

Chapter 11

**The Developing Defense Industries
of the Western Pacific**

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The Developing Defense Industries of the Western Pacific

The development and expansion of domestic arms production capabilities in the Western Pacific countries reviewed in this chapter—Australia, Singapore, Indonesia, and Taiwan—have necessitated substantial government investment and procurement (see figure 11-1). This figure, however, obscures the disparity in the levels of defense industrialization among these four countries. One of the primary reasons for this disparity is their relative access to advanced arms and high-technology imports. The small size of Australia's domestic defense industry may be explained partly by the ready availability of weapons systems from the United States and Europe. In contrast, Taiwan, Singapore, and Indonesia have more restricted access to foreign arms imports, which has spurred the expansion of their defense production programs.

Each of these states has been equipped by Western countries (see figure 11-2), and there has been substantial equipment standardization among them, partly because the United States has been the

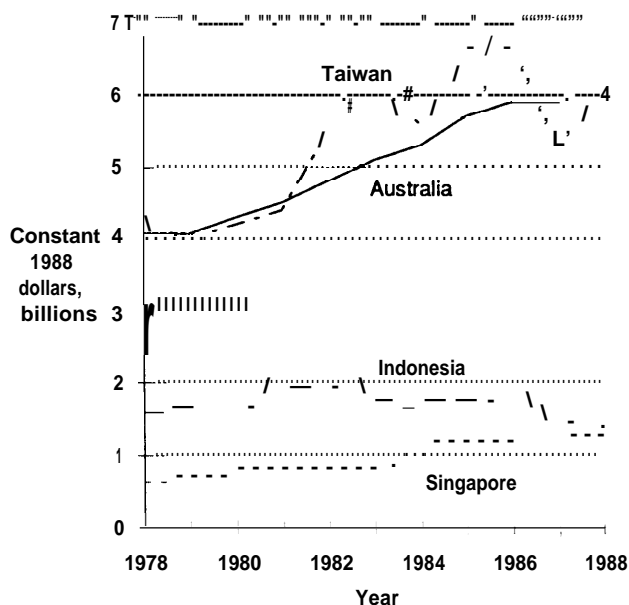
principal arms supplier to the region. Australia, Taiwan, Singapore, and Indonesia have all imported Northrop's F5-E fighter aircraft. These same four countries also imported the U.S. AIM-9L air-to-air missile. In addition, C-130 Hercules military transport aircraft have been acquired by Singapore, Indonesia, and Taiwan.

The arms production capabilities of these Western Pacific countries also vary in accordance with their respective manufacturing bases, military R&D programs, and government policies. Taiwan's technical expertise and diversified industrial base have enabled it to develop and build an indigenous high-performance combat aircraft in less than 10 years. The lack of a sufficient technological base and financial resources have precluded Singapore and Indonesia from embarking on similar defense projects. Instead, Singapore's and Indonesia's more modest defense production efforts consist largely of component manufacture and assembly work for the aircraft, shipbuilding, and ordnance sectors.

The development of the Western Pacific defense industries, however, has been significantly aided by the involvement of and technology transfers from U.S. and European defense companies through direct investment (Singapore), joint ventures (Australia), and licensed production (all) (see figures 11-3 and 11-4). Licensed production activity by U.S. companies is concentrated in the aircraft sector of these defense industrializing countries, although many countries have licensed other types of weapons for indigenous production in the Western Pacific. Australia, Indonesia, and Taiwan have manufactured various helicopters under U.S. license, including Blackhawk, Seahawk, and Bell utility. Germany dominates in the shipbuilding sectors of Singapore and Indonesia, providing licenses for the production of PB-57 fast attack craft (see figure 11-5).

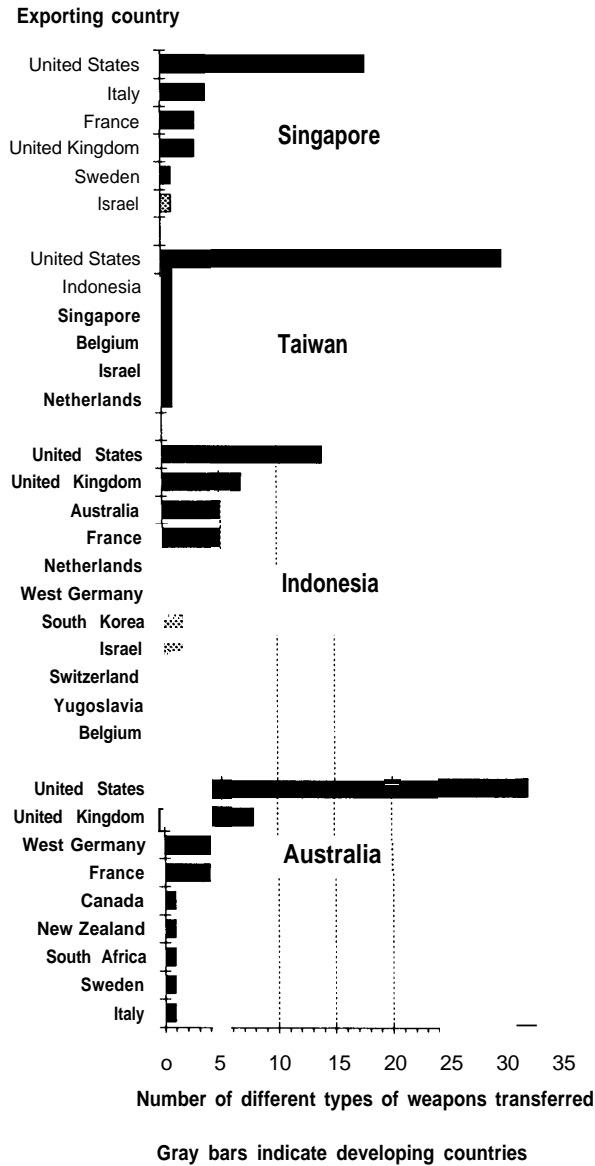
These countries have also benefited from their location in the lucrative Asia-Pacific market. Singapore's reputation as a regional aerospace center was boosted by its hosting of the 1988 Asian Aerospace Show (which included 674 companies from 31 countries) and by the 1989 Defense Asia exhibition (the first defense exhibition in Southeast

Figure n-1-Defense Expenditures in Four Western Pacific Nations, 1978-88



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

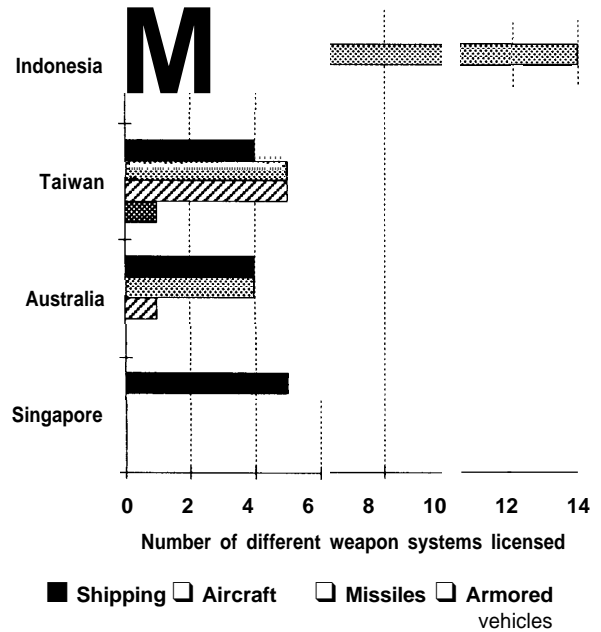
Figure 1 I-2—imports of Major Conventional Weapon Systems by Four Western Pacific Nations, by Exporting Nation, 1970-90



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

Asia to be certified by the U.S. Commerce Department). The continued increase in Asia-Pacific trade is also likely to bolster the region's domestic and foreign-based commercial shipbuilding and aircraft industries.

