Chapter 8

Defense Industrialisation Through Offsets: The Case of Japan[1]

Michael W. Chinworth
The Analytic Sciences Corporation (TASC), Arlington, Virginia, USA
and
Ron Matthews
School of Defence Management, Cranfield Institute of Science & Technology, Cranfield, UK

8.1 Introduction

Technology transfer, particularly offsets, has been the driving force behind the development of post-war Japan's defense industry. Yet Japan's lineage of foreign military technology absorption has more distant roots, dating back to the establishment of domestic naval and ordnance industries during the latter part of the nineteenth century. This suggests that emulation of 'best-practice' Western techniques has been the goal of Japanese defense industrialisation. But this is only partly true: Japan's fetish of technologically 'catching-up' with Western countries represents simply the preamble to the longer term goal of surpassing them.

Moving from aphorism to actuality, it is difficult not to be impressed by the success that Japan has enjoyed in pursuing its technological ambitions. In the defense-industrial field, Japan by the 1990s has built up a substantial, diversified military-industrial complex. Currently, there are around 2,000 contractors registered with the Japan Defense Agency (JDA). Of these, the 10 biggest account for about 65 per cent of domestic defense production value.[2] In addition, over 90 per cent of Japan's military procurement requirements is serviced by local defense manufacturers.[3] The value of this defense business is not insubstantial, given that Japan's defense expenditure is frequently cited to be the world's third biggest.

Japan's defense production capacity has been built up through technology offsets, notably licensed production of US military systems. But before examining how direct offsets have acted as the supply conduit for specialist defense products and processes, it is worthwhile pausing momentarily to consider the

assertion that Japan lacks either a 'defense-industrial base' or an 'arms industry'.[4] This seemingly strange observation, clearly at variance with reality, is justified by reference to conventional appreciation of the term, defense industrial base. The commonly held view is that a defense industrial base emphasises three key attributes, all of which are absent in the Japanese case. These attributes reflect the lack of significant dependence on:

a. the production of arms or other related products;
b. large government-financed or – supported R&D programs as the primary incentive for corporate involvement in defense production;
c. arms exports (to increase economies of scale and thus reduce costs).

Although it is possible to quibble over the relevance and rigour of this proposition (it, for example, begs the question how 'significant dependence' is in practice to be measured, and why should any or all of these conditions necessarily define defense-industrial capacity), there is no contesting the uniqueness of Japan's defense-industrial approach.

There are several novel features of this 'model'. To begin, there is a constitution which explicitly bans war (the famous Article Nine), but which affords political interpretation to allow for 'defensive defense'. Article 51 of the UN Charter (providing countries with the sovereign right of self-defense) was called upon by early post-war Japanese Administration as partial justification for the creation of (self-) defense forces. There are practical, definitional problems here, however, not least of which is that the exercise of distinguishing between offensive and defensive weapon systems is often a meaningless task. Also, in addition to the constitutional difficulties facing Japan in the maintenance of a minimal defense potential, there are various policy positions that have been adopted by successive Japanese governments which: ban the manufacture, use and transit through Japan of nuclear weapons (three non-nuclear principles); and strictly restrict arms exports (three arms export principles) to countries that are Communist, subject to UN sanctions and are involved or likely to be involved in conflicts. The guidelines restricting arms exports were enunciated in 1967 when Japan was just beginning to indigenously produce warships and main battle tanks (Type 61). In 1976, Japan's arms export constraints were considerably hardened to cover all countries, over and beyond those restricted by the three principles. In 1983 the export restrictions were loosened slightly to allow defense technology transfers to the US.

At the same time, export of military-related production machinery, such as sophisticated machine tools, was also banned, as was Japanese participation in foreign-based arms production ventures. Furthermore, until recently, Japan's armed forces were not allowed to operate on foreign soil, even for UN peacekeeping operations. Japan endeavours to restrict defense expenditure to one

per cent of GNP, spending a relatively small amount, around 2.5 per cent of the defense budget on defense-related R&D. Finally, the value of defense production accounts for only 0.5 per cent of total industrial output; a relatively insignificant amount when compared to the major arms producing nations.

The novel features of Japan's 'model' will be discussed later in this chapter where it will be observed that the characteristics of Japan's defense industrial base do appear out-of-kilter with those of western defense industries. Yet the Japanese approach to defense production is looking increasingly apposite to the circumstances of the 1990s, where the traditional characteristics of defense industrial capacity are something of an anacronism. In the contemporary strategic context, the subtleties of Japan's defense production strategy are becoming tellingly relevant to a world transformed by: the absence of a cold war psychosis; the halving of global arms exports since 1987; a reoriented emphasis on military systems displaying the characteristics of flexibility and mobility; and a penchant displayed by international governments and electorates for, if not 'peace dividends' (increased spending on schools and hospitals), then reductions in the social opportunity costs of high defense spending (restraining growth in government deficits).

