recipients. They may:

- Obtain favorable terms in barter deals involving oil or other raw materials.

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- Ration or withhold key components to foster dependence.
- Require that major repairs be done in the supplier country.

Because it will take most developing nations years to absorb sophisticated new systems into their inventories, a continuing training and advisory presence by major suppliers will be necessary, offering another potential avenue for leverage.

The Private Arms Market

Recent events again have shown that in times of critical need the private arms market promises much but in nearly every case fails to deliver. Private dealers and agents account for a small share of arms transfers and for the most part provide only small arms, ordnance, and key components for larger systems. While brokers claim to be able to provide aircraft, helicopters, guided missiles, and other sophisticated equipment, little, if any, ever materializes unless the country manufacturing the equipment permits the transfer. Much of the private arms business reflects services rendered to governments, which utilize the agents to launder arms deliveries to states and groups they cannot openly support.

Future Supply Patterns

Although the technological sophistication of weapon systems available to lesser powers will continue to grow, we believe there will be few, if any, major technological surprises among the systems available to the Third World during the next five years.[5] High technology weapons likely to be exported during the next five-year period include:

- Systems already in some LDC inventories, like the Exocet missile and F-16 jet fighter.
- More capable versions of these weapons, such as the updated French SM-39 Exocet and the Italian Otomat 2. On the aircraft side, the Mirage 2000 and 4000, currently under development, are now being offered for sale.

[5] See appendix E for additional information on trends in high-technology weapons.

Totally new weapons incorporating advanced technologies and new designs are not likely to be for sale. The technologies that will probably appear in systems on the arms market are already well known to the industrial nations. Even the specific technical characteristics and capabilities of most of the weapons themselves are relatively well known. With the possible exception of laser devices that could be available for use against personnel or optical systems, these systems do not represent major departures from currently existing types of weapons. Any radical changes are likely to involve unexpected and innovative applications of existing technologies by major suppliers in areas such as electronic countermeasures (ECM) and electronic counter-countermeasures (ECCM), which are highly competitive, difficult to monitor, and which can have a decisive effect on the outcome of a combat situation.

Among the technological advances that have contributed most noticeably to the lethality of modern weapons—and, hence, most likely to be in high demand—are those associated with weapons-guidance and homing systems. Relevant key technologies include microelectronics, computers, radar, signal processing, and electro-optics. Among the most sought-after applications of these technologies will be a growing variety of fire-and-forget weapons including air-to-air, air-to-surface, and antitank missiles, anti-radiation homing systems, and antiship missile-guidance systems that are significantly more resistant to countermeasures.

Other, less publicized but nonetheless significant technologies that are likely to be in high demand include those associated with advanced propulsion systems for aircraft and missiles; lightweight, high-strength materials; and advanced conventional munitions.

It is unlikely that there will be any major shifts during the next five years in the ability of the LDCs to produce their own high-technology weapons. Although many of the necessary technologies are widely available, most LDCs will find it less risky to purchase complete weapon systems or high-technology components from traditional arms suppliers.

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Implications for the United States

Proliferation

The increased demand for advanced weapon systems inspired by the conflicts in the Falklands and Lebanon will almost certainly lead to further proliferation of such systems and make control of conventional arms trade more difficult. Foreign governments may endorse the idea in principle but consistently bow to the legal and political difficulties involved. Moreover, major West European suppliers and the Soviet Union have come to view arms sales as an indispensable instrument in securing important political, economic, and military goals.

Demand for US Arms

Fallout from these crises will boost foreign demand for US military equipment and training still higher. US military hardware and support are already highly regarded among most Third World military planners, and the demonstrated effectiveness of US systems in the Falklands and Lebanon will increase their prestige. Relaxations of US arms export restrictions and the sale of high-technology items to Egypt, Israel, Pakistan, Saudi Arabia, and Venezuela have already created the perception that Washington will be more forthcoming than in the past. Although requests will continue to be moderated by financial constraints and diversification policies, foreign demands will grow for firstline US equipment, particularly Harpoon missiles, F-16 and F-18 jet fighter aircraft, a new generation of antitank missiles, and the Sidewinder (AIM-9L) air-to-air missile, as well as for increased support from US technical assistance teams.

As lesser powers reassess their needs for advanced weapons over the coming months, US attempts to sell scaled-down versions of state-of-the-art weapon systems will be strongly resisted by foreign recipients. The inability of US manufacturers of the FX fighters—the F-16/79 and F-5G, which are considered inferior to the F-16s—to secure a single order to date is a case in point.

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Rising LDC defense budgets are likely to increase the already high foreign debt accumulated by many US arms recipients at a time when international demand for their raw materials and manufactured exports has declined. This, in turn, will lead arms clients to pressure the United States to stretch out repayment periods and lower interest rates on military assistance. Requests for outright military grant aid or increased economic assistance to offset military purchases from some of the most seriously affected countries will probably increase.

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Longer Range Strategic Effects

While it is too early to assess the full effects of growing deployment of advanced weapon systems—in part because most nations have not yet decided on order-of-battle changes—the increased availability of modern weapons will clearly have some effect on the deployment and potential use of conventional military force by the United States and other major powers in the Third World. Uncertainties about the ability of potentially hostile developing nations to absorb high technology make military assessments difficult, but small-scale interventions in the Third World, particularly by forces lacking strong air cover, will become more risky. For example, surprise attacks on individual US surface combatants or even commercial vessels could be mounted by nations with small arsenals of Exocet-type missiles. Nations with high-performance aircraft and conventional munitions could inflict significant losses on an intervention force of any major power lacking adequate early warning capability. The British experience in the Falklands suggests, however, that well-led, well-trained professional Western forces will still hold a significant advantage over most Third World military forces.

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The introduction of new weapon systems into a country's inventory is likely to further affect current regional military balances. For example, upgrading Soviet equipment in Syria, particularly air defense systems, would require the Israelis, at a minimum, to reevaluate their tactics. They probably would have to develop new tactics and obtain new ECM systems. The acquisition of a new generation of surface-to-surface or air-to-surface missile by either India or Pakistan could similarly affect the local military balance and lead to an escalation of military purchases.

The Soviet Role

Some Third World countries are likely to reconsider their military supply relationships with the USSR in light of the poor showing of Soviet military equipment against US and West European equipment. Potential clients, such as Iran or Argentina, may be reluctant to buy substantial amounts of Soviet equipment. Jordan, a traditional recipient of US arms, may limit follow-on orders for the surface-to-air missile system it ordered from the USSR last fall if suitable alternatives can be acquired. Clients such as Iraq and Algeria, who have been moving away from complete dependence on the USSR, are likely to accelerate diversification. Iraq, for example, has recently attempted to obtain US military equipment, particularly antitank missiles and helicopters, through third parties. At the same time that they attempt to diversify, these traditional Soviet clients are likely to increase pressure on the USSR to provide more modern and sophisticated versions of equipment, particularly in light of the failure of Soviet equipment in the fighting in Lebanon.

Nonetheless, while the prestige of Soviet weapons has been tarnished by the recent fighting, most Soviet client states will probably remain dependent on the USSR for most or all of their military supplies and training. Some, such as Cuba and Vietnam, would find it politically impossible to shift to Western suppliers; others, like Ethiopia, Mozambique, and South Yemen, will be too poor to afford the costlier Western systems.