Figure n-3—Licensed Production of Major Conventional Weapon Systems in Four Western Pacific Nations, by Type of Weapon, 1970-90

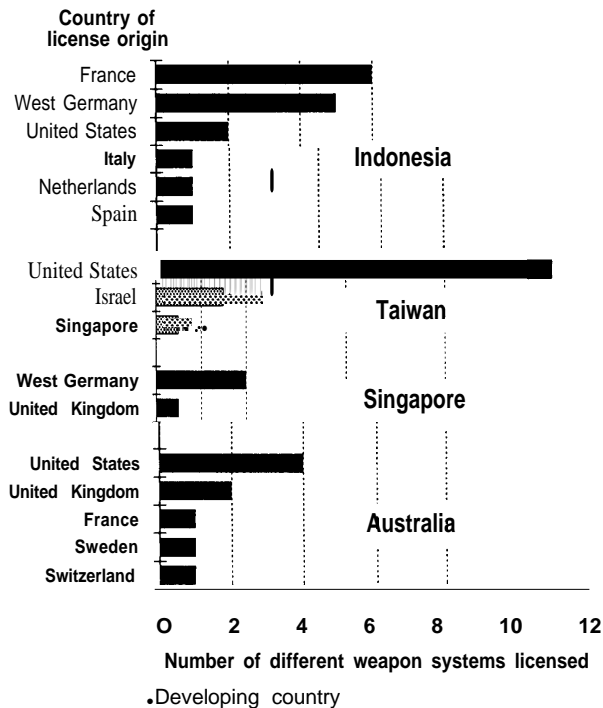


SOURCE: Office of Technology Assessment, from data in Stockholm International Peace Research Institute, SIPRI Yearbooks, 1970 through 1990, *World Armaments and Disarmament*.

THE DEFENSE INDUSTRY OF SINGAPORE

Although Singapore's development of a defense industry since the 1970s has been linked closely to the country's industrialization program, strategic considerations provided the industry's initial impetus. Singapore is located at the entrance of the Malaccan Straits, which connect the Indian and Pacific Oceans—the so-called Gulf-to-Japan route. As an export-dependent economy, Singapore is vulnerable to interruption of its vital trade channels. The country also has been sensitive to regional developments: the withdrawal of British forces from Southeast Asia in the 1970s, the increased Soviet influence in the region, the Vietnamese invasion of Cambodia, and the Communist insurgencies in Thailand, Malaysia, and the Phillipines. In response to the perceived destabilization of the region during the 1970s, Singapore encouraged military cooperation within the Association of Southeast Asian

Figure n-4-Licensed Production of Major Conventional Weapon Systems in Four Western Pacific Nations, by Country of License 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*.

Nations (ASEAN) and through the Five Power Defense Arrangement.¹

On a per-capita basis, Singapore is Asia's third wealthiest nation (behind Japan and Brunei). Its gross national product (GNP) growth over the last several years has averaged 11 percent, the largest in ASEAN.² The country's economic dynamism is explained by its export-oriented industrialization strategy in alliance with U. S., European, and Japanese translational corporations, which were attracted to Singapore because of its location and modern infrastructure. Singapore has used this

strong manufacturing base to create the most diversified and technologically advanced arms industry in ASEAN.

Singaporean Defense Industrialization

State promotion of defense industrialization has involved various forms of direct and indirect intervention in the Singaporean economy. The most important manufacturing sectors are transportation—aircraft and shipbuilding—and electronics. During the late 1960s, the Singaporean Government carefully promoted the shipbuilding industry, with special focus on construction and repair. The government invested heavily in three shipyards:

1. Singapore Shipbuilding and Engineering Pte. Ltd.,
2. Sembawang Shipyard (which was established as a private limited company with 75 percent government ownership to take over the Royal Naval Dockyard), and
3. Keppel Shipyard Pte. Ltd. (which was separated from the Port of Singapore Authority to form a wholly government-owned enterprise).³

Singapore also became increasingly attractive as an export base for Japanese shipping companies.

In addition to these activities, the Singaporean Government directly fostered the active participation of multinational corporations in the country's aircraft industries through financial and tax incentives. For example, companies were exempted from the usual 33-percent corporate income tax for up to 10 years. Companies such as Pratt & Whitney, Hawker Pacific, TRW, General Electric, Sundstrand, Garrett, and Westinghouse made major direct investments in component manufacture, assembly, and repair-service work; they were also attracted by Singapore's skilled low-wage labor. It is estimated that Singapore's wage costs are half those of the United States or Western Europe; this has resulted in production savings of 25 to 40 percent for some aircraft companies.⁴

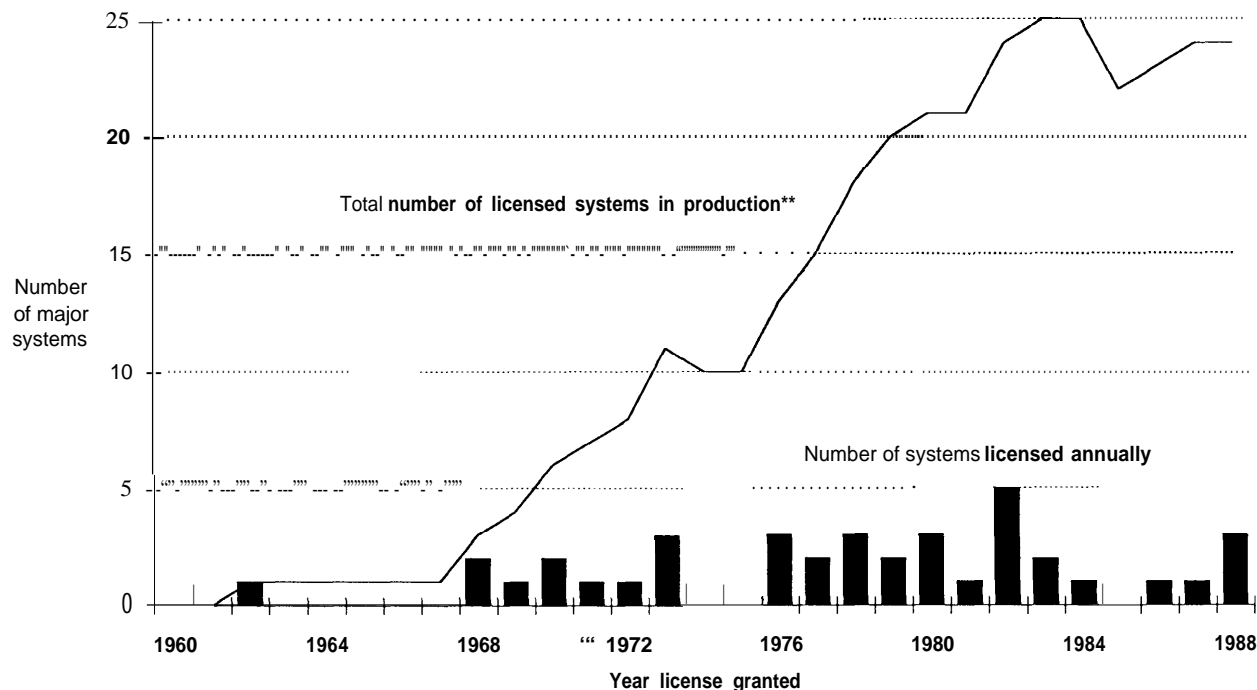
¹The bilateral security assistance provided by Britain to Malaysia and Singapore was terminated in 1971 and was replaced by a broader regional security agreement called the Five Power Defence Arrangements. This security framework involves Britain, Australia, New Zealand, Malaysia, and Singapore.

