Chapter 10

The Defense Industry of India

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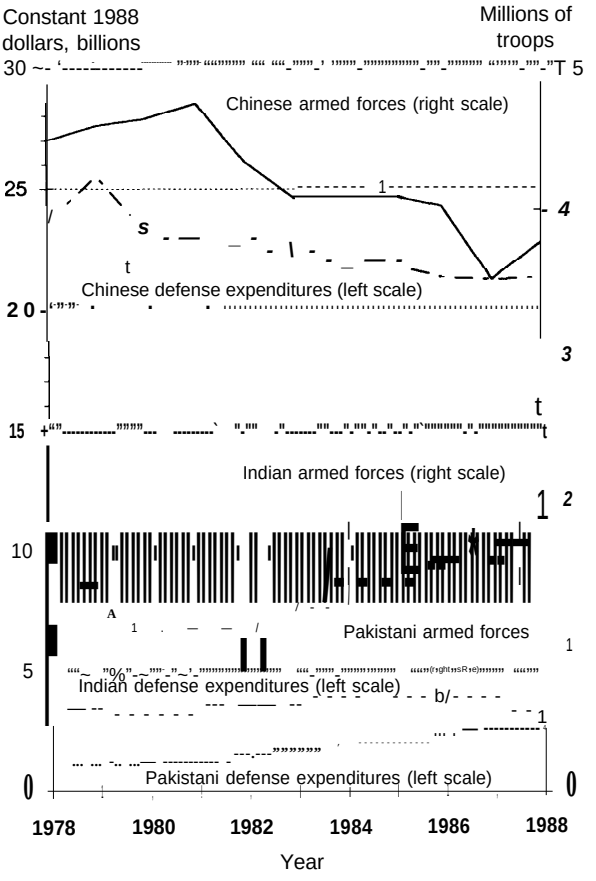
INTRODUCTION

India's military industrial complex is one of the oldest, largest, and most divers~led in the developing world. The expansion of India's defense industrial capacity, particularly in the 1980s, was largely conditioned by the South Asian arms build-up among China, Pakistan, and India (see figure 10-1). The growth of the Indian arms industries was fueled both by increases in domestic defense spending, which increased from $5.5 billion in 1980 to $9.5 billion in 1989, and by foreign military aid and arms transfers. Pakistan's receipt of $1.6 billion in U.S. military assistance (1982-87), including the acquisition of the F-16, was met by India's acceptance of a $1.74 billion arms transfer (1988-93) from the Soviet Union, which included licensed production of the Soviet T-72 tank, MiG-23 interceptor, and the MiG-29 Fulcrum.[1] India was the third largest recipient of arms transfers in the developing world during the 1985-89 period and the largest nonoil-producing arms importer (see figure 10-2).

Indian defense officials have also argued that the growing superpower presence in the Indian Ocean was a factor motivating its arms build-up, including the experience during the 1971 India-Pakistan War, when the *U.S.S. Enterprise was* deployed in the Bay of Bengal. The introduction of sophisticated arms to the region is also cited as a stimulus for increased domestic production of weapon systems. India's enhanced naval capability, which includes submarines and aircraft carriers, has already affected two of the region's six island states, the Maldives and Sri Lanka. Indian forces suppressed **a** coup against the government of President Gayoom of the Maldives in November 1988, and India continues to frustrate Sri Lanka's efforts to suppress its Tamil separatist guerrillas.

To secure its strategic objectives, the Indian Government has established a large scale defense industrial sector that includes 9 state-owned defense industries, 33 ordnance factories, and 34 R&D establishments and laboratories. The long-term goal has been to build an indigenous defense industrial base, capable of supplying **a** wide range of advanced defense equipment.