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Appendix A

Deliveries of High-Technology Equipment, 1976-81 [a]
(by Type and Region)

Number of Items

Equipment	World Total	Asia	Latin America	Middle East/ North Africa	Sub-Saharan Africa	Europe [b]	Communist [c]
Aircraft							
Fighters	1,678	326	48	1,200	58	34	12
MIG-25 (USSR)	138	8		130			
MIG-23 (USSR)	496	44		406	34		12
Jaguar (United Kingdom–France)	52	28	12	12			
Mirage F-1 (France)	161		18	143			
F-5 (United States, others)	343	191	18	110	24		
F-4 (United States)	307	55		218		34	
F-14 (United States)	80			80			
F-15 (United States)	30			30			
F-16 (United States)	71			71			
Helicopters	225	17		174	18		16
MI-24 (USSR)	213	17		162	18		16
Super Frelon (France)	12			12			
Reconnaissance	29	1		20		8	
RF-4 (United States)	28			20		8	
RF-5 (United States)	1	1					
Other	7	3		4			
IL-38 ASW (USSR)	3	3					
E-2C (United States)	4			4			
Naval Vessels							
Submarines	26	4	13	3		6	
Type 209 (West Germany)	9	2	5			2	
Agosta-class (France)	6	2				4	
Oberon-class (United Kingdom)	6		6				
GAL Type 500 (United Kingdom)	3			3			
Unspecified (United States)	2		2				
Other	104	11	8	50	12	5	18
Nanuchka patrol guided missile boat (USSR)	6	3		3			
Osa-II missile attack boat (USSR)	63	8		34	4		17
Koni-class guided missile frigate (USSR)	2			1			1

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Deliveries of High-Technology Equipment, 1976-81 [a] **(by Type and Region) (continued)**

Number of Items

Equipment	World Total	Asia	Latin America	Middle East/ North Africa	Sub-Saharan Africa	Europe [b]	Communist [c]
La Combattante guided patrol boat (France)	25		6	12	3	4	
57-001 guided missile boat (West Germany)	6				5	1	
Reshef patrol guided missile combatant (Israel)	2		2				
Missiles							
Air-to-surface	3,657	225	18	3,215		199	
AS-7 (USSR)	76		NA	76			
AS-9 (USSR)	70		18	52			
AS-11 (France)	920	80		840			
AS-12 (France)	NA					NA	
Shrike (United States)	141			141			
Maverick (United States)	2,046	145		1,702		199	
Standard (United States)	404			404			
Air-to-air	10,026	3,686	379	5,117	135	709	
AA-2 (USSR)	3,110	2,590	NA	500	20		
AA-3 (USSR)	NA		NA				
AA-6 (USSR)	263			263			
Magic R550 (France)	1,256	156	NA	1,100			
Shafrir (Israel)	244		244				
Phoenix (United States)	509			509			
Sidewinder (United States)	3,101	599	135	2,133		234	
Sparrow (United States)	1,543	341		612	115	475	
Surface-to-air	13,267	1,203	426	10,488	710	4	436
SA-2 (USSR)	1,044	22		864	100		58
SA-3 (USSR)	3,144	563	280	1,443	480		378
SA-6 (USSR)	2,014	134		1,700	130		NA
SA-9 (USSR)	493			493			NA
Roland (France)	342		82	260			
Crotale (France)	250			250			
Aspide (Italy)	NA		NA				
RBS-70 (Sweden)	132			132			
Seacat (United Kingdom)	194	130	64	NA	NA		
Rapier (United Kingdom)	1,170	NA		1,170			
Chaparral (United States)	2,897			2,897			
Hawk (United States)	1,587	304		1,279		4	

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Deliveries of High-Technology Equipment, 1976-81 [a] **(by Type and Region) (continued)**

Number of Items

Equipment	World Total	Asia	Latin America	Middle East/ North Africa	Sub-Saharan Africa	Europe [b]	Communist [c]
Antiship [d]	1,887	307	36	1,401	27	66	50
Styx (USSR, China)	880	168		658	4		50
Exocet [e] (France)	245	NA	30	176	19	20	
Otomat (France)	208		4	200	4		
Penguin (Norway)	5					5	
Gabriel (Israel)	76	74	2		NA		
Sea Killer (Italy)	63			63			
Harpoon (United States)	410	65		304		41	
Antitank guided	107,996	13,696	6,180	81,891	1,280	4,949	
Sagger (USSR, others)	5,946	NA	1,000	4,826	120		
Snapper (USSR)	15			15			
HOT (France)	3,064			3,064			
Milan (France, West Germany, United Kingdom)	7,445	10		5,955	1,000	480	
SS-10 (France)	20					20	
SS-11 (France)	9,900	3,500	400	5,700		300	
SS-12 (France)	150			150			
Dragon (United States)	39,251	589		38,662			
TOW [e] (United States)	35,421	9,597		21,519	156	4,149	
Cobra (West Germany)	780		780				
Mamba (West Germany)	4,000						
Swingfire (United Kingdom)	2,004			2,000	4		

[a] This table shows deliveries of high-technology weapons, rather than inventories. Losses due to combat, training, and retirement of obsolete weapons are not reflected. Nonetheless, the data show rough orders of magnitude of equipment available.
[b] Greece and Turkey.
[c] Cuba and Vietnam.
[d] Includes antiship missiles.
[e] Includes air-to-surface variants.

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Appendix B

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Appendix B

Table B-1 Number of Items

Deliveries of High-Technology Equipment to Asia, 1976-81 [a]

Equipment	Afghanistan	Brunei	Indonesia	India	South Korea	Malaysia	Pakistan	Singapore	Taiwan	Thailand
Aircraft										
Fighters										
MIG-25 (USSR)				8						
MIG-23 (USSR)				44						
Jaguar (United Kingdom/ France)				28						
F-5 (United States, others)			16		83			27	28	37
F-4 (United States)					55					
Helicopters										
MI-24 (USSR)	17									
Reconnaissance										
RF-5 (United States)					1					
Other										
IL-38 ASW (USSR)				3						
Naval vessels										
Submarines										
Type 209 (West Germany)			2							
Agosta-class (France)							2			
Other										
Nanuchka patrol guided missile boat (USSR)				3						
Osa-II missile attack boat (USSR)				8						
Missiles										
Air-to-surface										
AS-11 (France)				80	NA					
Maverick (United States)					145					
Air-to-air										
AA-2 (USSR)				2,590						
Matra R550 (France)				100			56			
Sidewinder (United States)					30		283	142		144
Sparrow					341					

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Table B-1

Number of Items

Deliveries of High-Technology Equipment to Asia, 1976-81 [a] (continued)

Equipment	Afghanistan	Brunei	Indonesia	India	South Korea	Malaysia	Pakistan	Singapore	Taiwan	Thailand
Missiles (continued)										
Surface-to-air										
SA-2 (USSR)				22						
SA-3 (USSR)	125			438						
SA-6 (USSR)				184						
Seacat (United Kingdom)				130						
Rapier (United Kingdom)		NA								
Hawk (United States)					304					
Antiship [b]										
Styx (USSR, China)				144			24			
Exocet [c] (France)						NA	NA			
Gabriel (Israel)									18	56
Harpoon (United States)					65					
Antitank guided										
Sagger (USSR, others)				NA						
Milan (France)				10						
SS-11 (France)				3,500						
Dragon (United States)										589
TOW [c] (United States)				15	4,913		4,430			239

[a] This table shows deliveries of high-technology weapons, rather than inventories. Losses due to combat, training, and retirement of obsolete weapons are not reflected. Nonetheless, the data show rough orders of magnitude of equipment available.
[b] Includes antiship missiles.
[c] Includes air-to-surface variant.

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Table B-2

Number of Items

Deliveries of High-Technology Equipment to Latin America, 1976-81 [a]

Equipment	Argentina	Brazil	Chile	Ecuador	Honduras	Peru	Venezuela
Aircraft							
Fighters							
Jaguar (United Kingdom/France)				12			
Mirage F-1 (France)				18			
F-5 (United States, others)			18				
Naval Vessels							
Submarines							
Type 209 (West Germany)						3	2
Oberon-class (United Kingdom)		2	2	2			
Unspecified (United States)						2	
Other							
La Combattante guided patrol boat (France)						6	
Reshef patrol guided missile combatant (Israel)			2				
Missiles							
Air-to-surface							
AS-7 (USSR)						NA	
AS-9 (USSR)						18	
Air-to-air							
AA-2 (USSR)						NA	
AA-3 (USSR)						NA	
Magic R550 (France)	NA			NA			
Shafrir (Israel)	NA		144	100	NA		
Sidewinder (United States)		87	48				
Surface-to-air							
SA-3 (USSR)						280	
Roland (France)	12	70					
Aspide (Italy)	NA						
Seacat (United Kingdom)			64				
Antiship [b]							
Exocet [c] (France)	4	20		6			
Otomat (France)							4
Gabriel (Israel)			2				

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Table B-2

Number of Items

Deliveries of High-Technology Equipment to Latin America, 1976-81 [a] (continued)

Equipment	Argentina	Brazil	Chile	Ecuador	Honduras	Peru	Venezuela
Antitank guided							
Sagger (USSR, others)						1,000	
SS-11 (France)						400	
Cobra (West Germany)	780						
Mamba (Italy, West Germany)	500		3,500				

[a] This table shows deliveries of high-technology weapons, rather than inventories. Losses due to combat, training, and retirement of obsolete weapons are not reflected. Nonetheless, the data show rough orders of magnitude of equipment available.
[b] Includes antiship missiles.
[c] Includes air-to-surface variant.