²World Bank Development Reports (Washington, DC: World Bank, various years).

³Gary Rodan, *The Political Economy of Singapore's Industrialization: National State and International Capital* (New York, NY: St. Martin's Press, 1989), p. 95.

⁴David Saw, "The Emergence of the Third World Aircraft Industry," *Military Technology*, vol. 4, No. 4, 1988, p. 51.

Figure n-5-Estimated Licensed Production of Major Conventional Weapon Systems in Four Western Pacific Nations,* 1960-66



*Indonesia, Taiwan, Singapore, and Australia.

● *Estimates based on the assumption that an average system is produced under license for 12 years.

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

Foreign investment in the local aerospace industry rose from \$28 million in 1977 to \$480 million 10 years later.⁵ The decision by overseas aerospace companies to locate their regional activities in Singapore has been reflected in the dramatic growth of industrial output in the aerospace sector: from \$47 million in 1977 to \$795 million in 1987.⁶ Many foreign airline companies now use Singapore as a base for the repair, overhaul, and support of aircraft engines and other systems. In particular, investments by Garrett and Vac-Hyd in the aircraft component industry represented impressive gains in technology available in Singapore.⁷

In order to upgrade technologically the economy's defense industrial base as well as sustain higher value-added manufactured exports, the Sin-

gaporean Government has also assisted the electronics, fabricated metal, and precision equipment industries. Foreign investment during the 1970s in these sectors was substantial and included the location in Singapore of Hewlett-Packard, National Semiconductor, SCM, Sundstrand Pacific, and Cincinnati Milacron, among others.

After 1979 the Singaporean Government embarked on a massive incentive program for investments in public and private sector R&D. Liberal capital depreciation allowances were provided for plant and machinery and subsidized financing for firms restructuring or upgrading their technological activities. The government also devised a 10-year Master Plan (1980-90) to improve the country's technological infrastructure. For example, the plan

⁵Ibid.

⁶Ibid.

⁷According to Rodan, Garrett's investment in a casting project enabled the company to supply induction hardened parts to other Garrett plants in Europe and the United States. Vac-Hyd implemented a manufacturing process for the heat treatment of aircraft engine components. Rodan, op. cit., footnote 3, p. 134.

provided for the development of Selectar Air Base for the aeronautical industries, and for the construction of the Singapore Science Park to accommodate the country's major industrial and scientific enterprises. While direct government R&D expenditure increased dramatically in the mid-1980s (from 0.4 percent of GNP in fiscal year 1981-82 to 0.6 percent in fiscal year 1984-85), it still lags behind other developing countries in Asia (South Korea 1.4 percent of GNP, Taiwan 1 percent).⁸ In 1988 the government launched the International Direct Investment program as a means of broadening Singaporean investment in industries that access new technologies and international markets for higher value-added manufactures and services.

Structure of Singapore's Defense Sector

Singapore's defense industries are primarily owned by the government through a holding company, Shoeng-Li. Founded in 1967 as the Chartered Industries of Singapore, the arms industries were reorganized in 1983 to form the Singapore Technology Corp. (STC). STC was structured to gain R&D production efficiencies through cooperative resource sharing and to market Singaporean military equipment. STC employs a labor force of over 8,000 employees, generates \$526 million in annual sales,⁹ and is Singapore's largest domestic enterprise. Because of government funding, it is able to purchase the latest technology to develop defense products in which its subsidiaries have the necessary expertise.¹⁰

Although the Ministry of Defense is responsible for STC'S operations, its subsidiaries are run according to commercial guidelines. STC is composed of four groups:

1. Singapore Technologies Industrial (23 companies),
2. Singapore Technologies Aerospace (6 companies),
3. Singapore Technologies Marine (1 company), and
4. Singapore Technologies Ordnance (17 companies).

Of the four divisions, Singapore Technologies Aerospace (STA) is the most prominent. It employs nearly 3,000 people and has 6 subsidiaries. The largest of these is Singapore Aerospace Manufacturing Co. (SAMCO), which is responsible for maintenance and refurbishment of the Singaporean Air Force's inventory as well as those of other air forces in the region. Singapore's defense programs include refitting the A-4S-1 Super Skyhawk fighter-bombers with the more powerful GE F404 engines for the Air Force; refurbishment and replacement of the avionics system of the C-130 Hercules military/civil transport aircraft for the U.S. Navy, and assembly from kits of S-211s and AS-332 Aerospatiale Super Puma helicopters. Two subsidiaries work on engine overhaul for Pratt & Whitney, General Electric, and Grumman. Another subsidiary, Singapore Aero-Components Overhaul, manufactures subcomponents for the General Dynamics' F-16 and Northrop's F5E/F.¹¹

STA recently has begun to acquire technology by investing abroad. STA through STC has a 2-percent participation in Pratt & Whitney's PW4000 engine project (more than Japan's Kawasaki Heavy Industries or South Korea's Samsung Aerospace). The engine is already being used to power the A310 Airbus in Singapore Airlines and could also be used in Boeing 747 and 767 aircraft, as well as the MD-11. In January 1988 a joint venture was established between British Aerospace (BAe) and STA/STC for the manufacture, repair, and integration of BAe components in return for marketing services.¹² In addition to the government-owned aerospace sector, there are over 25 companies in Singapore's private sector that manufacture aircraft components and are affiliated with such multinational aviation firms as United Technologies of the United States and Hawker Siddeley of the United Kingdom.

STC's second major division is the Singapore Shipbuilding & Engineering Co. (SSE). Its production capabilities have been limited because of the relatively small naval procurement budget and local private competition for ship repair work from the

⁸*Ibid.*, p. 180.

⁹*Armed Forces Journal International*, February 1990, p. 67.

¹⁰See "The Singapore Technology Corporation: Singapore's Own Military-Industrial Complex," *Pointer*, vol. 11, No. 1, October-December 1984, pp. 12-23.

¹¹Bilveer Singh, "ASEAN's Arms Industries: Potentials and Limits," *Comparative Strategy*, vol. 8, No. 2, 1989, pp. 249-264.

¹²"Singapore Shoots for the Sky," *Asiaweek*, Mar, 11, 1988, pp. 50-51.

larger Vesper Shipyard. During the mid-1970s SSE built seven TNC-45 fast attack craft (four for Singapore's Navy and three for Thailand's). It is also constructing five Type-62, 500-ton missile corvettes under license from Germany's Luerseen Werft. The naval ship repair business is expected to increase as a result of France's decision to use SSE for repair and overhaul work on its fleets operating in the Indian and Pacific Oceans.