Figure 10-1-South Asia Defense Expenditures and Military Force Levels, 1978-88

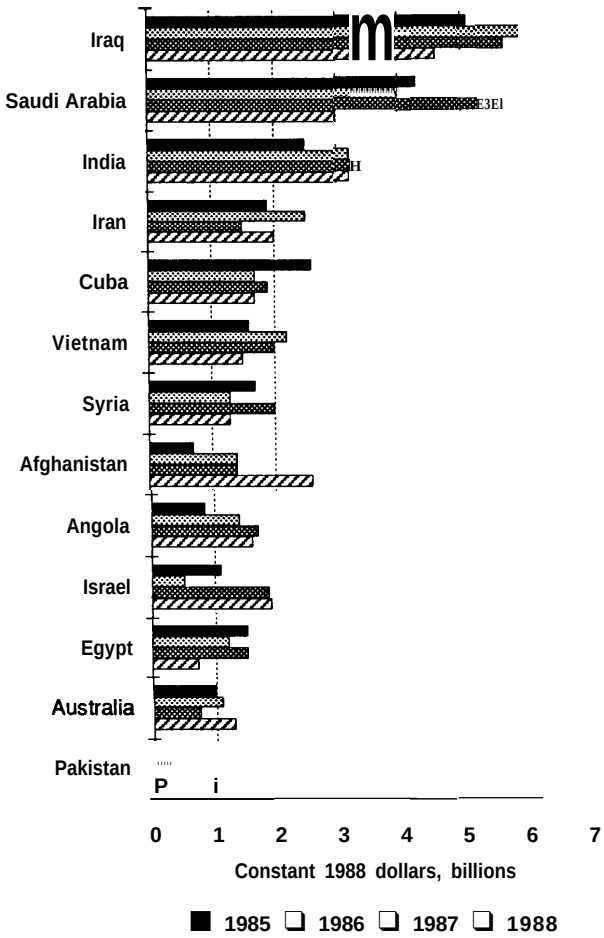


SOURCE: Office of Technology Assessment, from data in U.S. Arms Control and Disarmament Agency, *World Military Expenditures and Arrns Transfers,* 1989 (Washington, DC: U.S. Government Printing Office, 1990).

India's policy of self-reliance in defense production has been complemented by imports of sophisticated weapon systems and related technologies primarily from the Soviet Union (see figures 10-3 and 10-4 on Indian arms imports and figures 10-5 and 10-6 on Indian licensed production activities). The partial success of this strategy is reflected by India's advanced production capabilities (for a

[1]See *Ron* Mathews, *Defence Production in India (New* Delhi: *ABC* Publishers, 1989).

Figure 10-2-Leading Arms Importers, 1985-88



SOURCE: Office of Technology Assessment, from data in U.S. Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers,* f989 (Washington, DC: U.S. Government Printing Office, 1990).

developing nation) in all weapons categories: jet fighters, aircraft, and helicopters; main battle tanks and armored personnel carriers; diesel-powered submarines and frigates; ballistic missiles; electronic and communication equipment; and small arms, artillery, and ammunition.

However, the Indian defense industries remain dependent on foreign technology, particularly systems produced under license from the Soviet Union. In this regard, the mixed experience of India's defense industrialization demonstrates that successive licensed production of sophisticated weapon systems augments but does not guarantee the transition to independent local design and production. Over the past four decades, India's defense production program has suffered from the relative isolation of defense-related production activities. There is little technology spillover into the private manufacturing sector, and civil industrial input to defense production is negligible.

Since 1985 the Indian Government has encouraged greater interaction between defense production and civil industry by promoting private sector participation. For instance, a private firm, Kirloskars, is providing the diesel engine for the Arjun main battle tank. The tank's computer is being designed by Nelco and Bharat Electronics Ltd. (BEL) jointly, and Dunlop is supplying the rubber pads for the tank's tracks.

The Indian Government has also attempted to increase exports to offset the foreign exchange burden created by massive arms imports. Such efforts, however, are hampered by lack of international marketing expertise and by restrictive provisions in licensing agreements: for example, India's export of MiG-21 spare parts to Egypt was prohibited by the Soviet Union. India has exported small arms and ammunition to Jordan, Lebanon, and Oman, as well as nonarmored vehicles to Malaysia and Nigeria. The notable foreign sale was the export in 1983 of eight Chetak helicopters to the Soviet Union.[2]

India's Military-Industrial-Research Sector

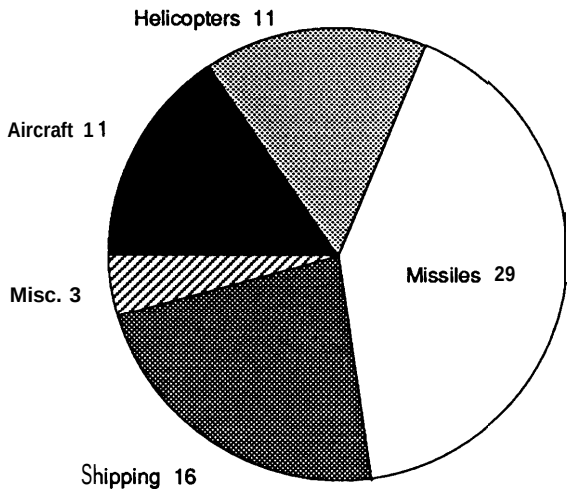
Central to India's military-industrial-research sector are the nine defense firms and the government's Defense Research and Development Organization (DRDO). The defense firms are administered by the Ministry of Defense; all manufacture weapons and equipment for the armed forces as well as capital goods for the civilian sector. Many of these firms were established by the British during World War II, while others were located in the private sector and subsequently acquired by the government (see table lo-l).