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Table B-3

Number of Items

Deliveries of High-Technology Equipment to the Middle East and North Africa, 1976-81 [a]

Equipment	Algeria	Bahrain	Egypt	Iran	Iraq	Israel	Jordan	Lebanon	Kuwait	Libya	Morocco	Oman	Saudi Arabia	Syria	UAE	Tunisia	North Yemen	South Yemen
Aircraft																		
Fighters																		
MIG-25 (USSR)	16				21					69				24				
MIG-23 (USSR)	48				46					180				132				
Jaguar (United Kingdom/France)												12						
Mirage F-1 (France)					28		7		20	38	50							
F-5 (United States, others)				76			5				6						23	
F-4 (United States)			35	55		32					12		84					
F-14 (United States)				80														
F-15 (United States)						28							2					
F-16 (United States)						71												
Helicopters																		
MI-24 (USSR)	44				61					33				12				12
Super Frelon (France)					12													
Reconnaissance																		
RF-4 (United States)				12		8												
Other																		
E-2C (United States)						4												
Naval vessels																		
Submarines																		
GAL Type 500 (United Kingdom)				3														
Other																		
Nanuchka patrol guided missile boat (USSR)	2																	
Osa-II missile attack boat (USSR)	9				2					12				6				5
Koni-class guided missile frigate (USSR)	1																	
La Combattante guided patrol boat (France)				12														
Missiles																		
Air-to-surface																		
AS-7 (USSR)														76				
AS-9 (USSR)					17					NA				35				
AS-11 (France)					840													
Shrike (United States)						141												
Maverick (United States)			52										1,650					
Standard (United States)				104		300												
Air-to-air																		
AA-2 (USSR)																	500	
AA-6 (USSR)	80									36				147				
Magic R550 (France)					200		NA			750			150					
Sidewinder (United States)			3	44		805			320				961					
Sparrow (United States)			21	362		225							4					
Phoenix (United States)				509														
Surface-to-air																		
SA-2 (USSR)	32				371					140				25			200	96
SA-3 (USSR)					536					580				327				
SA-6 (USSR)	400				750					550								
SA-9 (USSR)	8				178					57				250				
Roland (France)					260													
Crotale (France)			NA										250					
RBS-70 (Sweden)		84														48		
Rapier (United Kingdom)				130								728			312			
Chaparral (United States)				2,204		693												
Hawk (United States)			3			525	590		161									
Antiship																		
Styx (USSR, China)	100				75					158				216	8		28	73
Exocet [b] (France)					160							8			8			
Otomat (France)										200								
Sea Killer (Italy)				63														
Harpoon (United States)				167		100							37					
Antitank guided																		
Sagger (USSR, others)	NA			700						666	160			3,300				NA
Snapper (USSR)										15								
HOT (France)					450				2,000		614			NA	NA			
Milan (France)					800			250			1,525			3,000		380		
SS-11 (France)			4,000												1,700			
SS-12 (France)			NA											150				
Swingfire (United Kingdom)			2,000															
Dragon (United States)				20,937		13,176	300						4,249					
TOW [c] (United States)						13,560			1,555				136	5,416			574	278

[a] This table shows deliveries of high-technology weapons, rather than inventories. Losses due to combat, training, and retirement of obsolete weapons are not reflected. Nonetheless, the data show rough orders of magnitude of equipment available.
[b] Includes antiship missiles.
[c] Includes air-to-surface variant.

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Table B-4

Number of Items

Deliveries of High-Technology Weapons to Sub-Saharan Africa, 1976-81 [a]

Equipment	Angola	Ethiopia	Ghana	Ivory Coast	Kenya	Mada-gascar	Mali	Mozam-bique	Nigeria	Somalia	Sudan	Tan-zania	Zambia
Aircraft													
Fighters													
MIG-23 (USSR)		34											
F-5 (United States, others)		12			12								
Helicopters													
MI-24 (USSR)		18											
Naval vessels													
Osa-II missile attack boat (USSR)		4											
La Combattante guided patrol boat (France)									3				
57-001 guided missile boat (West Germany)			2						3				
Missiles													
Air-to-air													
AA-2 (USSR)						20							
Sparrow (United States)		115											
Surface-to-air													
SA-2 (USSR)		NA				NA				100			
SA-3 (USSR)	36	150					NA	144		NA		NA	150
SA-6 (USSR)												130	
Seacat (United Kingdom)									NA				
Antiship [b]													
Styx (USSR, China)										4			
Exocet [c] (France)				16					3				
Otomat (France)									4				
Gabriel (Israel)					NA								
Antitank guided													
Sagger (USSR, others)		120											
Milan (France)					NA					1,000			
Mamba (West Germany)			NA										
Swingfire (United Kingdom)											4		
TOW (United States)		126			30								

[a] This table shows deliveries of high-technology weapons, rather than inventories. Losses due to combat, training, and retirement of obsolete weapons are not reflected. Nonetheless, the data show rough orders of magnitude of equipment available.

[b] Includes antiship missiles.

[c] Includes air-to-surface variant.

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Table B-5

Number of Items

Deliveries [a] of High-Technology Weapons to Greece, Turkey, Cuba, and Vietnam, 1976-81

Equipment	Europe		Communist	
	Greece	Turkey	Cuba	Vietnam
Aircraft				
Fighters				
MIG-23 (USSR)			12	
F-4 (United States)	12	22		
Helicopters				
MI-24 (USSR)				16
Reconnaissance				
RF-4 (United States)		8		
Naval vessels				
Submarines				
Type 209 (West Germany)		2		
Agosta-class (France)	4			
Other				
Osa-II missile attack boat (USSR)			9	8
Koni-class guided missile frigate (USSR)			1	
La Combattante patrol guided missile boat (France)	4			
57-001 guided missile boat (West Germany)		1		
Missiles				
Air-to-surface				
AS-12 (France)		NA		
Maverick (United States)	100	99		
Air-to-air				
Sidewinder (United States)	234			
Sparrow (United States)	175	300		

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Table B-5 (continued)

Number of Items

Equipment	Europe		Communist	
	Greece	Turkey	Cuba	Vietnam
Missiles (Continued)				
Surface-to-air				
SA-2 (USSR)			46	12
SA-3 (USSR)			216	162
SA-6 (USSR)			NA	
SA-9 (USSR)			NA	
Hawk (United States)	4			
Antiship [b]				
Styx (USSR)				50
Exocet [c] (France)	20			
Penguin (Norway)		5		
Harpoon (United States)		41		
Antitank guided				
Milan (France)		480		
SS-10 (France)		20		
SS-11 (France)		300		
TOW (United States)	2,345	1,804		

[a] This table shows deliveries of high-technology weapons, rather than inventories. Losses due to combat, training, and retirement of obsolete weapons are not reflected. Nonetheless, the data show rough orders of magnitude of equipment available.
[b] Includes antiship missiles.
[c] Includes air-to-surface variant.