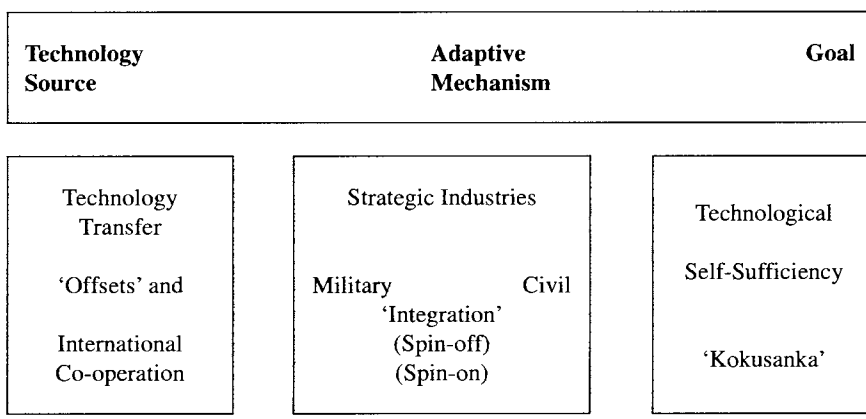
Japan's defense-industrial strategy spliced into the country's broader technonationalistic approach, the developmental reliance on offsets and the US-Japan defense technology relationship are the focal issues of this chapter. Section II assesses the role of technology transfer and strategic industries in securing Japan's military-civil objective of technological self-sufficiency. Section III profiles official offset policies in the development of Japan's postwar defense industry, and the important message emerging from this discourse is that political, economic and strategic pressures will likely in the short run justify continued rises in Japanese defense spending and further involvement in defense offset programs. While Section IV examines the general aspects of absorption and diffusion of foreign defense technology into Japan's defense sector, the subsequent two sections (V and VI) address the relative costs and benefits of defense offsets to both Japan and the US. The remaining sections (VII and VIII) deal with the relative cost of Japan's defense indigenisation programs and the dilemmas of international programs, including the frictions generated by offsets and Japan's perpetual search for technological advancement. The chapter concludes with a prognosis for the years ahead, and the contribution that offsets will make in the future development of Japan's defense industry. The development of strategic alliances, with perhaps European technology partners, may diminish Japan's dependence on the transfer of defense technology from the US. A gradualist redirection away from over-dependence on the US towards diversification in defense technology sourcing/sharing may thus signal Japan progressively charting a more nationalistic, self-reliant, defense industrial course.

8.2 Japan's Defense-Industrial Strategy

To comprehend Japan's defense industrial strategy, and the role defense offsets play within this, it is helpful firstly to understand the uniquely Japanese rationale underpinning 'security'. As a concept, security is broadly defined. Metaphorically, it is the hub of a wheel, with the reinforcing spokes comprising various economic, political, diplomatic, international and technological dimensions. Industrial and technological strength are viewed by the Japanese as key considerations in attaining security. The perceived close relationship between technology and defense has been a constant theme in modern Japanese development. From the start, influential Japanese taught that the advancement of independent knowledge and scientific competence were as necessary as military power to achieve security.[5] The modern translation of this philosophy is the notion of 'comprehensive security'. But although not incorporated formally into policy, it mirrors well Japan's philosophical approach towards security. Technology is power, providing the key to self-determination and autonomy.

Japan's defense industrial strategy is consistent with the logic of the country's broad model of technological development. This can be conceptualised by reference to the schema in Figure 1. As a constituent part of its industrial culture, Japan has sought control over its technological destiny. However, this requires local abilities to research, innovate, design and manufacture modern state-of-art technologies. Foreign direct investment in Japan has thus been eschewed by the authorities, preferring instead licensed production whenever possible.

Figure 1: Japan's Technonationalism Model



8.2.1 Kokusanka

Symbolising Japan's striving for technological self-sufficiency (and thus economic and military security) is the concept of *'kokusanka'*. Two American observers, Friedman and Samuels, offer the following observations on the concept, and how it influences Japanese thinking on technonationalism:

> From Meiji to the present, private and public procurement decisions have been guided by the three unwritten principles of *kokusanka*: 1) domestic supply; 2) if domestic supply is not possible, licenses should be secured using domestic manufacture and equipment; and 3) equipment should have broader application than specific to the project for which purchased.[6]

As a policy-approach, *kokusanka* was established in 1970 by the JDA Director General, Yasuhiro Nakasone. A 'Basic Policy Towards Defense Production' policy statement emphasised the need for defense production indigenisation, stating that:

> From the standpoint of autonomous defense, it is desirable for Japan to be defended with equipment developed and produced by Japan alone. From this point on the development and production of military equipment will be limited to Japanese industries as a matter of principle.[7]

Since the espousal of this policy position, there has been increasing domestic pressure for Japan to become self-reliant in arms production. A number of factors were responsible for this industrial orientation. There were firstly, security issues. The enunciation of Nixon's Guam doctrine around 1970 produced in Japan psychological after-shocks of seismic proportions. Importantly, there was a questioning of Washington's commitment to Japanese security. The sudden sense of isolation was heightened by President Nixon's unexpected visit to Peking, and his subsequent announcement, without prior consultation with Tokyo, that the world had moved from a bipolar to a multipolar economic and security system. The multipolar framework included China, traditionally an enemy of the Japanese. The Japanese security relationship with the US was also built around the argument that Japan was the bulwark against Communist expansionism of China and the Soviet Union.

There were also destabilising US-Japan issues in the economic sphere. The 1971 dollar devaluation, accompanied by the imposition of a 10 per cent import surcharge, negatively impacted on Japanese trade with the US and seriously undermined Japan's confidence in the US economy. The dollar crisis accentuated a growing unease in what was perceived as the relative decline of US economic power. This unease into the 1980s, especially in respect to America's continued military capability and commitment to defend Japan (and also its interests in Asia) which the Japanese felt were being enfeebled by US social and

economic malaise, including debilitating foreign and federal deficits. Not only were the Japanese funding the US spending gap but, to the angst of American public opinion, were also, through direct investment, winning an increasing share of local manufacturing output. Later much publicised comments on the demise and emasculation of American industry by Shintaro Ishihara and also Mr Sakurauchi, Speaker of the Lower House of Japan's Diet, in response to US 'Japan-bashing' further inflamed the susceptibilities of the US public and its politicians.[8]

Justification for *kokusanka* was also strengthened by frictions beginning to surface in US-Japan defense collaborative arrangements. There was a growing concern that only indigenisation would suppress the accelerating costs of reliability and maintainability of foreign weapons systems that Japan was incurring at the latter end of their life-cycle. In addition, there was disquiet at what were perceived as American attempts to impede the flow of comparatively more sophisticated defense technologies into Japan. The US 'black-boxing' of F-15 related technologies, for example, not only caused a relatively low local 'high tech.' content for the fighter (as a percentage of total aircraft value, the technology transfers were lower than the prior F-4 program, yet transfers for the F-15 may have been qualitatively superior) but, more significantly, a Japanese appreciation that the US were afraid of Japan's technological capabilities, and that reliance on the US for defense technology would thus form a structural barrier to the growth of all Japan's high-technology industries.[9]