STC oversees Singapore's ordnance industry. The ordnance sector consists of six subsidiaries, including the former Chartered Industries of Singapore, Ordnance Development and Engineering (which indigenously designed and produces the Ultimax-100 light machine gun), Singapore Automotive Engineering, Singapore Computer System, Singapore Automotive Leasing, and Unicorn International. Together these companies manufacture small-to-medium caliber infantry arms and their ammunition, and provide maintenance and modernization services for the Singaporean Army.

Exports

Singapore's defense exports, including sales of finished weapons systems and subcomponents, are extremely difficult to estimate. As Stockholm International Peace Research Institute (SIPRI) analysts note, there are a variety of trade channels: through Singaporean private defense-related producers; from Singaporean and other countries' companies through Unicorn, STC's export trading firm; and through ChartWell, a Singaporean-Chinese trading company. SIPRI reports that companies which have exported systems through Unicorn include General Dynamics; Rascal & Ferranti (U.K.); and Bofors & Ericsson (Sweden). While Unicorn is the obvious conduit for most of Singapore's defense exports, exports from the other two channels are much harder to decipher. Singapore's aerospace exports by STC subsidiaries were estimated at \$116 million in 1988, making the country the largest exporter of aircraft and parts in ASEAN.¹³

THE DEFENSE INDUSTRY OF INDONESIA

Among the ASEAN countries, Indonesia possesses the second most diversified and advanced defense industrial base. Its emergence since the mid-1970s has been conditioned by the country's geostrategic position, in conjunction with a deliberate policy of economic and technological modernization.

Strategic Motivations and Defense Policies

Indonesia's decision to invest in a defense industry reflected the government's aim to reduce dependence on other countries for the purchase and supply of weapons. Accordingly, Indonesia shifted its arms procurement pattern from heavy reliance on Soviet imports (1958-65) to purchases from the United States and West European suppliers (1967-76).¹⁴

Indonesia is an archipelago of over 13,000 islands situated along the straits leading from the Pacific into the Indian Ocean. Indonesia's articulation of a security doctrine of *wawasan nusantara* is based on its archipelago concept, which posits the indivisibility of land, sea, and airspace within the country's boundaries.¹⁵

Since its initial formulation in 1957, various factors have strengthened Indonesia's *wawasan nusantara* defense policy. The first was the perceived regional threat posed by the emergence in 1975 of a unified and militarily strong Vietnam. The second was the extension of Indonesia's maritime jurisdictions and its proclamation in 1980 of a 200-mile exclusive economic zone, following the provisions in the Law of the Sea Treaty. (Both Indonesia's Air Force and Navy have been restructured and equipped with Boeing-737 Surveillers and Nomad Search Masters as well as a small frigate force to defend its offshore oil fields and economic zone claims.) Third, Indonesia has been concerned about the continued naval presence of the superpowers and India's expansion of its naval fleet in the Indian Ocean.

¹³T. Ohlson, "The Asean Countries: Low-Cost Latecomers," M. Brzoska and T. Ohlson, eds., *Arms Production in the Third World* (London: Taylor & Francis, 1986), pp. 57-61.

¹⁴*Ibid.*, p. 57.

¹⁵Donald E. Weatherbee, "Indonesia: Its Defense-Industrial Complex," in James Katz, ed., *The Implications of Third World Military Industrialization: Sowing the Serpent's Teeth* (Lexington, MA: Lexington Books, 1986), pp. 165-185.

Together these strategic concerns and the Indonesian Armed Forces defense posture, 'Total People's Defense System,' have had a significant impact on the reorganization of the armed forces and the country's defense production program. The importance attached to Indonesia's defense sector stemmed from the national leadership's belief in the sector's contribution to both national security and economic development. This inseparability is manifested by the government's emphasis on dual-use defense industries. For example, the impetus for Indonesia's ambitious aerospace industry derives from civil as well as military objectives.¹⁶ This industry is regarded as an integral part of the country's broader industrialization plan. As one Indonesian Minister reasoned:

Now look at my country: 13,400 islands, from west to east a distance equal to that between San Francisco and New York. . . . We need aeroplanes and helicopters. We have a huge potential market.¹⁷

Such reasoning underpins the defense industrial rationale for Indonesia's development of its own airframe industry and design capability to produce aircraft for the country's short-to-medium haul transport routes.

Government Promotion Policies

Indonesia's defense sector consists of eight strategic industries, though only four are directly engaged in defense production. These four companies are: PT IPT Nusantara (aerospace), PT PAL Indonesia (shipbuilding), PT Pindad (small arms ammunition), and Perum Dahana (explosives). In addition, the government runs an R&D institute at the Puspitek Centre in Serpong, whose function is to develop and transfer new defense-related technologies to the defense industries. They are all government-owned and are under the control of the Council of Ministers on Strategic Industries.

The overall costs of subsidizing the defense industries are impossible to estimate because they are classified as strategic industries, and are thus closed to external review and audit. Analysts generally assume, however, that such high-technology industries are funded by off-budget means.

In addition to the policy of state-ownership, the Indonesian Government has used a number of infant-industry protectionist measures. It has banned the import of small aircraft and ships, and insists that both private and public transportation operators purchase state-produced equipment. Indonesia's domestic airline, Bouraq, has been forced to replace its fleet of Fokker F-50 passenger aircraft with locally built CN-235s designed primarily for cargo transport.¹⁸

In order to expand Indonesia's defense production base, the government has encouraged extensive involvement by foreign corporations in the country's defense industries. This involvement has occurred through transfers of technology, know-how, licensing, offsets, and joint ventures. As a result, Indonesia, like its ASEAN neighbors, is highly dependent on imported designs, components, and technical assistance. As figure 11-4 above indicates, Indonesia's sources of licensed production are the most diversified of the Western Pacific countries. Its aircraft industry has manufactured helicopters under license from U.S., German, and French defense firms. In aircraft, Indonesia has relied on U.S., Spanish, French, and Italian technology transfers. Indonesia's arms industry has benefited considerably from such technology transfers, enabling the sector to increase its technological sophistication while bypassing many of the usual developmental stages.

A corollary to a liberal technology transfer policy is the government's attempt to generate spillovers from defense into civilian industries, reinforcing the acquisition of dual-use technologies. The Indonesian Government has provided domestic and multinational automotive and electronics industries with fiscal and export incentives to encourage the development of related technologies and subcomponents.

Finally, Indonesia's impressive progress in defense-related production has been attributed to the efforts of Dr. B.J. Habibie, Minister for Research and Development, and director of the Agency for Development and Application of Technology (BPPT). Habibie, a former technical director of the German aerospace giant, Messerschmitt-Bolkow-Blohm (MBB), and an Indonesian national, presides over

¹⁶Singh, *op. cit.*, footnote 11, pp. 249-264

¹⁷"Indonesia's Dynamic Aircraft Industry," *Southeast Asia Development Digest*, June-July 1986, p. 20.

¹⁸*Armed Forces Journal International*, *op. cit.*, footnote 9, p. 62.