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Appendix D

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Appendix D

Equipment in Production and for Sale [a]

Type	United States	France	United Kingdom	West Germany	Italy	Others	USSR
Aircraft							
Fighter	F-15	Mirage III/5/50	Jaguar	Tornado	Tornado	Kfir	MIG-23/27
	F-16	Mirage F-1	Tornado			F-5E/F	MIG-25
	F-5	Mirage 2000	Harrier				SU-20/22
	F-14	Super Entend-ard					
	F-4						
Trainer	T-33	Alpha Jet	Hawk	Alpha Jet	MB 326	Xavante EMB 326 [b]	MIG-21UM
			Strikemaster		MB 339	Neiva Univer-sal	U-MIG-23
			Bulldog		S.211	EMB 312	
Other	E-3 AWAC	Atlantic ASW	Nimrod AWACS	C-160 Transall	G-222	Bandeirante EMB 110	IL-76
	E-2C AWAC	Falcon	Jetstream			Embrar EMB 111	AN-26
	P-3 ASW	C-160 Transall				Xingu EMB 121	
						Araguaia EMB 120	
						ARAVA	
						Westwind	
Helicopter	Bell 204, 205	Alouette III	Sea King [b]	PAH-1	Bell Models [b]	Ecureuil [b]	MI-6
	Bell AH-1	Super Frelon	Gazelle		Hughes Models [b]	Lama [b]	MI-14
	Boeing CH-47	Puma	Lynx		A-109		MI-24
	Boeing Shawnee	Super Puma	Puma		A-129 [b]		
	Sikorsky Choctaw	Gazelle			CH-47 [b]		
		Ecureuil					
		Dauphin					
		Lama					
Vehicles							
Tanks	M-60	AMX-13	Chieftain	Leopard II	OF-40	Merkava	T-62
	M-1	AMX-30	Challenger	TAM			T-72
		AMX-32	Vickers				

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Equipment in Production and for Sale [a] (continued)

Type	United States	France	United Kingdom	West Germany	Italy	Others	USSR
Armored Personnel Carriers	M-113A1	AMX-10 APC	Shorland	Marder	M113 [b]	Urutu	BTR-60
		Panhard Md	Saracen	UR416	Fiat 6614		
		VBX-170	AT-150			Jararacca	
		AMX-13 VTT					
		VAB-(6x6)					
		VBC 90					
Armored Cars	V-150	Panhard E3R	Scorpion		Fiat 6616	Cascavel	BMP
		AML	Saladin			Ramta Ram VI	
			Ferret				
			Shorland				
			Samson				
Missiles							
Surface-to-air	Chaparral	Crotale	Tigercat	Roland	Aspide		SA-2
	Hawk	Roland	Seacat		Seasparrow [b]		SA-3
			Seadart				SA-6
			Rapier				SA-8
			Blowpipe				SA-9
			Seawolf				
Air-to-air	Sidewinder	RF30	Sky Flash			Shafrir II	AA-2
	Sparrow	Super R530					AA-3
	Phoenix	Magic R550					AA-6
Air-to-surface	Maverick	AS.30					AS-7
	Bullpup	AS.11/12					AS-9
	Shrike	Exocet					
	Standard						
Antiship	Harpoon	Martel	Sea Skua	Kormoran	OTOMAT I/II	Gabriel I/II	SS-N-2
		OTOMAT I/II	Martel				
		Exocet					
		LASSO					
Antitank	Dragon	SS-10	Swingfire	Mamba		Cobra [b]	AT-1
		SS-11	Milan	HOT			AT-3
		SS-12		Milan			
		Harpon					
		HOT					
		Milan					

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Equipment in Production and for Sale [a] (continued)

Type	United States	France	United Kingdom	West Germany	Italy	Others	USSR
Ships							
Frigates	Bostwick-class	F 2000S	Type 24	F 122	Lupo		Koni
				MEKO 122			
Patrol combatants	Asheville-class	PR 72	Province	S 143-A	CNR 6000		Nanuchka
				FS 1500	MV 400 TN		
				FPB 57			
Missile attack boats		La Combat-tante	Ramadan	TNC 45		Reshef	Osa-II
Fast patrol craft		P 48-S	Castle	FPB 38			
Attack submarines	Tang-class			Type 209			F-class
				TR 1700			
Others		Durance (oiler)		Oiler			
				Minehunter			

[a] Other equipment for sale, in the design and development stage, includes P110 (UK), Mirage 4000 (France), AMX fighters and Garibaldi CVN (Italy), and the EH-101 helicopter (UK & Italy). Most suppliers also sell a wide variety of used military equipment from their inventories.
[b] Produced under license; marketing restrictions vary.

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Appendix E

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Appendix E

High-Technology Equipment: Availability to Third World Countries Within Five Years

Aircraft
Air-to-Air Missiles
Tactical Air-to-Surface Missiles
Precision-Guided Munitions
Antiship Cruise Missiles
Surface-to-Air Missiles
Antitank Guided Missiles
Munitions
Laser Devices
Submarines

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Table E-1

Aircraft, by Capability

Model	Type [a]	Producing Country	Availability
Most capable			
F-4	MR	United States	Immediate
F-14	MR	United States	Immediate
F-15	MR	United States	Immediate
F-16	MR	United States	Immediate
F-18	MR	United States	5 years
MIG-23	MR	USSR	Immediate
MIG-25	MR	USSR	Immediate
MIG-27	A	USSR	Immediate
Jaguar	A	United Kingdom/France	Immediate
Tornado	MR	United Kingdom/West Germany/Italy	5 years
Mirage 2000	MR	France	Immediate
Mirage 4000	MR	France	5 years
E-3A	AEW	United States	Immediate
Less capable			
F-5G	MR	United States	5 years
F-8	MR	United States	Immediate
F-16/79	MR	United States	5 years
CF-101	MR	United States	Immediate
F-104	MR	United States	Immediate
MIG-21	MR	USSR	Immediate
TU-22	B	USSR	Immediate
Nesher	MR	Israel	Immediate
KFir	MR	Israel	Immediate
Lavi	MR	Israel	5 years
Mirage III	MR	France	Immediate
Less capable (continued)			
Mirage 5	MR	France	Immediate
Mirage 50	MR	France	Immediate
Mirage F1	MR	France	Immediate
Super Entendard	A	France	Immediate
Viggen	MR	Sweden	Immediate
Lightning	MR	United Kingdom	Immediate
Buccaneer	B	United Kingdom	Immediate
Piranha	MR	Switzerland	5 years
E-2C	AEW	United States	Immediate
P-3	ASW	United States	Immediate
IL-38	ASW	USSR	Immediate
Least capable			
A-4	A	United States	Immediate
F-5	MR	United States	Immediate
SU-7/20/22	A	USSR	Immediate
TU-16	B	USSR	Immediate
Alpha Jet	A	France/West Germany	Immediate
Draken	MR	Sweden	Immediate
Marut	MR	India	Immediate
Hawk	A	United Kingdom	Immediate
Sea Harrier	MR	United Kingdom	Immediate
AM-X	A	Italy/Brazil	5 years
Orao	A	Romania/Yugoslavia	5 years
Atlantic	ASW	France	Immediate

[a] MR (multirole)—primary air-to-air mission with considerable ground attack capabilities.
A (attack)—primary ground attack mission with some air-to-air capabilities.
AEW (airborne early warning)—designed for early warning of hostile aircraft and control of friendly aircraft to intercept them.
B (Bomber)—designed for ground attack and/or antishipping missions; no air-to-air capabilities.
ASW (antisubmarine warfare)—primary ASW and maritime reconnaissance missions; may have some capabilities against surface ships.

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Appendix E

High-Technology Equipment: Availability to Third World Countries Within Five Years

Aircraft

A large variety of relatively high-performance aircraft is already available to Third World countries, and still others may be produced by or sold to them in the next five years.

A significant percentage of these aircraft types consists of aircraft capable of combating the most modern aircraft in service in the United States or the USSR. They include the US F-4, F-14, F-15, and F-16; the Soviet MIG-23, MIG-25, and MIG-27; the British/French Jaguar; and the French Mirage 2000. The US F-18, the British/German/Italian Tornado, and the French Mirage 4000 may also be for sale to or operational in Third World countries within the next five years. Most of these aircraft are multirole fighters capable of air defense and ground attack missions with little or no modification. In addition, the US E-3A AWACS, currently in use by Saudi Arabia, significantly enhances the effectiveness of air operations and would be a powerful force in the hands of Third World countries.

Less capable but still potent aircraft available to Third World purchasers include the US F-8, CF-101, and F-104; the Soviet MIG-21 and TU-22; the Israeli Nesher and Kfir; the French Mirage III, Mirage 5, Mirage 50, Mirage F1, and Super Entendard, the Swedish Viggen; and the British Lightning and Buccaneer. The US F-5G and F-16/79, the Israeli Lavi, and the Swiss Piranha could be in service in the Third World within a few years. The US E-2C airborne early warning (AEW) aircraft now used by Israel is similar in function to the E-3A, but is less effective. The US P-3 and the Soviet IL-38 antisubmarine warfare aircraft, essentially identical to those in frontline service in the United States and the Soviet Union, are already operational in Third World countries and constitute small but modern ASW forces.