In the 1990s, Japan's interpretation of *kokusanka* now has a greater emphasis on commercialism. In support of this, Friedman and Samuels state:

> The Defense Production Committee of Keidanren has justified kokusanka, which it has championed, in at least five ways: 1) Japan's unique policy of 'defensive defense' requires different equipment than that manufactured in Europe and North America; 2) the 'special spirit and body size' of Japanese military personnel, as well as Japan's special 'land, water and seas'; 3) licensing breeds dependence of the licensor on the licensee, ..[sic].. making upgrading difficult; 4) licensors are less willing to transfer technology to Japan, now that Japan's technological level has improved; and 5) co-development with other nations can succeed only if Japan has something of its own to offer. The significance of this and numerous other similar arguments is its almost total lack of any credible military rationales for autonomous weapons development.[10]

This final point is important. Japan's self-imposed policy of restricting arms exports robs domestic industry of scale. Combine this with the fact that off-the-shelf procurement of defense items from the US would be substantially cheaper (see evidence cited later in this chapter), then an additional defense-industrial rationale apparently exists, beyond either of those pertaining to economic or military considerations. While economic and military factors clearly do have roles to fulfil, using the defense industry as a technology 'driver' in securing indige-

nous civil technological development appears a plausible third rationale for local defense capacity. In consonance with other aspects of Japan's development strategy, there is a recognition that technological self-sufficiency is a long term goal.

8.2.2 Strategic Industries

Japan's mechanism for facilitating transition from technological serfdom to independence is via the promotion of 'strategic' industries through indicative and strategic planning. Emanating from policy discussion in 1970, the Japanese have fostered the development of what may be described as critical technology industries. There is not a tight definition of what constitutes a 'strategic' industry, but it is obvious it harbours the potential for generating: high value added production; rapid output growth; knowledge-intensive innovations; and horizontal and vertical industrial linkages with the wider economy.

There is a debate over whether US defense offsets have acted as a catalyst for developing Japan's strategic high-tech. industries. This debate has now crystallised into whether Japan is an ally or economic rival of the US. The fear is that rising bilateral technonationalism is creating fuzziness in the political bonding of the two countries.[11]

Undoubtedly, military spin-offs from US defense offsets have played a helpful role in the promotion of Japan's civil industries. Certain examples of spin-off stand out, not least the 'Bullet' train's brakes which are held to derive from local production of the F-86 aircraft, as well as other examples cited later in this chapter. Other less celebrated military spin-offs clearly do occur, including skills generation, process precision techniques and organisational efficiencies stimulated through defense offset work. The aerospace sector is a case in point, here. Around 75 per cent of Japan's aerospace production value is accounted for by military production.[12] However, because the aerospace industry is characterised by a high degree of industrial concentration, this means that incipient civil aerospace production is undertaken by the military aerospace manufacturers using the same premises, workers and even production machinery. Technological cross-threading such as this not only ensures synergy, but complements learning acquired through civil aerospace offsets. Although it is impossible to quantify the importance of such military spin-offs in aerospace establishments, such as, for instance, the Mitsubishi Heavy Industries plant where F-15 fighters are produced employing the same skilled operatives and process machinery as Boeing civil jets, it is clear a high level of integration is involved. The fruits of this civil-military production arrangement have been two-fold. Firstly, the growth in indigenisation. Note here, that Japan has made impressive strides towards self-sufficiency in component parts for aircraft; domestic manufacturers now supply almost 100 per cent of the polished skin for aircraft and

approximately 80 per cent of the country's requirement for titanium forgings is met locally.

Secondly, the deepening aerospace skill base has facilitated not only increased offset work, but also an ability to engage in more sophisticated production activities. In the defense area, Japanese firms are responsible for frontier development of co-curing composites on the FSX aircraft wing structures; indeed, 80 per cent of the aircraft, including electronics, will be indigenous. On the civil side, Japanese aerospace companies have achieved progressive expansion of work responsibilities through successive collaborative projects. In this respect, the case of Boeing is instructive:

> While there are 14 Japanese primary subcontractors to Boeing on the 747 and 737, there are 19 on the 757, and 24 on the 767. Seventy per cent of Boeing's foreign procurement for the 767 were from Japanese firms, and the Japanese value-added in each Boeing 767 reached, in some estimates, 30–50 per cent by 1991.[13]

Defense production investment through offsets has fostered several forms of beneficial spin-off, including industrial synergy and project management and systems integration expertise (especially under the FSX program). There is also the possibility that profits and overhead absorption under military programs have enabled Japan's defense firms to bid competitively on commercial contracts. Note in this regard, Mitsubishi's direct design and subcontracting links in Boeing's 777 project. However, the assertion that military offsets have sponsored Japan's civil technological development is overdone. The argument ignores the considerable physical and human capital resources Japan has accumulated through civil technology transfer and generations of substantial local educational investment. A more credible viewpoint is that defense offsets have furnished a military capability for Japan to produce and later develop comparable and enhanced weapons systems.

It is important to emphasise, however, that in contrast to the conventional understanding of the term, defense industrial capacity, Japan's defense sector has not been developed in technological isolation from other industries, rather it has been deliberately infused into the country's civil manufacturing base. Of course, this enables skills, techniques and organisational efficiency to be transferred via the traditional military-to-civil spin-off route. Significantly, however, it additionally provides an enabling mechanism for Japan's strategic civil, and also 'dual-use', industries to sponsor the technological advancement of defense products and processes. In this manner, innovations can be 'spun-on' from strategic industries to the defense sector.