Indonesia's defense-industrial sector, and is credited with the development in Indonesia of one of the world's best equipped airframe manufacturing facilities.

Indonesia's Defense Companies

The centerpiece of the Indonesian defense industry is the state-owned firm, PT IPT Nusantara. Established in 1976 from the Air Force's Institute for Aviation Industry in Bandung as well as from Pertamina's Advanced Technology and Aeronautics Division, the company now employs 12,750 people whose average age is only 24 years old.¹⁹ Nusantara reportedly has produced over 92 commuter aircraft and 125 helicopters. The company, in keeping with Indonesia's heavy reliance on technology transfers, has licensed-production agreements with France's Aerospatiale for Super Puma antisubmarine warfare helicopters, Germany's MBB for BO-105 utility helicopters, Textron in the United States for 412 transport liaison helicopters, and with Spain's Construcciones Aeronautical S.A. (CASA) for the CN-212 and CN-235 medium transports. Its most ambitious project is the indigenously designed Advanced Air Transport Plane, the ATRA 90. This propfan, 50-passenger aircraft is being jointly developed with Boeing.²⁰

In July 1989, British Aerospace reached an agreement to increase industrial subcontracts as a result of Indonesia's acquisition of various BAe products, including the Hawk and the Rapier surface-to-air missile. Other offset arrangements, which reflect IPTN's emergence as a competitive overhauled and aircraft parts manufacturer, include component production for Fokker-100 and F-16 aircraft. (The 1986 F-16 offset agreement with General Dynamics ensured Indonesia's military parity with its ASEAN rival, Singapore.)²¹

The success of the Indonesian aircraft industry is evidenced by the fact that in 1976 only 10 percent of the component parts for aircraft were manufactured locally. Today 90 percent are produced either at the Bandung factory or by other Indonesian subcontractors. The Indonesian aircraft industry has also found

a small, but useful export market in various developing countries: Thailand purchased five CN-212s, Saudi Arabia bought four CN-235s, Brunei has also ordered several CN-235s, and Malaysia has purchased one Super Puma.

PT PAL, the naval shipbuilding firm, is Indonesia's second major defense concern. Although PT PAL has built fast patrol boats and search and rescue vessels using designs from the Maritime Engineering School, limitations within the shipbuilding sector have encouraged further foreign collaboration and purchases. The yard produces under license Boeing hydrofoils (which are fitted with missile capabilities) and Luerssen/Fulton Marine missile fast attack craft. Despite these achievements, Indonesia's Navy is reaching "block obsolescence." In an effort to sustain a limited modernization program, Indonesia has purchased four former Dutch Navy Van Speijk-class frigates. Still, Indonesia's aging fleet will require considerable investment by the government if it is to remain committed to modernizing the PT PAL Surabaya shipyard for naval shipbuilding.²²

The production of small arms and ammunition is based at the government-owned main factory PT Pindad. Pindad manufactures semi-automatic rifles under license from Pietro Beretta of Italy; M-16s and 5.56 assault rifles under license from Colt Industries in the United States; and FNC rifles under license from Fabrique Nationale Herstal in Belgium. Indonesia at present does not produce any guided missiles. A factory at Perum Dhana, however, does manufacture explosives and rockets.²³

THE DEFENSE INDUSTRY OF TAIWAN

The Carter Administration's "derecognition" of the Republic of China on Taiwan (ROC) in 1979, because of the overarching U.S. policy objective of pursuing normalization of relations with the People's Republic of China (PRC), drastically altered Taiwan's strategic as well as international positions. The United States had been the mainstay of the security of Taiwan since 1954. Taiwan depended

¹⁹"Indonesia's Dynamic Aircraft Industry," op. cit., footnote 17, p. 22.

²⁰Ohlson, op. cit., footnote 13, p. 59.

²¹*Armed Forces Journal International*, op. cit., footnote 9, p. 62.

²²*Ibid.*, p. 63.

²³Singh, op. cit., footnote 11, p. 63.

heavily on U.S. security assistance, especially arms transfers. Most of these transfers were for aircraft, combat equipment, and missiles. Divested of formal security assistance with the termination of the Mutual Defense Treaty, and with a subsequent 1-year moratorium on U.S.-Taiwanese arms transfers, Taiwan's security was increasingly threatened. By 1982 the PRC had augmented its military capabilities, reaching a 10:1 superiority over Taiwan in armed forces and conventional weapons. In terms of the naval balance, for example, the International Institute of Strategic Studies estimates that the PRC is superior to Taiwan in frigates, 37 to 10; in patrol and coastal craft, 915 to 73; and in submarines, 93 to 4.²⁴

Under pressure from congressional supporters of the Taiwan Relations Act, the Reagan Administration recommenced transfer of military equipment, including air-to-ground missiles and armored vehicles. It also allowed for the extended licensed production of 60 Northrop F-5E aircraft. The administration decided, however, not to accede to Taiwan's request for the acquisition of an advanced tactical fighter such as the F-16, the F-20, or F/A-18, nor the coveted Harpoon antiship missile.

In addition to these strategic concerns, Taiwan's international isolation increased in the early 1980s, as other nations feared strained relations with the PRC should they continue or initiate arms sales to the island. The ROC was also excluded from various international organizations, including the United Nations. Though Taiwan still retains security ties with Israel, Saudi Arabia, South Africa, and South Korea, there are limits to the exports by these countries of technologically advanced weapons systems.

In response to these developments, the Taipei government embarked on an ambitious program of "self-reliant national defense." As one analyst observed:

This was made possible by the provision by the United States on a selective basis of technological inputs and expertise to initiate and advance in-

igenous production programs. . . . As such, American policy provided both the incentives and the means for Taiwan to develop a defense industrial capacity.²⁵

Taiwan has relied extensively on licensed production of U.S. weapon systems to supplement the parallel decline in U.S. grant assistance and to buttress its own indigenous defense production efforts (see figure 11-4, above). Throughout the 1970s and 1980s, Taiwan has assembled the F-5E Tiger II fighter, the Bell 205 UH helicopter, and various missiles, including the air-to-air AIM-9J/9L and the Hawk MIM-23 surface-to-surface missile, all under U.S. licenses. Taiwan has also received assistance from Israel to develop its missile and shipbuilding industries. It license-produces the Israeli Gabriel ship-to-ship missile and the Dvora fast attack craft.

Unlike other East Asian newly industrializing countries, Taiwan's indigenous defense production program is driven less by export incentives than by the strategic threat posed by a PRC naval blockade of Taiwan's principal ports (especially Kaohsiung, which handles approximately 65 percent of the island's trade). To deter such an attack by the PRC's submarine fleet, the Taipei government has invested heavily in the naval sector (antisubmarine warfare capabilities and surface attack boats, equipped with antiship missiles). Additionally, to maintain the ROC's tactical air superiority over the Taiwan Straits, the Indigenous Defense Fighter (IDF), a supersonic, lightweight fighter, was developed indigenously and deployed in December 1989.²⁶

Taiwan's Defense Companies

Established in 1969 in Taichung, the Aero Industry Development Center (AIDC) is a branch of the Taiwanese Air Force and currently employs more than 3,000 workers.²⁷ Similar to the experiences of other aircraft producers in the region, the AIDC's recent production of its first defense fighter, the IDF or Ching Kuo, is based on a phased development program. The AIDC's capabilities grew from maintenance and overhaul work to the licensed produc-

²⁴International Institute of Strategic Studies, *The Military Balance, 1990-1991* (London: Brassey's, 1990), pp. 149-150, 178. For a thorough overview of U.S.-Taiwan security relations, see Stephen P. Gilbert, "Safeguarding Taiwan's Security," *Comparative Strategy*, vol. 8, No. 4, 1989, p. 439.