The last group of high-performance aircraft is less capable than those mentioned above. It includes the US A-4 and F-5, the Soviet SU-7/20/22 and TU-16, the French/German Alpha Jet, the Swedish Draken, the Indian Marut, and the British Hawk and Sea Harrier, which are currently in the inventories of Third World countries. The French Atlantic ASW aircraft is also in service outside of NATO countries. The Italian/Brazilian AM-X and the Romanian/Yugoslavian Orao may be in service in a few years.

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A large number of relatively low-performance aircraft are used by lesser powers and are easily obtainable by any nation. Aircraft in this category would include those such as the F-86, MIG-15, and MIG-17, which are considered obsolete by the major powers and are widely distributed to other countries. Others in this category would be light ground attack aircraft and armed trainers, such as the Strikemaster, Pucara, A-37, and M.B. 326. These aircraft do have some air-to-air and air-to-surface capabilities, but should not be expected to present a sizable threat to a major power under normal circumstances.

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The key technologies involved in designing and producing a high-performance combat aircraft include: turbojet and avionics technology; structural design and lightweight, high-strength materials; aerodynamics, stability and control; and air-launched weapon systems technology.

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France and the United Kingdom, and of course the United States and the USSR, are capable of designing and producing high-performance engines for combat aircraft. In addition, Australia, China, Israel, India, Japan, Sweden, and most NATO countries have produced engine components and in most cases complete high-performance engines under license. For other countries, major stumblingblocks to indigenous high-performance engine production are turbine blade cooling, materials, and fabrication.

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The greatest obstacle to production of state-of-the-art avionics is the large-scale manufacture of solid-state technology devices. These devices are used as building blocks for microprocessors and infrared/electro-optical devices. The United States, the USSR, Japan, Canada, Israel, the United Kingdom, France, East and West Germany, Sweden, Italy, China, Taiwan, Czechoslovakia, and perhaps Australia and Poland possess this capability. Without advanced avionics, a combat aircraft will be at a severe disadvantage in an electronic countermeasure environment, during night and adverse weather operations, and during engagements beyond visual range.

The United States, Japan, West European countries, and, to a lesser extent, the USSR, predominate in the fields of structural design optimization and advanced lightweight, high-strength materials. While these technologies are very important in the design of a high-performance combat aircraft, they are not as critical as those mentioned above. The same statements hold true for advanced aerodynamic concepts and stability and control technology. Basic structural, aerodynamic, and stability concepts are well known, and conventional materials such as aluminum and steel are easily available. The lack of the most advanced structural or aerodynamic technology should not, by itself, prevent the production of a high-performance combat aircraft.

The final key area in the design of an effective combat aircraft is perhaps the most important. The integration of various weapon systems—air-to-air missiles (AAM), tactical air-to-surface missiles (TASM), and other precision-guided munitions—with the aircraft can often turn a mediocre platform into a highly effective combat system. The ability to use these weapons effectively is usually highly interrelated with the avionics carried by the aircraft. This is the case with most AAMs and TASMs that use some form of semiactive or command guidance. However, with weapons using active or passive guidance, the effectiveness of the weapon depends more on the capabilities of the weapon itself than on the avionics of the launching aircraft. The Exocet antiship missile and the AIM-9L AAM are examples of the latter. The nations that lead the avionics field have the greatest capabilities in designing and producing weapon systems and mating them to a suitable airframe.

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Table E-2

Air-to-Air Missiles, by Capability

Types	Producing Country	Availability
Most capable		
Radar guided		
Sparrow M	United States	5 years
Phoenix A	United States	Immediate
Skyflash	United Kingdom	Immediate
Aspide	Italy	Immediate
Super R530	France	5 years
Magic R550	France	Immediate
IR guided		
Sidewinder L	United States	Immediate
Sidewinder M	United States	5 years
Python 3	Israel	5 years
Less capable		
Radar guided		
Sparrow F	United States	Immediate
AA-6	USSR	Immediate
AA-7	USSR	Immediate
IR guided		
AA-2D	USSR	Immediate
AA-8	USSR	Immediate
Shafrir	Israel	Immediate

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Air-to-Air missiles

Air-to-air missiles (AAM) on the international arms market fall into two categories, each characterized by a different guidance type. The first class of AAM guides to the target using radar energy reflected off the target aircraft. These missiles can be fired from almost any aspect to the target but are most effective when launched in a head-on attack. The second type of AAM relies on infrared (IR) energy radiated by the target for guidance. The more advanced IR missiles can also be launched from any aspect, but most are restricted to launches from a tail-on aspect. Because of the differing guidance techniques used, each class of AAM has some unique advantages over the other. For example, radar-guided AAMs generally have greater launch ranges and can attack aircraft flying over a wider range of altitudes than IR missiles. However, IR AAMs are cheaper, lighter, and typically require far less complex support avionics on the launch aircraft. These advantages permit less developed countries with only moderately advanced aircraft to purchase large numbers of highly advanced IR AAMs, some with an all-aspect launch capability.

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The table roughly ranks IR and radar-guided missiles likely to be in growing demand on the international arms market. Except for the Phoenix A, all of the radar-guided missiles listed depend on the launch aircraft for radar illumination of the target and are collectively known as semiactive radar (SAR) guided AAMs. For this type of missile to be effective, the launch aircraft must maintain its direction of flight

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during the missile's flight, thus making the aircraft quite vulnerable to attack. Among the remaining SAR missiles, those listed as "most capable" generally have a greater launch range, a higher maximum velocity, greater maneuver capability, better electronic countermeasures resistance, and/or better look-down/shootdown capability than those labeled as "less capable."

Among the most significant trends in radar, AAM technology is toward providing the missile with its own radar illuminator (for example, active radar-guided AAM). This capability, called launch-and-leave or fire-and-forget, permits the launch aircraft to take evasive action after firing. Only the Phoenix A, which was exported to Iran, has an active radar seeker, and it can only be fired from the F-14 fighter. While the technology to develop active radar AAMs probably exists in numerous countries outside the United States and the USSR, only France is actively exploring putting it to use. However, it will not become operational until the late 1980s at the earliest.

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The most important factor which distinguishes the Sidewinder L/M and Python 3 (which is under development) AAMs from the less capable IR AAMs is their ability to be fired in a head-on attack. This translates directly into a highly accurate, fire-and-forget missile with a greater launch range than the remaining IR AAMs. The technology that made this possible was the development of cooled, highly sensitive IR detectors used in the missile's seeker. This technology is available in France, the United Kingdom, Italy, and others and most likely will be incorporated in any future IR AAM they may develop. The use of this technology undoubtedly will be hastened because of the results of air battles waged in the Israel/Lebanon and UK/Argentina conflicts. The apparent success the Israeli and British fighters have had against their Syrian and Argentine counterparts appears to be due in large part to their use of the Sidewinder L. Because of this, the Sidewinder L and other similarly capable IR AAMs will be much in demand in the international arms market.

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Table E-3

Air-to-Surface Missiles, by Capability

Missiles and Munitions	Producing Country	Availability
Most capable		
Non-ARM TASMs		
Maverick	United States	Immediate
ARM TASMs		
AS-9	USSR	Immediate
Precision-guided munitions		
Walleye glide bomb [a]	United States	Immediate
Less capable		
Non-ARM TASMs		
AS-12	France	Immediate
AS-20	France	Immediate
AS-30	France	Immediate
ARM TASMs		
Shrike	United States	Immediate
Precision-guided munitions		
Paveway	United States	Immediate
Matra	France	Immediate

[a] Walleye is judged superior to Paveway and Matra only because of its greater range capability.

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Tactical Air-to-Surface Missiles

The sale of tactical air-to-surface missiles (TASM) represents one of the biggest growth areas in arms exports to the Third World. The attractiveness of these weapons lies in their potential to substantially upgrade a country's airborne firepower at relatively low cost. Usually there is no need to invest in new launch platforms or exotic avionics. As long as the host country has aircraft capable of carrying a TASM, usually only minor modifications to the aircraft are necessary to produce a viable launch platform. The major exporting countries of TASMs are the United States, the USSR, and France. France exports only electro-optically or command-guided TASMs whereas the United States and the USSR also sell antiradiation-homing missiles (ARM).