Japan's strategic 'dual-use' industries, operating in the civil-military penumbra, have a wealth creating bias. They embrace, for instance, the aerospace,

telecommunications, electronics, computer, ceramic-packaging, automobile-bearing and machinery industries. These key industries are targeted and guided by the 'visible' economic hand of the planning authorities, including MITI, and funded and nurtured to realise long term 'dynamic' global comparative advantage.[14] As a consequence, these industries have enjoyed remarkable growth performance. Japan's 23 per cent of machine tool trade is the world's biggest. Kyocera is the world's largest producer of ceramic packaging. More bearings are now produced by Japan than any other country, including the US. The Japanese car manufacturers come close to dominating world production. Japan has the world's 10 biggest microelectronic chip producers. Even its aerospace sector, the cinderella of the international aerospace business, achieved the world's fastest turnover growth (8.5 per cent) over the 1980–91 period.[15]

The strategic industries' product sophistication is illustrated by a 1989 US Department of Defense Report, which stated that Japan leads the US in certain critical technologies that possess dual-use application.[16] For example, microelectronic circuitry, gallium arsenide and other compound semiconductors and robotics, being not only the growth poles for civil economic development, but also the critical technology inputs for enhancement of the military's capability in mobility, communications and systems integration.

Civil-military technology sharing is a manifestation of a wider cooperative trait, representing a further distinguishing characteristic of Japan's defense-industrial model. While governments of western defense industries grapple with the trade-off between competition (choice and market forces) and concentration (scale), Japan has seemingly resolved the dilemma by treating these two factors as complementary rather than mutually independent. Competition occurs at the initial stage of bidding for development contracts, but thereafter, work is shared between the primary contractor — the winning bidder, and its sub-contractors — the losing bidders to the contract. Notably, the relationship is one of sharing technologies, efficiencies and innovative designs; a truly integrative, cooperative approach. In a typical case, 65 per cent of a Japanese prime contractor's work is subcontracted. Of total subcontracts, 20 per cent goes to other primes; 45 per cent is directed to domestic specialist parts suppliers; 17 per cent is accounted for by work let to 'back shops' or manufacturers with close links to the primes; and 18 per cent is spent on imports.[17]

This work sharing, cooperative aspect, has in part been cultivated because of the oligopolistic structure of the defense industry. 'Competition amongst the few' has in turn encouraged a high degree of technological cross fertilisation, whereby different though related civil-military collaborations with leading foreign defense manufacturers have led to a substantial build-up of technical expertise in a small number of industrial 'champions'.

Finally, it is important to make reference to Japan's unique defense R&D approach. The relatively low defense R&D spend, at 2.5 per cent of the defense budget, belies the important role this R&D funding plays in advancing defense production. There are two aspects of Japan's defense-related R&D requiring comment. Firstly, overall R&D expenditure is now roughly equivalent to that of the US.[18] But while around 50 per cent of US R&D spending is devoted to the military sector, approximately 80–95 per cent of Japanese spending — both public and private — is dedicated to commercial applications.[19] Emphasis on commercially oriented R&D not only maximises the socio-economic return to Japan, but the approach also facilitates viable spin-ons to the defense industrial base. A good example of this process is the manner in which the private sector has sponsored the development of the FSX fighter support aircraft's advanced phased-array radar. The Japan Defense Agency did not directly pay for any of the development of the underlying gallium arsenide chip technology, which was undertaken by a number of Japanese companies, including Mitsubishi Electric Co (MELCO) and Sumitomo Industries.[20]

A second facet of Japan's defense R&D model has regard to the role of the public sector Technical Research and Development Institute (TRDI). The TRDI has only modest funds available to support defense R&D, but this misreads its purpose. Its primary aim is not to act as a funding agency, but rather as a facilitator of potential defense-related technologies. The TRDI contracts provide seed finance for promising technologies already under development in the private sector. The requirement that at least 50 per cent of the funding must come from the private sector partner enables TRDI to extend its financial support to hundreds of fledgling projects in the private sector.[21] Of course, as is the case with western defense contractual arrangements, in the event the project goes to full-scale production then the company's R&D investment will be recovered in product price.

However, the practice of overhead recovery needs to be qualified, depending on the nature of the contract, whether it is competitive or non-competitive. For instance, in the UK, companies with non-competitive contracts (where R&D costs are unpredictable) will enjoy government funding set against development milestones. In the US, the defense contractual system is characterised by an even more generous degree of government financial support. Not only is the R&D element 100 per cent borne by the US government in respect of defense contractors under contract, but when 'competitive' R&D is conducted for the purposes of a new program (for example, the F-22 project) defense contractors can often recover parts of their investment *even if they lose the competition*. Currently, the US Department of Defense is considering reforming this system in favour of the Japanese approach which requires manufacturers to share the risk by investing in R&D and prototype development.

Defense R&D funds allocated to the TRDI have risen from below 1 per cent in the mid-1970s to 2.6 per cent in 1994 fiscal year (FSX prototypes account for 70–80 per cent of this budget). Reflecting Japan's focus on the development of state-of-art defense technologies, there have been calls recently for a doubling of defense R&D funding to 5 per cent of the defense budget. As Japan's defense R&D funds directly and indirectly promote local defense capability, it is likely that increased R&D funding if it were to materialise would reinforce the intermediate indigenisation-through-offsets effort, contributing towards greater longer term defense self-sufficiency.

8.2.3 Offsets

Defense offsets, the concern of this chapter, provide the technology source. Offsets have been a common feature of the technological development of modern Japan. Whereas in the late nineteenth and early twentieth centuries the technologies transferred were mostly from the then 'great' industrial power, Britain, in the post second world war period, technologies have flowed from the contemporary great industrial power, the US. A tenet of offset arrangements, however, is that they involve reciprocity. This used to be straightforward. Japan would procure defense items from the US, and as a *quid pro quo* the Japanese would be allowed to license produce the defense item. Offset arrangements are decidedly more complex today, now that Japan's defense-related industries are almost at technological par with their US counterparts.

American defense offsets to Japan have recently become a controversial issue because the relative costs and benefits of offsets to Japan and the US have changed now that the Communist threat has all but disappeared. Washington expresses particular concern over critical technologies haemorrhaging to Japanese defense establishments. The Americans argue that these outward flows provide the potential for future Japanese competition, the further erosion of the US' defense industrial base, and a threat to the economic viability of America's strategic industries. Tokyo, on the other hand, accuses the US of technological imperialism, because of its refusal to transfer frontier defense technologies in offset packages.