The largest state firm is Hindustan Aircraft Ltd., whose main aerospace production factories are located in Bangalore and Nasik. Another 10 facilities are spread throughout 6 Indian states.

Bharat Electronics Ltd. (BEL) is the second largest defense firm. Sixty percent of its production (radio, radar, and electronics equipment) is for the

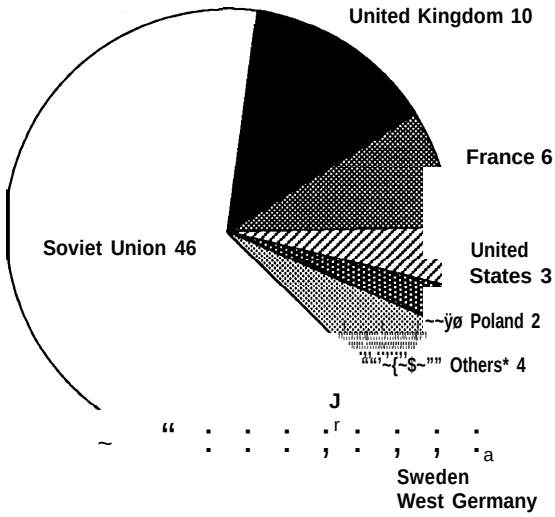
[2]Dilip Mukerjee, "Hi-Tech Players in a Dangerous Game of Catch," *Far Eastern Economic Review,* June 9, 1988.

Figure 10-3-Indian Major Conventional Weapon import Deals, by Type of Weapon, 1970-90



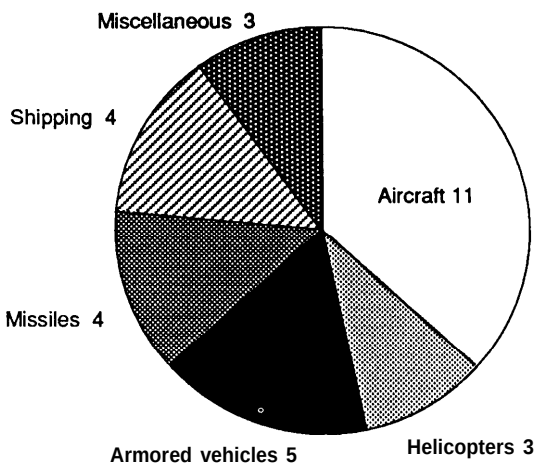
SOURCE: Office of Technology Assessment, from data in Stockholm International Peace Research Institute, SIPRI Yearbooks, 1970 through 1990, *World Armaments* and *Disarmament.*

Figure 10-4-Indian Major Conventional Weapon import DeaLs, by Country of Origin, 1970-90



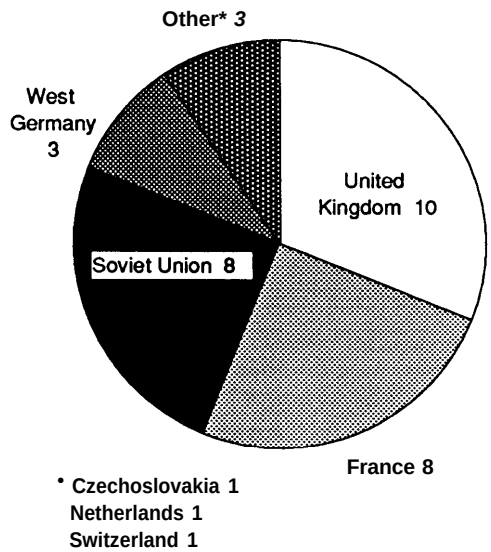
SOURCE: Office of Technology Assessment, from data in Stockholm International Peace Research Institute, SIPRI Yearbooks, 1970 through 1990, *World Armaments and Disarmament.*

Figure 10-5-Indian Licensed Production of Major Conventional Weapons, by Type of Weapon, 1970-90



SOURCE: Office of Technology Assessment, from data in Stockholm International Peace Research Institute, SIPRI Yearbooks, 1970 through 1990, *World Armaments and Disarmament.*

Figure 10-6-Indian Licensed Production of Major Conventional Weapons, by Country of License Origin, 1970-90



SOURCE: Offioe of Technology Assessment, from data in Stockholm International Peace Research Institute, SIPRI Yearbooks, 1970 through 1990, *World Armaments and Disarmament.*

armed forces; the remaining 40 percent is destined for the civil market (TV broadcasting equipment and satellite receiver terminals). The third state-owned defense company is Bharai Earth Movers Ltd. (BEML), whose products include transport trailers and earth moving equipment. BEML is the largest exporter of the nine state-owned defense companies.