Antiradiation-homing missiles are designed to home in on radar emissions from ground-based radars such as those associated with surface-to-air missile (SAM) systems. Optimal use of these missiles can effectively neutralize an opposing country's early warning radar–guided system and radar SAM batteries. The US Shrike ARM has been exported only to Israel and possibly a few other countries, but the Soviet AS-9 system is widely marketed and has appeared in South America, the Middle East, and Afghanistan. Of the two systems the AS-9, in general, is the most capable because of its greater launch range (usually about 50 km). Typically, the greater an ARM launch range the less likely it is that the launching aircraft will be exposed to hostile SAMs. The most critical technology in ARM design is in the missile guidance and

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control system, especially its receiver and tracking subsystems. Expertise in these technologies probably exists to varying degrees in numerous countries outside the United States and the USSR. However, indigenously produced ARMs are unlikely to appear in the Third World in the next five years. Instead, the availability of existing ARMs to the Third World, particularly the Soviet AS-9, will probably increase substantially.

Non-ARM TASMs, which include TV, laser, infrared, and command-guided TASMs can already be found in large numbers throughout the Third World. The major exporters are the French with their AS-12, 20, and 30 series, the United States with the Maverick line, and the Soviets with their AS-7. The capabilities of these TASMs vary widely, but as a general rule their overall performance is severely degraded in poor weather.

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As with ARMs, the most important technologies reside in the guidance and control systems of the missiles, and the expertise to produce similar systems exists in many countries. In fact, Argentina has already produced a command-guided TASM called the Pescador. Future designs will focus on increasing the launch range, enhancing poor weather capabilities, decreasing vulnerability to countermeasures, and concentrating more on the development on fire-and-forget systems to decrease the vulnerability of the launch aircraft.

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Precision-Guided Munitions

Two types of electro-optically guided munitions are or soon will be available to Third World countries. The first type is the laser-guided bomb, which is produced by both the United States and France (known respectively as the Paveway and Matra systems). Essentially of similar design, operation, and capability, these weapons home in on the reflected laser energy radiated from a target illuminated by either a ground-based or aircraft-mounted laser designator. Both systems are designed around a conventional bomb that is modified, using a kit, to include aerodynamic surfaces for increased lift and maneuverability, and a seeker with its auxiliary electronics that locks on to the reflected laser energy and guides the bomb to its target. The key technologies on these systems involve the design of the laser designator and the laser seeker. While both of these subsystems use reasonably advanced technologies, duplication of their design and production are judged to be within the capability of numerous countries outside the United States and the USSR, including the United Kingdom, France, Italy, and Israel. Assuming that a lesser power has access to ground-based illuminators, these laser-guided bombs can be carried by almost any Third World aircraft capable of delivering a conventional bomb and launched to targets at ranges of less than about 15 kilometers.

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The second type of guided munition on the arms market is the US-built Walleye glide bomb. The Walleye uses large wings to maximize its range and glide to its target. Unlike the Paveway, however, it utilizes a gyrostabilized TV camera in its nose to acquire and lock on to the target. One version of the Walleye uses a data link to send the TV image back to the aircraft, thus permitting the pilot or weapons officer to send steering commands to the Walleye using a joy stick. The key technologies in the Walleye involve the design of the TV seeker and the data link subsystem, both of which are quite complex. It is thus doubtful that many countries outside of Western Europe and Japan can produce a weapon of similar design and capability. (See table E-3.)

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Table E-4

Antiship Missiles, by Capability

System	Guidance Category [a]	Producing Country	Availability
Ranges greater than 100 km			
AS-5a	A	USSR	Immediate
AS-5b	A	USSR	Immediate
SS-N-9	A	USSR	5 years
Martel AS-37	A	France	Immediate
Sea Eagle	A	United Kingdom	2 years
Otomat Mk 2	A	France/Italy	Immediate
Harpoon	A	United States	Immediate
SSC-1b	B	USSR	Immediate
Martel AJ-138	C	France	Immediate
Ranges 40 to 100 km			
Exocet	A	France	Immediate
SS-N-2c	A	USSR	Immediate
Otomat Mk 1	A	France/Italy	Immediate
RBS-15	A	Sweden	3 years
Penguin Mk 3	A	Norway	5 years
Ranges less than 40 km			
SS-N-2a	A	USSR	Immediate
SS-N-2b	A	USSR	Immediate
Kormoran	A	West Germany	Immediate
Penguin Mk 1 and 2	A	Norway	Immediate
Gabriel Mk 3	B	Israel	Immediate
Gabriel Mk 1 and 2	C	Israel	Immediate
AS-15TT	C	France	Immediate
Sea Skua	C	United Kingdom	Immediate
Sea Killer Mk 1 and 2	C	Italy	Immediate

[a] See text for category definitions.

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Antiship Cruise Missiles

Antiship cruise missiles on the international arms market include air-launched, shore-launched, ship-launched, and sub-launched cruise missiles. The missiles vary considerably in terms of range and guidance type. In ranking the missiles' capabilities, we divided them into three flight-range categories: greater than 100 km, 40 to 100 km, and less than 40 km. Range is an important category, because the greater the range the greater the standoff capability of the launch platform and hence the reduction in launch platform vulnerability. Within each range category, we ranked the missiles in three guidance categories: A, B, C:

- *Category A* is the most capable, representing missiles with autonomous guidance such as active radar or infrared homing. Autonomous missiles require no interaction with the launch platform after launch and therefore permit the launch platform to leave the threat area immediately after launch.

- *Category B* includes missiles that have an interaction with the launch platform in flight (such as beam-rider or command-guided) but also have a seeker for terminal homing.

- *Category C,* the least capable, includes missiles that have an interaction with the launch platform but no terminal homing. Without terminal homing these missiles tend to be less accurate than those in Category B. Antiship cruise missiles are included in the table.

In selecting a cruise missile, a purchasing country may make its decision based on a number of criteria. It must select a missile whose capabilities match its needs (for example, coastal defense or open-ocean use). Another important aspect is the launch platform. Some of the missiles listed can be launched from a variety of launch platforms, whereas others are restricted to a fewer number of potential launch platforms. For example, the US Harpoon is designed to be compatible with a number of launch platforms to include aircraft, ships, and submarines. On the other hand, the UK Sea Skua can be launched only from the Lynx helicopter because the missile terminal guidance requires the helicopter's radar. Thus, acquisition of the missile may require purchase of a specific launch platform as well, which may substantially increase the cost of the total system depending on the sophistication of the system.

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The purchasing country would also have to consider the cost of maintenance. Generally speaking the more sophisticated the weapon the greater the maintenance cost. A lack of technological capability for maintenance by the purchasing country can in principle be offset by a maintenance contract with the producing country, of course, at a greater cost.

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The amount of training required for use of the missile is another major consideration. Personnel must be trained not only in launching the missile but also in targeting. Particularly for the longer range (over the horizon) systems, targeting may require the greatest degree of training.

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A number of countries are now developing countermeasures to antiship missiles because of the grave threat posed by these weapons. Thus, future antiship missiles will be developed to cope with these countermeasures. We would expect to see more use of dual-mode seekers (for example, active radar/IR and active radar/millimeter wave) and more sophisticated signal processing. Much of the technology is currently available; the limitations are primarily cost and willingness of the producing country to sell such sophisticated weaponry.

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Surface-to-Air Missiles

The short- and medium-range surface-to-air missile systems are listed by their characteristics and ranked in three categories:

- Category A—modern medium-range SAM.
- Category B—early generation medium-range SAM; modern short-range SAM.
- Category C—early generation short-range SAM.

Even the Category C systems provide a great improvement in air defense over small arms fire and antiaircraft artillery (AAA). Properly used by a well-trained and disciplined crew that understands the operational limitations of the weapons, Category C SAMs are capable of shooting down the most modern ground attack aircraft. The systems listed do not include the latest US and Soviet systems (the US Patriot and the Soviet SA-10, SA-11, and SA-X-12) since it is unlikely that they will be deployed outside the developer's country in the next five years.

Key Technologies

The major technological advances from early generation SAMs to today's systems have involved the use of solid propellants and the application of solid-state electronics technology, improved computer software, and phased-array radar antennas to provide increased capability in clutter, ECM, and weather-degraded environments. While these technologies have greatly improved SAM performance, the improvements have occurred incrementally rather than in quantum jumps. This incremental improvement is expected to continue through the foreseeable future.