Politico-economic friction aside, defense offsets have earned US contractors substantial revenues since the 1960s, and on the Japanese side, have made a significant contribution to the indigenisation of Japanese defense production. The aerospace sector, designated a *kiban gijitsu* (key technology) by MITI, has made substantial progress in this respect: the F-1 fighter incorporated a Japanese fire control design; the T-4 — an intermediate jet trainer — was the first post-war aircraft for which the fuselage and engine have been developed in Japan; over

80 per cent of the equipment and materials used in the Japanese P3-C (Orion) are being acquired domestically; and the FSX fighter aircraft will have locally developed and produced software source codes as part of a suite of locally produced electronics equipment. Other aerospace developments include participation in the development and coproduction of the V2500 turbofan engine and local development of a next generation of assault helicopter.[22] Moreover, mostly all Japan's air defense missiles are now indigenously produced. But, of course, much of Japan's domestic defense production is undertaken under license.

In the naval area, all Japanese combat vessels are domestically manufactured. For example, Mitsubishi Heavy Industries (MHI) and Kawasaki Heavy Industries are producing one *Harushio* class submarine annually. Decommissioning of naval craft occurs much earlier in Japan, making Japan's navy one of the youngest — in terms of hull life — in the world.

Finally, the Japanese have made considerable progress in developing local production capabilities in land equipment. Japan Steel Works produces artillery pieces under license from numerous foreign defense contractors, including Royal Ordnance and Oerlikon-Buhrle. Japan has also reached near self-sufficiency in producing the full range of infantry weapons. There is a division of labour here, with Minebea, the bearings manufacturer, specialising in pistols and machine guns, Howa Machinery, in rifles, and Sumitomo Heavy Industries in light machine guns. Komatsu, the manufacturer of civil heavy earthmoving equipment, produces armoured bulldozers. Mitsubishi Motors, Hino, Isuzu, Toyota and Nissan provide self-sufficiency in 'B' vehicle production. These dual-use vehicles are also controversial exports. For instance, Toyota 4 × 4 vehicles have been linked to the 1980s Libya/Chad and Spanish Sahara conflicts. Indigenisation-through-offsets has also characterised the production of main battle tanks (MBT). Until recently, the mainstay of Japan's tank force was the Type-74. This 38 tonne MBT was produced by MHI, with the tank's 105 mm gun manufactured under license from Royal Ordnance. The Type-74's major subsystems are of Japanese design and production. Currently, JSW is the prime contractor for the 50 tonne Type-90 MBT. JSW is producing this tank's 120 mm smooth bore gun under license from the German company, Rheinmetall. Among several advanced features, the Type-90 tank employs composite armour using fillers developed by Kyoto Ceramic, with assistance from the TRDI.

8.3 Postwar Offset Developments

Throughout the postwar era, the Japanese government has favoured importation of foreign technology to help stimulate local industry. Indeed, this pattern of

technology flows was established well before 1945, reflecting Japan's approach toward economic development as a whole.

The postwar defense industry, after being decimated by war and disassembled by the Occupation authorities, was soon reconstructed. With the establishment of a legitimate defense force in 1954, government once again looked toward foreign technology as a matter of policy to assist this rebuilding. Government policy statements to this effect have been clear and direct.

Japan's drive for defense industrial self-sufficiency can be explained by other factors as well. It is important to establish the government's rationale for maintaining a certain level of defense capability despite its longstanding security relationship with the United States. The first official Defense White Paper in the postwar era, published in 1970, spells out the justification:

> [A] nation must not harbor vague expectations toward its partner or fall into dependence upon it, seeking to be saved by the partner. Such expectations and dependence will involve the danger of not only implanting a sense of irresponsibility toward national defense among the people, but also of degenerating the national spirit ... It is necessary to establish an autonomous defense system with the aim of defending our own country by ourselves and to develop the means of effective mutual cooperation within national consensus.[23]

Thus, two rationales were evident in JDA's early thinking: first, a nation could not be expected to maintain its side of the security bargain with the United States without having its own defense capabilities. Second, failure to do so would lead to lax attitudes in defense, and thus undercut the security relationship.

8.3.1 Official positions regarding offsets

Subsequent position papers have spelled out the strategic, economic, political and technological rationale for a domestic defense industry. Although the tone of official statements has varied slightly over the years, the general thrust of government policies has remained consistent. Japan has made clear its desire to develop a domestic arms industry, relying on foreign technology only as needed. The second White Paper continued the themes of the first in this regard:

> Through indigenous research and development, it is possible to develop defense equipment fully suitable to the nation's terrain and situation, and such equipment can be easily maintained and supplemented. Second, developmental capability for defense technology will expand and improve, exerting a beneficial effect on industry. As a result, self-supporting maintenance and control of defense equipment becomes possible, and potential defense power can be cultivated.[24]

Having outlined the philosophy behind defense industrial production, the Defense Agency went on to describe the role of foreign producers:

Defense equipment which requires highly advanced technology for development, and cannot be realized with domestic technology or would necessitate enormous development costs, has been domestically produced through foreign license agreements. This has not only accomplished the acquisition of manufacturing technology, but also eased maintenance and resupply.

When equipment cannot be developed with domestic technology, or if production volume is limited so that licensed domestic production is too costly, procurement is made through importation.[25]

This policy established Japan's priorities: domestic development, licensed production, importation. The last clearly is the final option, and given consideration only when very limited volumes and/or exceedingly costly high tech items are involved. In most cases, the Japanese government has insisted that for major weapons systems, domestic options are less expensive. One of the significant points to note with the 1976 statement is that it was made as Japan was moving to consider the purchase of advanced fighters and missile systems (F-15 and later Patriot SAMs), so one can assume that the posture was articulated in this fashion in part to strengthen the government's negotiating leverage.