²⁵Janne E. Nolan, *Military Industry in Taiwan and South Korea* (London: Macmillan Press, 1986), p. 47.

²⁶For a good analysis linking Taiwan's defense policy objectives to the country's arms production program, see A. James Gregor, "The Republic of China on Taiwan," in Katz, op. cit., footnote 15.

²⁷Saw, op. cit., footnote 4, p. 49.

tion of various aircraft, principally the Bell UH-1H helicopter for the Army and the F-5 E/F fighter for the Air Force.²⁸

The IDF aircraft, which analysts claim to be comparable to the Northrop F-20, will replace Taiwan's obsolete front-line interceptors, Lockheed F-104s and Northrop F-5E/Fs. The production costs of this program are estimated at over \$1 billion, but financing has not been a constraint. The fighter's short delivery time would not have been possible without substantial assistance from U.S. defense companies, which supplied technical expertise and components. General Dynamics, in consultation with the government-owned Chungshan Institute of Science and Technology (CIST), helped to design the airframe (which closely parallels the U.S. F/A-18 Hornet). In addition, nearly 100 Taiwanese engineers received training and technical assistance at General Dynamic's Texas facility.²⁹ Other U.S. companies that have supplied components for the IDF program include Lear Astronautics Corp, which provided avionics integration and the fly-by-wire flight control system; Garrett, which aided the development of the IDF's engine (a modified version of the Garrett TFE-1088 turbofan); and General Electric, which provided the IDF's "look down-shoot down" capability with its GD-53 Doppler fire-control radar, a derivative of the AN/APY-67(V) radar.³⁰

Concurrently, AIDC has invested heavily in the indigenous production of components and engines. AIDC manufactures the Lycoming T-53 engines for its Bell helicopters under U.S. license. Taiwan's aircraft industry produces about 40 percent of its required components in conjunction with local private industry. Most of its avionics equipment, however, continues to be imported from the United States.

Taiwan's naval production facility is the state-owned China Shipbuilding Corp. (CSC) in Kaohsiung. In addition to this large shipyard, Taiwan possesses extensive civilian shipbuilding capabilities. Prior to the recession in world shipping demand, these shipyards had been engaged in the

extensive construction of oil tankers and large ships for export. The development of Taiwan's indigenous naval capabilities has been constrained by the Navy's preferred reliance on imports of surplus or aging U.S. warships.

The CSC shipyards have refurbished nearly 30 U.S. destroyers and frigates, retrofitting them with modern antisubmarine warfare electronics, fire-control systems, and Sea Chaparral air defense missiles. CSC also has manufactured the PSMM-MK5 fast attack craft under a U.S. license arrangement with Tacoma Boat Building Co. Owing to complications arising from subsequent U.S. restrictions on the required missiles, the shipyard has switched to producing fast attack craft based on the Israeli Dvora design. Finally, Taiwan's CSC is preparing to construct larger warships, ten 2,000-ton Ulsan-class frigates in cooperation with South Korea's Hyundai Shipbuilding Corp., and 8 FFG-7 Perry-class frigates with the assistance of the U.S. Bath Iron Works Shipbuilders.³¹

Taipei has long considered modernization of its missiles and access to related electronics technologies of vital importance to the island's defense. As a result, Taiwan has sought to improve its air defense system and upgrade its current inventory of U.S. AIM-9 Sidewinder, Hawk, Maverick, and Nike Hercules systems (among others). The country's modest missile production program is based at CIST. This R&D center has developed the Hsuing Feng, a licensed-produced version of Israel's Gabriel 2 antiship missile, and the Ching Feng, a medium-range, surface-to-surface missile. Although CIST claims to have produced this latter missile indigenously, analysts concur that the Ching Feng was probably reverse engineered from the Lance, a U.S. missile currently in Israel's inventory. CIST also is producing a shorter range missile, the Kun Wu, an antitank, wire-guided missile (a variant of the Soviet AT-3 Sagger).³²

Equipment for Taiwan's ground forces is produced under the Defense Ministry's Combined

²⁸For a thorough analysis of Taiwan's IDF program, see "Fighter Made in Taiwan," *Defense Asia-Pacific*, vol. 2, 1989, pp. 4-7.

²⁹Gilbert, op. cit., footnote 24, p. 436.

³⁰"Fighter Made in Taiwan," op. cit., footnote 29, p. 7.

³¹"Taiwan T. Start Building Warships," *Defense Asia-Pacific*, vols. 3/4, 1989, p.10.

³²*Jane's Defense Weekly*, Nov. 17, 1984, p. 890; and Shim Jae Hoon, "Chinese Missile Sales Shake Taiwan's Diplomatic Ties," *Far Eastern Economic Review*, June 2, 1988.

Service Forces (CSF). CSF has three departments related to arms production:

1. the Military Industrial Service, manufacturer of ordnance and related electronics and communications equipment;
2. the Military Vehicles Production Service (also known as the Fighting Vehicles Development Center), producer of armored vehicles; and
3. the Quartermaster Service, manufacturer of uniforms, gas masks, parachutes, and other materiel.

The Military Vehicles Production Service is the largest and most important of these departments. It has designed and produced various armored vehicles, including an armored infantry fighting vehicle based on the U.S. M-118 armored personnel carrier, and a light, Type 64 tank derived from the U.S. M-41. Currently, this department is developing a medium-weight main battle tank.³³

Government Promotion of Defense-Industrial Linkages

The Taipei Government has actively promoted export-oriented industrialization in conjunction with defense production activities through the development of indigenous R&D as well as through foreign transfers of technology. Since the late 1960s, Taiwan's decentralized science and technology policy has focused on institution building. The National Science Council (NSC), created in 1967, has been responsible for overall guidance, coordination, and evaluation of R&D activities (including higher education) in the public and private sectors. Between 1977 and 1987, NSC financed between 50 and 65 percent of the country's total spending on R&D.³⁴ Such financing has been considered necessary due to the lack of R&D investment by Taiwan's small to medium-sized manufacturing firms. Out of the approximately 2 percent of GDP spent on R&D, primary emphasis is given to engineering fields, accounting for 70 percent of total R&D expenditure during the 1977 to 1987 period.³⁵

In 1973 the Industrial Technology Research Institute (ITRI) was established to promote public and private R&D for defense-related applications. Today ITRI is Taiwan's leading R&D institution and has played a critical role in the development of the country's high-technology defense-related industries. It both introduces its own R&D products to industry and facilitates transfers of technology through its extensive network with universities, research centers, and domestic as well as multinational firms.