India's naval sector consists of three shipyards: Magazon Docks Ltd. (MDL), Goa Shipyards, and

Table 10-1—Indian Defense Production, 1987-88 (1988 dollars, millions)

Selected defense firms	Production	Profit before tax	Exports	Employment
Hindustan Aeronautics	546	31.0	0.09	43,833
Bharat Electronics	328	24.0	0.80	19,266
Bharat Earth Movers	431	40.0	35.12	16,151
Magazon Docks	200	28.0	0.00	14,355
Goa Shipyards	14	-.87	0.03	2,091
Garden Reach Shipyards	63	–.77	0.00	10,427
Bharat Dynamics	32	3.0	0.00	1,798
Midhani	22	0.26	0.00	
Total	1,637	124.9	36.04	109,428

SOURCE: Office of Technology Assessmen, 1991.

Garden Reach Shipyards. Established in 1774 and acquired by the Ministry of Defense in 1960, MDL is India's preeminent shipyard, capable of building warships such **as** frigates and submarines, as well as cargo and passenger ships. At present approximately 60 percent of the yard's production is in the civil sector, specializing in ship repair, construction of off-shore oil platforms, and floating docks and cranes. Goa Shipyards Ltd. was acquired in 1964 and is a subsidiary of Magazon Docks. It specializes in ship repair and engineering work. Located in Calcutta, Garden Reach Shipyards is engaged primarily in ship repair and engineering activities, such as the manufacture of air compressors, turbine pumps, diesel engines, and generators. Two-thirds of its production is for the civil sector.

Three relatively small defense firms are engaged in missile production, machine tool manufacturing, and the development of alloys. Bharat Dynamics, Ltd. has produced under license Aerospatiale's SS-11-B1 antitank missile. Praya Tools, Ltd. manufactures machine tools as well as castings and forgings used in defense production. Mishra Dhata Nigam Ltd. (MDNL) was established in 1973 principally to reduce India's dependence on imported specialized metals (titanium and tungsten) and alloys for fabricating components for the nuclear and aerospace industries. It has received significant foreign assistance from France (Creuset Loire and Perchiney - Ugine Kuhlman) and from West Germany (Krupp).

Unlike many other defense producers among the newly industrializing countries, India has invested heavily in its defense R&~ base to achieve greater self-sufficiency in defense production, and to reduce imports of foreign technologies. Under the Ministry of Defense, the Defense Research and Development Organization operates 42 major laboratories and employs 25,000 people, of whom 6,000 are scientists and engineers.

The DRDO functions as a central coordinating agency for the execution of defense-related research (see figure 10-7). For example, it conducts research in the fields of aeronautics, combat vehicles, electronics, naval science, metallurgy, and rockets and missiles. Expenditure on defense R&D as a percent of the total military budget remained relatively constant at approximately 2 percent until the late 1980s, when it jumped to 4.5 percent. This increase was necessary to support the design and development of India's most ambitious defense production programs: the Light Combat Aircraft and Helicopter projects; the Gas Turbine Engine project; and the Arjun main battle tank program.[3] Additional military research is conducted within each defense firm, and by the ordnance factories and universities.

INDIGENOUS AND LICENSED DEFENSE PRODUCTION ACTIVITIES

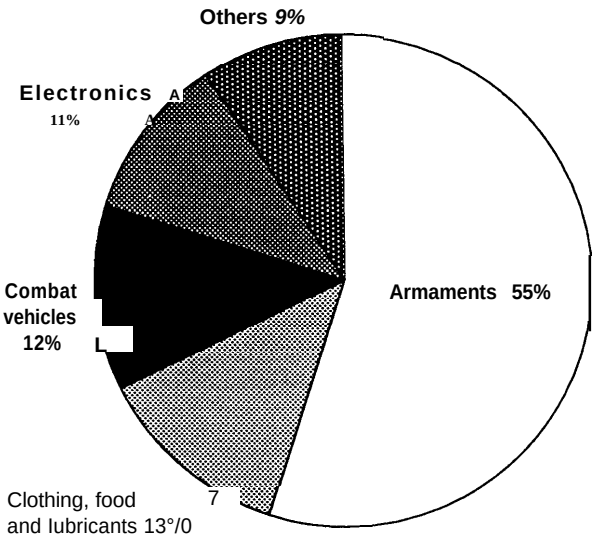
Naval

In response to India's regional ambitions in the Indian Ocean, the mission of the Indian Navy changed significantly during the late 1970s. According to one analyst:

> The original sea control/shore defense orientation, which largely emphasized preserving the integrity of India's coastal waters against a Pakistani threat, has steadily given way to an assertive naval orientation . . . [The new strategic posture includes] . . . the defense of sea lanes and the preservation of

[3] Y. Lakshmir, *Trends in India' s Defence Expenditure (New* Delhi: ABC Publishing House, 1988), p. 65

Figure 10-7—Production of the Defense Research and Development Organization



SOURCE: Indian Ministry of Defense, *1989 Annual Report.*

zones of influence, where the emphasis has shifted from a specifically shoreline defense to a portmanteau conception labelled "defense of the nation's maritime interests.

This includes the defense of Jndia's coastline and seaborne trade as well as its broader economic and foreign policy interests in the Indian Ocean.

To meet these new requirements, India has relied principally on weapon systems purchased from the Soviet Union and Western Europe. The acquisition of the British carrier, *Viraat,* formerly the HMS *Hermes,* has been complemented by an inventory of naval aircraft-Sea Harriers, Tu-142 maritime reconnaissance aircraft, and Dornier 228 light patrol aircraft as well as a number of antisubmarine warfare helicopters including Sea Kings and Ka-27s/25s. Some analysts believe that India is also seeking collaboration with European shipbuilding companies to build a third aircraft carrier.

India's shipbuilding facilities are also engaged in both licensed and indigenous production activities: MDL has produced frigates under British license and is producing Godavari frigates indigenously. The latter 3,000-ton frigate is the only ship of its kind in the world **that can carry two** helicopters and support antisubmarine warfare. MDL also is building two diesel-powered submarines under license from West Germany's Howaldtswerke Deutsche Werft Ag. (HDW).[5] India's naval fleet has been greatly expanded by recent deliveries of five Soviet Kashin II destroyers, eight Foxtrot and eight Kilo conventional submarines, and one Charlie I nuclear-powered submarine.[6] (A 704-acre submarine dockyard has been built with Soviet assistance at Vishakaputnam, headquarters of the Indian submarine fleet.) Garden Reach Shipyards has manufactured fast patrol craft and inshore patrol vessels for the Coast Guard. Some observers suggest that these new acquisitions will enable the Indian Navy to structure surface strike groups for offensive purposes, while the Navy's submarine force architecture will greatly enhance India's sea control and denial capabilities.[7]

Armor

Although India successfully manufactured the Vijayanta (a modified Chieftain tank) under British license, its indigenous design and production of **a main** battle tank has been delayed. Initiated in 1980 by the DRDO'S Combat Vehicle Development Establishment, the Arjun main battle tank is still in the development phase because of problems related to its power plant. The power plant remains under development at the Gas Turbine Research Establishment. Delays in this program led to the Defense Ministry's decision to license-produce the Soviet T-72 tank as an interim measure.

Missiles

The DRDO, and its Defense R&D Laboratory (DRDL) have made steady progress in India's ballistic missile program. The DRDO has produced and tested the long-range surface-to-air missile Akash, the **surface-to-surface missile Prithvi, which has a range of 150 miles** and can carry a nuclear payload, the surface-to-air missile Trishul, and the most advanced antitank missile, Nag. However, the **apex** of the DRDO'S missile program has been the development of a new generation of long-range, surface-to-air missiles called Agni. With the Agni's

[4]Ashley J. Tellis, "India's Naval Expansion: Reflections on History and Strategy," *Comparative Strategy,* vol. *6, No. 2, 1987,* pp. 192-193.
[5]See Dr. Michael Vlahos, "Middle Eastern, North African and South Asian Navies," U.S. *Naval Institute Proceedings,* vol. 3, No. 3, March 1985.
[6]Tellis, op. cit., footnote 4, p. 204.
[7]Ibid.

successful May 1989 test flight, India became the first developing nation to design and produce an intermediate-range ballistic missile derived from civilian space activities.[8] The Agni carries a l-ton payload and is capable of reaching China's southern cities; carrying a half-ton atomic bomb, this missile could hit Beijing (2,200 miles). The Agni program benefited substantially from foreign technical assistance to its sister space program. West Germany provided three indispensable missile technologies: guidance, rocket testing, and composite material handling and fabrication.[9]