With major procurement decisions out of the way in several areas in the mid- to late-1980s (F-15 fighters, E-2C anti-sub aircraft, etc.), Japan could turn increasingly toward domestic development with the aim of fielding more systems that were 'home grown'. The pattern fits its tendency for import substitution evident in other commercial fields. In this case, Japan had by the early 1980s moved from an aid dependent importer of US systems to a producer of US systems with increasingly high offset levels. As it began to supplement this work with independent R&D, it could posture itself so that it could pose a challenge to traditional suppliers. In the short term, this increased its bargaining leverage with the US when dealing with offset and technology licensing issues. In the long run, it supplemented plans to develop autonomous capabilities.

JDA outlined the perceived need for increasingly independent R&D as follows:

The remarkable progress of science and technology in the industrialized countries has brought about major changes in military strategies and tactics. Consequently, the modernization of equipment has come to occupy an important position in the effort to maintain military power.

Advanced military technology also has a far-reaching ripple effect on civilian demand. For this reason, military research and development programs in various countries are being promoted also in hopes of generating such a spill-over effect.

Regarding defense-related technology in Japan, initial research was designed primarily to improve the equipment supplied by the United States. The country [Japan] was also preoccupied initially with the introduction and assimilation of technology from other countries. However, the level of Japanese defense technology has now reached the point where the country is capable of developing its own equipment ... which we believe are no worse than comparable technology in other major countries.[26]

The rationale for continuing these activities is evident: Japan was growing concerned after its F-15 experience about losing access to advanced technologies:

> Of late, major nations have tended to become extremely cautious about exporting their up-to-date technology, although they are eager to export equipment in the form of finished products. Under such circumstances, it will be necessary for this country to establish a better R&D system in order to manufacture new types of equipment independently.[27]

In general, the three priorities noted above (domestic development and procurement, licensed production and importation) remained unchanged, although the shift clearly was toward greater reliance on domestic capabilities. In this context, offset programs had to be re-examined in the light of Japanese autonomous defense development capabilities. For the most part, however, the United States remained more concerned with providing equipment as part of Japan's larger commitments to its self-defense rather than the economic consequences. It was only with the FSX debate that the priority in the US shifted to economic factors (or at least assumed equal status with security considerations in offset policies).

The 1980 White Paper also noted US standardization efforts within NATO, and urged cooperation with those efforts. However, it also noted that Japan was unique, implying that while it might cooperate with US/Europe common R&D programs, it would not necessarily commit to common equipment development from those programs.

As defense spending/procurement increases reached a peak in the late 1980s, the Defense Agency pushed harder towards more complete domestic development, outlining its rationale for increasingly independent capabilities in the following manner:

> ... it is particularly important to continue efforts to maintain and improve the technological standards related to military equipment required for national defense in years to come. Japan is the second largest economic power in the Free World and has a high level of industrial technology capable of independently carrying out research and development projects in the field of high technology. The Defense Agency is conducting research and development by taking advantage of technological expertise accumulated in the private sector ... It has been increasingly necessary for the country to direct more positive efforts to research and development on equipment.[28]

Heavy reliance on the private sector was reinforced by a reorganization in July 1987 that eliminated minor research programs that could be pursued more effectively by private sector research facilities. In addition, the TRDI's role was defined to include research that lacks an immediately identifiable demand in commercial sectors. This could be an important development for TRDI's institutional role, perhaps representing a judgment by JDA that fielding advanced weapons systems will require selective development of specialised technologies with primarily military applications.

At the same time, however, a flexible approach was emphasised to maximise the utilisation of commercial technology in military systems — all with the ultimate aim of making Japan equal or superior to other countries in terms of its defense technology base.[29] This outlook is summarized in the 1993 White Paper:

> The Defense Agency will positively utilise the private sector's technology on the basis of its excellent technology in the field of microelectronics and new materials including ceramics and composite materials. Particularly in the area of basic research the Defense Agency will rely heavily on the technology pooled in the private sector. Furthermore, the Defense Agency, carrying out a technological research project to integrate private technology into future high-technology equipment, will build it up as a system that will meet the unique operational requirements of this country. Accordingly, the Defense Agency will achieve effective improvement of superior equipment capable of competing with technological standards of foreign countries.[30]

With the emergence of the FSX program, the JDA devoted greater attention towards the rationale and benefits to Japan of cooperative R&D. Joint research and development is considered to be important from the standpoint of not only developing effective equipment through incorporating advanced Japanese and US technologies but also promoting defense cooperation between the two countries.[31]

Thus, the Japanese government shifted its posture on total autonomy in defense equipment, recognizing bilateral cooperation as an interim measure in reaching long term goals of developing a self-sustaining defense research, development and production capability. It also reflected a realisation that Japan could not, in fact, embark independently on projects as ambitious as replicating an F-16 fighter.

Nonetheless, long term objectives have not been abandoned, as indicated in a subsequent White Paper:

> Research and development on next-generation support fighter aircraft, various guided missiles and other equipment and material will be promoted. Efforts will be made to enhance research and development, and to conduct research contributing to basic advanced technology in relevant fields.[32]

That is where JDA currently stands: something in limbo, caught in an uncertain threat environment, with a comprehensive review of security policies still under way, and political changes in the short and long term that could later alter the government's attitude on defense programs. The JDA remains committed to independent capabilities, but recognizes the political necessity of remaining tied with US R&D and production. This necessity is underscored by Japan's own cutbacks on procurement. Thus, as an interim measure, Japan probably will remain allied with the US for the foreseeable future, in terms of both formal security relations and its procurement decisions, at least until the budgetary situation clears up in Japan.