In an effort to boost private sector involvement in such critical industries as semiconductors, electronics, precision machinery, and metallurgy, the government established the Hsinchu Industrial Park in 1980. Modeled after California's Silicon Valley, the government solicited high-technology firms by providing tax and duty exemptions, and subsidized facilities such as factory buildings, transportation, and communications networks. The Park's location near Taiwan's premier universities is also meant to attract high-tech firms. By 1989 over 98 firms employing 17,000 people had located in the Park. Total production in 1988 was valued at \$1.7 billion.³⁶

The outlook for Taiwan's continued pursuit of indigenous development of sophisticated weapons systems is circumspect. For the foreseeable future, Taiwan's arms industries will remain dependent on foreign suppliers of advanced subsystems (avionics and engines) and manufacturing technology. Additionally, despite efforts by ITRI, the linkage of applied, private sector R&D to defense-related activities is still embryonic. Further efforts have been frustrated because of the country's "talent gap"—the brain drain to the United States of Taiwan's highly skilled scientific and technical personnel. Finally, although exports of military equipment to regional neighbors could help recuperate the heavy investments in defense production, access to such markets is likely to be constrained by the countervailing pressures imposed by the PRC. Nevertheless, Taiwan's strong export performance, especially of mid-tech electronics, will be employed by Taipei as an economic bridge to expand and strengthen its foreign relations.

³³A.J. Gregor, R.E. Harkavy, and S.G. Neuman, "Taiwan: Dependent Self-Reliance," in Brzoska and Ohlson, op. cit., footnote 13, pp. 239,243.

³⁴See Walter Arnold, "Science & Technology Development in Taiwan and South Korea," *Asian Survey*, vol. 28, No. 4, April 1988, pp. 437-450.

³⁵Paul K. C. Liu, Ying-Chuan Liu, and Hiu-Lin WU, "New Technologies, Industry, and Trade — The Taiwan Experience," *Industry of Free China*, vol. 72, No. 4, October 1989, pp. 23-35, and *Industry of Free China*, vol. 72, No. 5, November 1989, pp. 7-24.

³⁶Bob Johnstone, "Taiwan's Hi-Tech Hothouse," *Far Eastern Economic Review*, Aug. 31, 1989, p. 47, and "Hi-Tech Dilemma," *Far Eastern Economic Review*, May 15, 1986.

THE DEFENSE INDUSTRY OF AUSTRALIA

The 1969 Guam Doctrine and subsequent U.S. foreign policies towards the Asia-Pacific region led Australia in the 1980s to reconsider its forward defense posture in favor of a strategy that emphasized increased autonomy and self-reliance. Consequently, to reduce the country's heavy dependence on imports of U.S. defense equipment, the Australian government has attempted to expand its small defense industrial base (primarily through increased domestic weapons procurement) and to promote overseas exports of local defense products. Additionally, the Australian Armed Forces were reorganized during the mid- 1980s to meet the priorities of first, defending the country, and second, securing Australia's sphere of influence in the Southeast Asian-Pacific region.

As various analysts have pointed out, defense planning is exceedingly difficult because, in conjunction with the country's continent size and vast coastlines, Australia faces no clear, direct military threat.³⁷ Instead, Australia's strategic concerns are largely regional, deriving from instabilities caused by the Soviet military buildup of the 1970s and by its northern neighbor, Indonesia. Australia's relations with Indonesia have often been strained because of the latter's 1963 to 1966 confrontation with Malaysia, and more recently, Timor. Though an Indonesian threat to Australia is not considered serious, India's rapid expansion of its carrier-based naval fleet is of some concern to Australia's Royal Navy.

Australia also plays a strong regional role in the South Pacific, where smaller nations with more limited economic and defense resources have looked to Australia as the region's policeman. The largest recipient of Australian military assistance is Papua New Guinea, whose territory has been invaded by Indonesian "hot pursuit" raids (see figure 11-6).

In view of potential regional destabilization, Australia has strengthened its defense cooperation

program with ASEAN states, especially Singapore and Malaysia. This regional security role has been reinforced under the Australia-New Zealand-United States (ANZUS) defense treaty, as well as through the Five Power Defense Arrangement (Australia, New Zealand, United Kingdom, Singapore, and Malaysia). Under these security arrangements Australia has provided training and advisory assistance as well as joint military exercises and exchange visits of military personnel. The Royal Australian Air Force (RAAF) has deployed two Mirage fighter squadrons in Malaysia and has provided P-3C surveillance aircraft to Singapore and Malaysia.³⁸

Defense Production in Australia

Australia's unique strategic position and consequently small military procurement budget have deterred the development of an extensive defense industrial base. In addition, with respect to the acquisition of military equipment generally, there has been a strong predilection by the military towards overseas imports, especially from the United States. In the public sector, the dockyards, eight munitions factories, and one aircraft company continue to perform the same defense work as during World War II, namely, overhaul and refurbishment of aircraft and naval vessels and the production of communications and ground force equipment.³⁹ However, most of Australia's defense production activity is located in the private sector, which primarily consists of aircraft-related industries.

Aircraft

The Australian Aircraft Consortium consists of the Government Aircraft Factories, Commonwealth Aircraft Corp., and Hawker de Havilland. This consortium is developing a new Australian basic trainer for the RAAF and for export. The Government Aircraft Factories manufactures the indigenous Jindivik remotely piloted vehicle and the Nomad light transport aircraft.

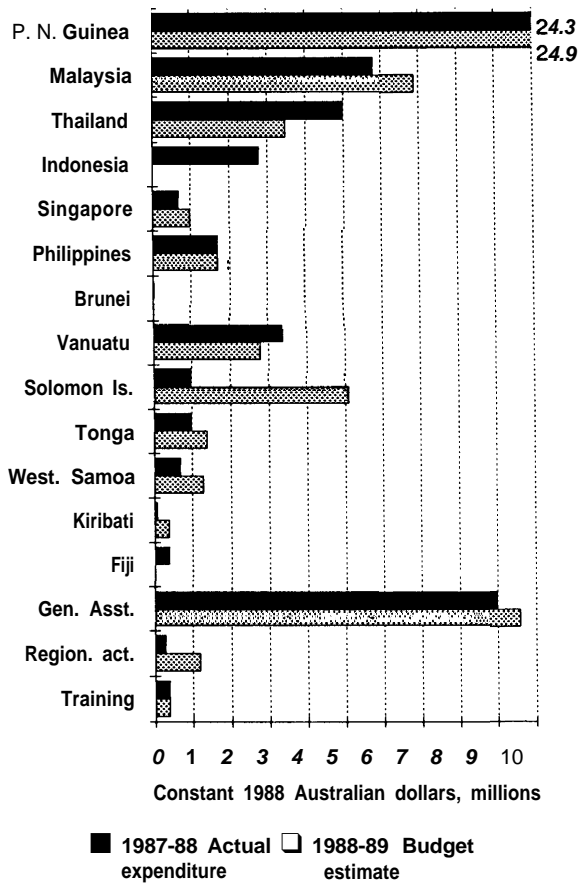
Hawker de Havilland is the licensed producer of the Swiss PC-9 trainer. Under U.S. license this company also assembles Blackhawk and Seahawk

³⁷See Robert O'Neill, "Strategic Concepts and Force Structure," in R. O'Neill and D. Homer (eds.), *Australian Defense Policy for the 1980s* (St. Lucia: University of Queensland Press, 1982).

³⁸P.D. Hastings, "Australian Regional Defence Cooperation in the 1980s," in *ibid.*, and Australian Senate Standing Committee on Foreign Affairs and Defense, *Australians Defense Co-operation With Its Neighbors in the Asian-Pacific Region* (Canberra: Australian Government Publishing Service, 1984).