Aerospace

While Hindustan Aircraft Ltd. (HAL) successfully produced the British Aerospace Gnat fighter and its trainer version, Ajeet, as well as the HS-748 military/commercial transport aircraft, its attempts to design and produce indigenous supersonic combat aircraft have failed. One example was the development of the HF-24 Marut fighter during the late 1950s and 1960s. HAL designed and eventually fabricated the airframe but neglected to develop a suitably advanced engine. By the time an imported engine (a MiG- 19 Vk-7) was modified and fitted, the plane was technologically obsolete. India has been forced to abandon its policy of self-reliance in defense production because design or production problems frequently resulted in the cancellation of projects (Ajeet), and because of the lack of engineering and quality control expertise.[10] India increasingly has relied on licensed production and outright procurement of foreign weapons systems. As one Indian defense scientist quipped, "Every time we need to develop a better mousetrap, the country has to import a better cat. "[11]

Strong Indo-Soviet military cooperation has developed in the wake of India's failed policy of self-reliance in defense production. India is the only country outside the Warsaw Pact to license-produce Soviet aircraft, and it has gained considerable experience in the manufacture of the MiG-21/-2l *bis*, and the MiG-27. HAL will shortly produce MiG-29 Fulcrums.

Beginning in the early 1970s, HAL wanted to diversify and looked to West European aircraft companies to license-produce an advanced fighter and to transfer the technologies related to their materials and components. Of the possibilities-the French Mirage 2000, the Swedish Viggen, and the Anglo-French Jaguar, the latter was chosen in 1978. Though HAL has assembled two-thirds of the 116 fighter aircraft, attempts to indigenize component production have been frustrated. One of the major problems is the preference by the Indian armed forces to purchase weapon systems from abroad.

In an important departure from its role as an assembler of foreign-made aircraft, HAL, with the DRDO, has embarked on an ambitious program to design, develop, and produce a combat aircraft for the Indian Air Force (IAF) requirements of the 1990s. The Light Combat Aircraft (LCA) project is receiving considerable design and technical assistance from U.S. and European companies. General Electric has supplied seven F404 engines to power the LCA prototypes. These engines are eventually to be replaced by the indigenously designed and manufactured GTX-35 gas turbine engine. Various U.S. companies-Allied-Signal, Litton, and Honeywell-are bidding to provide the LCA'S flight control and other electronic systems. The U.S. Air Force reportedly will provide training, consulting, and test facilities.[12] Finally, HAL, in partnership with Messerschmitt-Bolkow-Blohm in Germany, is in the development phase of an Advanced Light Helicopter program, which will complement the IAF's squadrons of Chetak (Alouette III), and Cheetah (Lama) helicopters.[13]

U.S. responsiveness to India's requests for technology transfers and supplies of critical components for the LCA project marks a significant departure from the previously strained Indo-American relationship. Some observers believe that if the United

[8] "Another Long-Range Missile Developed," *India Weekly,* July 17,1987, p. 10, and Richard M. Weintraub, "IndiaTests Mid-Range Agni Missile," *The Washington Post, May 23, 1989,* pp. Al, A21.

[9] For a thorough account of West Germany's participation in India's ballistic missile program, see Gary Milhollin, "India's Missiles-With a Little Help From Our Friends," *The Bulletin of Atomic Scientists, vol. 45, No. 9, November 1989,* pp. 31-35.

[10] Interviews with various defense company officials.

[11] "India: Indigenous Programs Flourish Amid Defense Modernization," *International Defense Review,* vol. *19, No. 4,* 1986, P. 436.

[12] Ian Anthony, "The Trade in Major Conventional Weapons, " in Stockholm International Peace Research Institute, SIPRI Yearbook 1989, *World Armaments and Disarmament* (Oxford: Oxford University Press, 1989), p. 212.

[13] Hiroshi Kimura, "Air Forces in the Asia pacific Area," *Defence Asia-Pacific,* vol. 2, 1989, p. 25.

States establishes a firm foothold in India's defense production program, it may achieve the twin objectives of extending U.S. influence and providing export opportunities for American defense companies, while reducing India's dependence on the Soviet Union. The Soviet Union has sought to counter this challenge to its strong defense relationship with India by offering to integrate the LCA'S characteristics into the yet undeveloped MiG-35 aircraft.