Prospects for Proliferation

The level of technology required for the independent development of an effective SAM system is beyond the capability of the nonindustrialized Third World. Even the simplest shoulder-fired IR-homing SAM requires sophisticated solid-state processing and electro-optical devices, which are far beyond the capability of Third World manufacture. While some countries, particularly the oil-rich countries, may be able to buy the requisite manufacturing technology, it is unlikely that this procurement and the training of the necessary skilled labor force could be accomplished within the next five years. To date, these countries have chosen to buy existing SAM systems from outside sources. 25X1

countries currently producing SAMs are: the United States, the USSR, China, the United Kingdom, France, Italy, Sweden, and Japan. 25X1 both Egypt and India are currently attempting to develop SAMs based on the Soviet SA-6. Within five years both of these countries should succeed in this attempt, but only with technical assistance from one of the presently producing nations. It is possible that other nations may attempt similar programs or may begin manufacture under license from a producing country (as did Japan, Italy, the NATO consortium, and China). Such programs would require extensive assistance and probably a supply of components by the licensing country. 25X1

Other important factors influencing the effectiveness of SAM use by Third World countries is the ability of such countries to operate and maintain the weapons. Many of the simple, short-range weapons are very sensitive to gunner performance and, consequently, very sensitive to gunner training. (For example, the Soviets typically require one year of training for their SA-7 gunners.) It is also important that the operator fully understand the limitations of the system in order to maximize its performance. System maintenance encounters the same difficulty as indigenous manufacture of SAMs—lack of skilled technicians. Without the attention of well-trained maintenance technicians (or external maintenance support) the complex electronics associated with the computers and radars of the advanced SAM systems will fail rapidly. 25X1

We anticipate a continued proliferation of SAM systems in Third World countries, principally through the purchase of existing systems. The best defense would be provided by a combination of modern, medium-range systems (Category A), modern short-range weapons (Category B), and radar-guided gun systems. We expect, however, that most Third World armies will concentrate on acquiring the less expensive, short-range weapons in combination with radar-directed guns. 25X1

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Antitank Guided Missiles

Antitank guided missiles (ATGMs) currently available on the international arms market can be grouped into two basic categories: first generation, or manually guided, and second generation, or semiautomatically guided. The technology associated with either group is not overly sophisticated, as demonstrated by the indigenous development of ATGMs in about 12 countries and the current production of one or more ATGM systems by over 20 countries. Regardless of sophistication, these missile systems pose a significant threat to all Western armored vehicles.

Deployment of first-generation ATGMs began in the late 1950s, and by the mid-1970s, 14 different ATGM systems had been developed, one or more of which were in service with the ground forces of more than 60 countries. The most common of these were the French SS-11 and the Soviet AT-3, both of which were sold to more than 20 countries, and the West German Cobra, which was sold to 18 countries and was licensed for production in Italy, Turkey, Brazil, and Pakistan.

The first-generation ATGM systems are very difficult to control, require extensive gunner training, and have low probability of hit under combat conditions. Development of semiautomatically guided ATGMs greatly alleviated these problems by relieving the gunner of his missile guidance responsibility. With these systems, the gunner has only to track the target; the missile is then automatically guided to that target. The first systems of this type available for foreign sale, the French Harpon and the Soviet AT-2C and AT-3C, were developed in the late 1960s. All three of these are variants of first-generation systems (SS-11, AT-2, AT-3) with improved guidance systems. The guidance improvements involved the addition of electro-optical equipment to the missile launchers and little or no change to the missiles themselves. This type of modification increases system effectiveness with minimal development costs and little impact on ongoing missile production, it should be very attractive to countries already producing a first-generation ATGM system. The Yugoslavs, for example, had by 1977 developed their own semiautomatic variant of the Soviet AT-3, which they were producing under license, and have reportedly offered "modification kits" for sale to other producers of first-generation systems.

Table E-6

Antitank Guided Missiles (by Producing Country)

Producer	1st Generation	2nd Generation	
		Medium	Heavy
United States		Dragon	Shillelach TOW I-TOW
United Kingdom	Vigilant Swingfire	Milan	
France	Entac SS-10 SS-11 SS-12	Milan	Harpon HOT
West Germany	Cobra Mamba	Milan	HOT
USSR	AT-1 AT-2A AT-2B AT-3A	AT-4 AT-7	AT-2C AT-3C AT-5 AT-6
Poland	AT-3A		AT-3C
Czechoslovakia	AT-3A		AT-3C
Israel		Picket	
Japan	KAM-3D		KAM-9
North Korea	AT-1 AT-3		
Indonesia	SS-11	Milan	
Egypt	Swingfire		
Taiwan	Sword		
China	AT-3		
Switzerland	Mosquito		
Sweden	Bantam		
Argentina	Mathogo		
Yugoslavia	AT-3		
Brazil	Cobra Mamba		
Turkey	Cobra Mamba		
Pakistan	Cobra Mamba		
Italy	Cobra Mamba		

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The Soviet AT-2C and AT-3C are in production in the Soviet Union and in some non-Soviet Warsaw Pact countries. They are deployed throughout the Warsaw Pact and have been exported to a number of Third World countries. The incorporation of semiautomatic guidance and later improvements to the warheads of these missiles have greatly increased the effectiveness of these systems, which were deployed in their original configurations about 20 years ago.

By the mid-1970s, deployment of tube-launched, second-generation ATGM systems had begun. These missiles are packaged in sealed tubes that serve as launchers and shipping containers and facilitate their handling as "rounds of ammunition." In addition to improved guidance, these systems typically have increased lethality, higher velocities, and increased battlefield survivability. The most widely deployed of this type are the US TOW, which is in service in 32 countries, and the French Milan, which has been sold to 17 countries and has now been licensed for production in India. The Indian license also allows third-party sales by India, with French approval. Other systems of this type that have been exported are the US Dragon, the French HOT, and the Soviet AT-4. The newer Soviet systems have not yet been widely exported, but the AT-4 is in service in all Warsaw Pact countries and has recently been offered for sale to two non–Warsaw Pact countries. Increased export of AT-4 is expected as is export of the AT-5 and AT-7, which are currently deployed only with Soviet forces.

Improved second-generation ATGMs are expected to be available internationally within the next five years. A version of the Milan with an improved warhead has been offered for sale by the French, and an improved warhead has been developed for the US TOW. Other improvements likely to become available are night sights and countermeasure-hardened guidance links.

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More advanced ATGM systems are being developed by the major powers, with primary development efforts directed toward improved guidance and warheads. It is highly unlikely that any of these more advanced systems will be available for foreign sales within the next several years. It is equally unlikely that many lesser powers would choose to deploy more advanced systems in the near term, due to the costs of the advanced missiles and to the quality and effectiveness of systems already available.

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The shaped-charge warheads of all currently fielded ATGM systems (first- and second-generation) will defeat most currently deployed armored vehicles (such as M60, LEO I, Centurion, and T-62) and, depending on the specific missile system and combat scenario, pose some degree of threat to all armored vehicles (including M1, LEO II, Chieftain, T-64, and T-72). Although the first-generation, manually guided systems are not as accurate as their semiautomatic successors, they can be very effective when used in large numbers by well-trained gunners, as evidenced by Egyptian use of the Soviet AT-3 in the 1973 Middle East war. The more effective second-generation systems that are available are more expensive, but an investment of about $2,500 to $15,000 per round provides a high probability of kill at ranges up to 4,000 meters against million dollar main battle tanks.

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Worldwide ATGM production is shown in the table, with missile systems divided into medium and heavy classes. Typically, medium ATGMs are man portable or crew served and have a maximum range of 2,000 meters or less. Heavy ATGM systems have ranges greater than 2,000 meters (typically 3,000 to 5,000 meters) and are mounted on ground vehicles and/or helicopters.