³⁹P. Dibb, *Review of Australia's Defense Capabilities*, Parliamentary Paper No. 163 (Canberra: Australian Government Publishing Service, 1986), pp. 110-111.

Figure 11-6-Recipients of Australian Defense Cooperation Funds, 1988-89



SOURCE: Office of Technology Assessment, from data in Graeme Cheeseman, "Australian Defence Exports," *The Pacific Review*, vol. 2, No. 3, 1989.

helicopters and manufactures the airframe and landing gear for the U.S. F/A-18 Hornet. The company provides civil aircraft subassemblies for the Boeing 737, 747, and 757, the MD80, and the Airbus A300 and A320, and manufactures parts and assemblies for the U.S. F404 jet engine. With annual sales of approximately \$100 million, de Havilland's production is divided 60 percent for the domestic market and 40 percent for export.

Naval

Barrington Slipways Pty. Ltd. is a shipbuilding company that produces tugs, oil-rig supply vessels and an amphibious heavy-lift ship for the Royal Australian Navy (RAN). De Havilland Marine manufactures the Carpentaria- and Capricornia-class patrol boats. Managed by the Office of Defense Production, Garden Island Dockyard is involved in

the repair and refit of the RAN guided missile destroyer modernization program. Vickers Cockatoo Dockyard Pty. Ltd. performs naval overhaul work, including submarines, and construction of warships and heavy naval vessels for the RAN.

Small Arms and Ordnance

The Australian Government's Office of Defense Production includes the Government Aircraft Industries and the nine ordnance factories. The latter produce under license munitions, naval artillery, and small arms (the LIAI assault rifle and the F-1, a locally designed 9 mm submachine gun). Amalgamated Wireless Ltd. is the manufacturer of the Jindalee over-the-horizon-backscatter radar. The battlefield optical fiber cable short-haul communications system, and the HF jammer system for the Australian Army. Amalgamated is also participating in the project definition study for the RAN's new submarine program.

The potential development and expansion of these defense industries is frustrated by the lack of effective guidance from the Ministry of Defense. For example, during a 1974 Industries Assistance Commission's inquiry into the Australian aerospace sector, Australian aircraft manufacturers complained that "the lack of any real policy guidelines. . . from the Government" regarding defense procurement inhibited any corporate strategic planning for meeting the armed forces' defense requirements. Ten years later, a review of the government's own

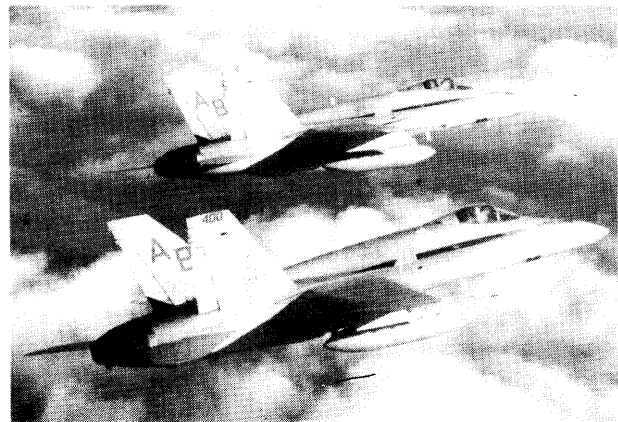


Photo credit: U.S. Department of Defense

The Royal Australian Air Force procured 75 F/A-18 Hornet fighters, which were licensed-produced in Australia by companies operating under the Australian Aircraft Consortium. Production began in the early 1980s, and the last Hornet fighter was delivered in May 1990.

defense industries acknowledged that “despite significant past expenditure the capabilities and capacities of the Government’s defense factories and dockyards are ill-matched to our strategic needs.”⁴⁰

To redress Australia’s inadequate defense industrial base in the face of its policy of self-reliance, in the mid-1980s the government initiated a four-pronged strategy:

1. rationalization of public-sector defense industries;
2. expansion of defense-related R&D activity;
3. facilitation of greater private-sector involvement in defense production, particularly in the local aircraft, electronics, and shipbuilding industries; and
4. promotion of Australia’s defense exports.

Of the four, R&D investment and exports have been accorded the highest priority.

Although Australia’s main R&D organization, the Defense Science and Technology Organization (DSTO), has designed a few sophisticated weapon systems such as the Jindalee radar, its capabilities are limited. In fact, observers have commented that DSTO in effect represents a liability because of its limited interaction and cooperation with those organizations engaged in defense-related R&D (academic institutions, other government R&D organizations, such as the Atomic Energy Commission, and high-technology firms). In large part this weak link between government R&D and the defense industry results from inadequate government funding: defense R&D is approximately 3 percent of total defense outlays.

Since 1985 the Australian Government, in conjunction with the Ministry of Defense, has instituted a policy aimed at increasing overseas sales of defense products and services. The objective was to establish Australia as a regional “center of defense excellence,” given its already favorable position within ASEAN and the South Pacific. According to one Australian defense industry analyst such measures include the following:

1. technical and R&D assistance from related government departments, including use of government laboratories and test facilities;
2. marketing assistance through the Australian Trade Commission and in concert with defense personnel (embassy staff, endorsements provided by the armed forces, etc.);
3. provision of spares held in the ADF’s inventory to secure arms export agreements and speed delivery times;
4. offset credits for potential buyers of Australian defense products; and
5. joint ventures between Australian and overseas firms as a means of increasing export competitiveness.⁴¹ (Hawker de Havilland’s involvement in the McDonnell Douglas MDX helicopter project is a recent example.)⁴²

These measures were not only directed at securing a market niche for Australian firms in the international arms trade, but were also implemented to offset endemic balance-of-payments problems stemming from imports of foreign military hardware. (Approximately 23 percent of the total defense budget—in 1986-87 A\$1.72 billion—is spent on imports of defense equipment and related technology transfers.)⁴³

To date, Australian defense exports have been relatively modest. They vary from A\$100 million to A\$500 million per year and consist primarily of small arms and ammunition.⁴⁴ The largest importers of Australian equipment are from the industrialized countries (the United States and the United Kingdom). Still, Australia’s regional neighbors through the Defense Cooperation Program have been important purchasers as well. Indonesia has purchased Sabre aircraft, patrol boats, and Sioux helicopters. Papua New Guinea has imported Nomad surveillance aircraft, and Malaysia and the Solomon Islands have bought 16-meter patrol boats. However, the combined effects of overcapacity of production in world arms markets and Australia’s relatively small and unsophisticated defense sector suggest that Australia’s export potential will remain extremely limited.

⁴⁰Cited in Desmond Ball, “National Security Policy,” in O’Neill and Horner, *op. cit.*, footnote 37, p. 147. See also Dibb, *op. cit.*, footnote 39.

⁴¹See Graeme Cheeseman, “Australian Defence Exports,” *The Pacific Review*, vol. 2, No. 3, 1989, pp. 221-222.

⁴²P. Lewis Young, “Australia Abandoning Mind-Set of Fighting OtherGuy’s War,” *Armed Forces Journal International*, November 1989, p. 46.

⁴³Cheeseman, *op. cit.*, footnote 41, p. 221.

⁴⁴*Ibid.*, p. 220.