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Table E-7

Ammunition, by Producer

	Artillery	Tanks
Belgium	SRC International 155-mm ERFB PRB 75-mm HEAT 105-mm HEAT 155-mm ERFB	PRB 76-mm HEAT 90-mm HEAT 90-mm HESH 105-mm HEAT 105-mm HESH
Canada	Space Research 175-mm ERFB	
China	70-mm HEAT 75-mm HEAT	105-mm APFSDS
France	Hotchkiss-Brandt 155-mm RAP	GIAT 90-mm HEAT 105-mm APFSDS Luchaire 90-mm HEAT IMI 105-mm HEAT
Israel	IMI 155-mm RAP	IMI 105-mm APFSDS 105-mm HEAT
Italy	SNIA-Viscosa 105-mm RAP	SNIA-Viscosa 90-mm HEAT 105-mm HEAT
Netherlands		Eurometaal NV 105-mm APDS 105-mm HESH
Spain		Barreiros-Hermanos 90-mm HEAT 105-mm HEAT
United States	20-mm AP (DU) 30-mm AP (DU) 155-mm RAP 155-mm ICM (AP grenades)	76-mm HEAT 90-mm HEAT 105-mm APFSDS 105-mm APFSDS-P 105-mm HEAT
United States (continued)	155-mm ICB (AT mines) 155-mm Guided (Copperhead) 203-mm RAP 203-mm ICM (AP grenades) 203-mm ICM (dual-purpose grenades)	152-mm HEAT
United Kingdom	Royal Ordnance 105-mm HESH	Royal Ordnance 105-mm HESH 105-mm APFSDS 120-mm APFSDS 120-mm HESH 76-mm HESH
USSR	115-mm RAP 122-mm HEAT 122-mm RAP 152-mm RAP 122-mm Indirect Flechette 152-mm Indirect Flechette	76-mm HEAT 85-mm HEAT 100-mm APFSDS 100-mm HEAT 115-mm APFSDS 115-mm HEAT 125-mm APFSDS 125-mm HEAT
West Germany		Rheinmetall 120-mm APFSDS 120-mm APFSDS-P 120-mm HEAT 90-mm APFSDS 90-mm APFSDS-P 105-mm APFSDS 105-mm APFSDS-P 90-mm HEAT 105-mm HEAT

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Munitions

Improvements occurring in conventional munitions provide a twofold benefit to the user: (1) the projectiles are more lethal and (2) they allow an older gun to be effectively upgraded on a par with newer gun systems because the munitions are the killing end of artillery and gun systems. The most prominent example of this upgrading occurs with tanks. Many tanks considered obsolete by our standards are in worldwide use and are armed with 105-mm guns. Most of these older tanks could use the modern 105-mm ammunition recently developed for the United States and/or NATO, which would immediately give them the same penetrating power found in firstline battletanks of NATO countries and allow them to penetrate the armor of very modern US and NATO tanks. The major deficiency these tanks would then have is a lack of armor protection comparable with newer tanks.

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The same improvements occur with artillery ammunition; older guns that fire modern ammunition would have firepower comparable with new guns

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Technology transfer, from a manufacturing sense, is not an important issue in the munitions area. Most Third World countries purchase rather than manufacture ammunition. There are numerous ammunition manufacturing countries willing to sell ammunition on a worldwide basis.

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The effectiveness of modern ammunition produced by a wide variety of manufacturers is about equal, but modern munitions as a class is much more effective than older ones. As an example, the new 152-mm Soviet flechette round has a lethal area 23 times greater than the older Soviet 152-mm high-explosive fragmentation round.

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In artillery and tank ammunition, the modern rounds are the ERFB (extended range full bore), RAP (rocket-assisted projectiles), HESH (high-explosive squash head), APFSDS (armor-piercing fin-stabilized discarding sabot), APFSDS-P (armor-piercing fin-stabilized discarding sabot with depleted uranium core), and the HEAT (high-explosive antitank). ERFB and RAP are designed to extend artillery range by 20 to 30 percent; the other types are primarily used against tanks. (The table lists some modern ammunition available for artillery and tanks.)

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Laser-guided artillery projectiles such as the US Copperhead will probably be in use by the United States and NATO in the next five years. These projectiles contain high-technology seekers designed to withstand the tremendous accelerations that occur when an artillery projectile is fired from a gun.

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Laser Devices

A wide variety of visible and near-infrared laser rangefinders, illuminators, and designators are produced by US, UK, and French firms and are readily available on the international arms market (see table). Any country could obtain such laser devices and might be able to deploy them on battlefield equipment and use them in a limited role against personnel and sensitive electro-optical devices.

Such laser devices would present a serious threat to military equipment and personnel. Low-energy lasers can be used as optical jammers and countermeasures against optical sensors and guidance systems; depending upon the wavelength and pulse energy, a low-energy laser could be used to cause temporary or permanent blindness of personnel viewing the laser beam. The present threat of "off-the-shelf," laboratory-type lasers against personnel was dramatically demonstrated in October of 1981: a low-power argon laser, purchased from Spectra-Physics, was used by a civilian to irradiate a Los Angeles police helicopter. The pilot was immediately disabled and disoriented (flashblinded) for about 10 to 15 seconds.

Lasers capable of structural damage or out-of-band damage to sensors (for example, frosting or crazing of exterior optical surfaces) are in the R&D stage. These lasers have cw-output powers greater than 20 kw or pulse energies greater than 30 kJ. No country has yet deployed such laser weapons, and these high-energy laser weapons are not expected to be available to Third World countries within the next five years.

Table E-8

Selected Laser Devices Available Worldwide

Product	Firm	Wavelength (micrometer)	Energy (microjoule)
TK/60s laser rangefinder	ILS (US)	1.06	15
NT-90 laser	ILS (US)	1.06/0.53	20-90
NT-60s0 laser transmitter	ILS (US)	0.53	150
LF6/7 designator/ rangefinder	Ferranti (UK)	1.06	100
Type 307 CO2 laser ranger	Ferranti (UK)	10.6	15
UV TEA laser	Marconi (UK)	10.6	60
TCV29 laser rangefinder	CILAS (Fr)	1.06	100

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Submarines

Almost all of the submarines sold in the export market are diesel-electric-powered, attack-type submarines displacing 1,000 to 2,000 metric tons while submerged. These submarines generally can dive to depths of about 200 to 300 meters, and typically carry 10 to 20 torpedoes for use against surface ships and other submarines. A West German consortium, HDW/IKL, sells the most popular submarines, variants of the Type 209. Over 35 Type 209s have been sold, and more are under construction. None of the submarines contain major technological innovations, nor will they in the foreseeable future. In general, however, IKL/HDW submarines are quieter and contain more incremental-type innovations.

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Diesel-electric submarines are inherently quiet, and would be difficult to detect by any means. Thus, they probably represent a significant threat to an opponent.

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Table E-9

Submarines

System	Producing Country	Availability	Remarks
Type 2000	West Germany	Immediate	Designed by HDW especially for export, it is a 2,500-ton submarine with a range of 25,000 nm. It has six torpedo tubes capable of firing any 21-inch weapon such as the US Mark 48 torpedo or Harpoon. We know of no sales of this design, however, Germany is attempting to sell system to the United States.
Type 209	West Germany	Immediate	Several versions are available for export. More than 35 have been sold for export. The latest customer is India. The submarine displaces up to 1,500 tons, has a range of up to 8,000 nm. It has eight 533-mm torpedo tubes and carries up to 14 torpedoes. Argentina has two T209s.
TR1700	West Germany	Within 5 years	Designed and built by Thyssen Noordtseewerke, the competitor of HDW/IKL. The TR1700 displaces 2,300 tons, has six 533-mm torpedo tubes, and carries 22 torpedoes. Argentina has ordered four. The first TR1700 should be ready for sea trials in 1983.
TR1400	West Germany	Within 5 years	The baby brother of the TR1700, the TR1400 displaces only 1,700 tons. It is intended for coastal defense. Argentina has ordered two.
Agosta-class	France	Immediate	The Agosta-class diesel-electric attack submarine has four 550-mm torpedo tubes and can carry 20 torpedoes designed for the 550-mm tubes. Spain has ordered four and Pakistan has ordered two.
Type 2400	United Kingdom	Immediate	The 2,400-ton Type 2400 submarine has six 533-mm torpedo tubes and can carry up to 18 torpedoes. The only orders for this class are the Royal Navy, however, Vickers is marketing this submarine in competition with the TR1700, the T2000, and the T45.
Type A45	Sweden	Immediate	This is an expert version of the Type A14 in service with the Swedish Navy. There are no known customers for the A45, which is a rather mundane boat.
Foxtrot-class	USSR	Immediate	The USSR has exported a number of Foxtrot-class diesel-electric attack submarines to client states.
Romeo	China	(See remarks)	China has built several of these 1,400-ton diesel-electric attack submarines for North Korea. Production is continuing for the Chinese Navy. Thus, we cannot rule out possible exports in the future.

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