The present stance on the domestic defense industry has moderated somewhat since the high growth periods of the early to mid-1980s, but still retains a focus on domestic development wherever possible. At one level, justification remains — as far as JDA is concerned — for the maintenance of at least the present level of forces and defense production capacity despite signs of relaxations in tensions in the world as a whole and in the Asia/Pacific region in particular as a prudent posture that will help assure that the positive signs evident in the region will continue. The JDA feels that even though the security situation in the area may be relaxing, a minimal defense capability remains desirable.[33] The JDA has become more circumspect in its support for domestic industry, noting vaguely that the 1976 National Defense Program Outline (NDPO) states that 'the posture of each service must be basically maintained with due consideration to qualitative improvements aimed at parity with the technical standards of other nations.'[34] This suggests that domestic industry and the Self-Defense Forces must maintain certain capabilities, but it does not explicitly state what types of capabilities, or where they are to come from, thus reflecting the present unsteady and uncertain state of defense production in Japan.

8.3.2 Threat Perceptions and the Need for Local Defense Capabilities: Justification for Offset Arrangements with the United States

There has been an intricate logic linking threat perceptions in Japan with the need for defense spending and a justification for local production and thus offsets from the United States. The perceived threat of the former Soviet Union — felt more strongly in the United States than perhaps in Japan — served as the justification for expanding Japanese defense spending from the late 1970s through the early 1990s. The JDA has argued for higher spending throughout its existence despite several distinct phases Japan's relations with the Soviet Union. The 1976 National Defense Program Outline, for example, was developed under the assumption that the United States and the Soviet Union would continue in a state of *detente* for the foreseeable future. Nevertheless, higher funding was justified consistently since then, first in order to meet the goals of the 1976 Outline, then under the justification of an increasingly hostile Soviet Union. While ties have not turned around completely, the JDA continues to request higher spending, now in order to maintain the gains made over the past decade in fulfilling a plan that originally was developed with a less hostile state of global affairs in mind.[35]

An expansion of Japanese roles and missions, beginning in the late 1970s and continuing throughout the 1980s, further justified higher emphasis on defense spending in general, and autonomous defense production in particular. For example, the Carter Administration formalised defense guidelines with

Japan in November 1978. These called for greater coordination between US and Japanese commands, joint planning for the defense of Japan in case of external attack, stepped-up joint military exercises, and mutual logistical support.[36] Former Prime Minister Zenko Suzuki agreed in May 1981 to assume responsibility for defending the sealanes approaching Japan to a distance of 1,000 nautical miles. (This zone encompasses the waters between Japan and the Philippines, swinging east from the Philippines to Guam.)[37] US and Japanese officials subsequently completed a joint sealane defense plan for the waters around Japan in December 1986. While this plan remains classified, it is worth noting that US officials had proposed in 1981 sea control missions for Japanese naval and air forces as well as the capability to close off three critical straits around the country (Tsushima, Tsugaru and Soya) to potential aggressors.[38] One of the difficulties facing policymakers today is that these commitments remain a part of established Japanese defense policies despite the changes in global and regional circumstances, contributing to pressures to continuing increasing defense spending at a time when most nations are reducing their budgets. Japan's recent acquiescence to United Nations peacekeeping roles reflects this situation.

Collectively, these commitments create a justification for continued defense spending and local defense production. Local production, in turn, warrants offset arrangements from the United States to compensate in part for Japan's willingness to assume greater defense burdens. (And it should be noted that the depth of conviction in Japan regarding the threat posed by the former Soviet Union has been a matter of longstanding debate.)

Restraints exist on Japan's defense spending that, in turn, hamper its ability to expand local production despite offset agreements. The country's total defense spending has been limited by policy and/or practice since 1976 to an amount equal to 1 per cent of the country's gross national product. Economic growth has enabled the defense budget to reach a significant level, but manpower requirements consume nearly half of the Japan Defense Agency's total spending (41.8 per cent of fiscal 1993's budget, for example, although this is a measurable decline from 45.1 of just eight years earlier), reducing the amount available for procurement.[39]

8.3.3 The Defense Plans

Japanese defense procurement has been orderly and predictable throughout the postwar period, only recently coming under the kind of intense scrutiny that defense budgets faced prior to the phased-in buildup periods. The buildup periods in the 1960s and most of the 1970s focused primarily on establishing some semblance of a genuine military force in the wake of US troop withdrawals and,

in the mid-1960s, the suspension of military aid. These procurement programs took place over the 1958–61, 1962–66, 1967–71, and 1971–75 Japanese fiscal year periods.[40]

8.4 The Defense Industry and Foreign Technology

No country has received more licenses of military systems from the United States in the world than Japan. Between 1960 and 1988, the US licensed 28 major weapons systems to Japan; the second largest recipient over the same period was Italy, with 22 major system licenses. Taiwan and South Korea combined had 22 over the same period of time.[41] Recent licensed production programs include the following which are illustrated in Table 1:

Table 1: Selected Japanese Defense Programs Under License Production

Aircraft (fixed wing):
F-86
F-104 Starfighter (Lockheed)
F-4 Phantom (McDonnell-Douglas)
F-15 Eagle (McDonnell-Douglas)
F-16 Falcon (General Dynamics; base aircraft for FSX development programme)
P-3C Orion (Lockheed)

Aircraft (rotary wing):
KV-107/2A (Boeing)
CH-47D Chinook (Sikorsky)
UH-60J (Sikorsky)
UK-1H Huey (Bell)
AH-1 Cobra (Bell)

Missiles:
Nike Ajax surface-to-air missile (McDonnell-Douglas)
Nike Hercules surface-to-air missile (McDonnell-Douglas)
MIM-23 Hawk surface-to-air missile (Raytheon)
MIM-104 Patriot surface-to-air missile (Raytheon)
AIM-7F Sparrow air-to-air missile (Raytheon)
AIM-9L Sidewinder air-to-air missile (Raytheon)
BGM-71C I-TOW anti-tank missile
Multiple launch rocket system (MLRS — LTV/FMC)

Others:
M-110A2 203-mm self-propelled howitzer

Foreign inputs into Japanese industry are nothing new. Foreign technology inputs were critical in the development of Japan's defense industry almost up to the outbreak of World War II. The US Strategic Bombing Survey, for example, noted after the war's conclusion that:

> the Japanese aircraft industry owed more to the US than it did to its own government. ... United States fighter and bomber pilots fought against aircraft whose origins could be traced back to United States drafting boards. Many Japanese engines and propellers came from American designs which had been sold under license in prewar years. Many top Japanese aeronautical engineers could claim degrees from Massachusetts Institute of Technology, Stanford and California Tech. Their best production men had served apprenticeships with Curtis, Douglas, Boeing, or Lockheed. Here and there, war-time German influence was evident, especially in the jet- and rocket-powered types that never became operational, but it can be fairly stated that the Japanese fought the war with aircraft on which the strongest influences in design were American.[42]

The period following the Korean conflict was fundamental in establishing attitudes within Japan involving the value of imported technology and techniques in general and defense related methods in particular. Much of the postwar period is characterized by an attitude that military technology and production methods represent the leading edge of advanced technologies, suitable for both infusions into the general economy and stimulating the economy through a 'pull-effect.' The visible influence of US military orders in Japan during the Korean conflict and immediately afterwards had a great impact on this attitude (although it must also be said that the depressed state of the Japanese economy at that time made any infusion of orders, technology and production techniques welcome).

US stimuli came through several sources with equally diverse technology transfer implications. Direct orders for military forces in Japan came in such areas as uniforms for GIs (thus providing a boost to the local textiles industry), aircraft spare parts production, engines — mostly spare parts — for trucks and military Jeeps, complete trucks (10,000 were procured in the Korean conflict period), ship repairs, ammunition, licensed radio production (from RCA through the US military, leading to the establishment of that industry in Japan), materials (especially steel) and other areas (see Table 2 for total procurements in the early postwar period). In addition to the stimulative impact of these orders, Japanese industry gained direct training and experience in production/industrial engineering, production control, quality controls, inventory controls, standardisation of production of advanced products, and other fields. Japanese companies tended to be favoured with the most advanced techniques at that time, due to the US military's emphasis on meeting its own standards.[43] At the peak of the Korean conflict, US forces in Japan directly employed over 270,000 Japanese citizens, over half of them in technical fields. While it would be an overstatement to credit these foreign inputs for the complete revival of the Japanese economy, they certainly were a factor.

Table 2: Special Procurements By US Forces During the Korean Conflict

Contracts of $10,000 or more	
Year	**Value ($)**
1950	328,922,000
1951	331,520,000
1952	476,426,000
1953	158,614,000
Total:	1,295,482,000
Total US Military Procurement in Japan	
Contracts of $10,000 or more	
Year	**Value ($)**
1956	256,871,000
1957	316,789,000
1958	200,453,000
1959	198,894,000
1960	171,534,000
1961	165,651,000
1962	222,441,000
1963	151,644,000
1964	144,971,000
1965	151,982,000
1966	206,450,000

Source: US Department of Defense; Daniel L Spencer, 'Military Transfer: International Techno-Economic Transfers via Military By-Products and Initiative Based on Cases from Japan and Other Pacific Countries', Defense Technical Information Center, Defense Logistics Agency, AD6606537, March 1967, pp. 52, 56.

These procurements represented on average, 75 per cent of total US military procurements in the Asia/Pacific region during the Korean conflict.[44] Military aid, support for US and Japanese military forces, and other financial sources provided additional economic stimuli to Japan during this period, underscoring the belief in industry circles that defense production could be profitable and a positive benefit to the economy.

The Vietnam war proved equally profitable in some respects for Japan, although by this time the relative impact on the Japanese economy was far smaller due to its rapid growth in the 1960s. Nevertheless, adding in such

expenditures as expenses by US GIs during 'rest and recreation' (R&R) leaves in Japan, take estimates of the net inflow to the Japanese economy during this period to as high as $2 billion.

8.4.1 War as a Profit Making Activity

As early as the Korean War, US defense planners saw the utility of Japan serving as a forward line of defense in Asia, providing both a base for US forces in the region and a source of logistical support. With no domestic airlines or official military forces of its own, Japan resuscitated its domestic aircraft industry in 1952 by manufacturing spare parts for US military aircraft based in Japan — a full two years before the establishment of either the Self-Defense Forces or the Japan Defense Agency. Total aircraft production in Japan rose from ¥23 million in 1952 to ¥2,091 million the following year. During the period between 1952 and 1954, demand by the US armed forces in Japan constituted between 60 and 80 per cent of total aircraft production. The Japan Defense Agency gradually supplanted the US presence and by 1958 over 80 per cent of total aircraft production was directed to JDA needs.[45] The Pentagon also stressed the military advantages of US and Japanese forces using US-designed weapons in common, a theme that continues to this day.[46]

All these factors contributed to perceptions within industry circles that military production could be beneficial to the Japanese economy and individual businesses. This has not been a universally held view, of course, but has contributed to periodic pressures by industry and some government officials to import military technologies and expand defense production in Japan. As long as Japan remained under the US security umbrella, it was in a position to profit from these programs. These and other considerations provided incentives to Japan for importing US military technology through licensed production programs.

When the Pentagon has denied technology transfers to Japan, more often than not it came in the name of denying potential loss of the technologies into unfriendly hands rather than out of economic concerns. It appeared to be most concerned over threats that such technology could fall into the hands of the former Soviet Union or other unfriendly powers.[47] The Defense Department rejected the request of the Japan Defense Agency that Japanese firms have access to all software in co-producing the Patriot missile, including the guidance and target identification components.[48] Similarly, the Defense Department withheld data on electronic systems, radar equipment, and compounds used in the body of the F-15. In those instances, economic factors did enter into play, but the primary concern remained the loss of technology into Soviet hands.[49] Subsequent reviews of the F-15 and other MOUs often have resulted in the Defense Department releasing some materials technology and other previously withheld items.[50]

8.4.2 The Defense Industry and Diffusion of Technology Through Offset Programs

The number of major players in the Japanese defense market is limited, although, as mentioned in this chapter's introduction — over two thousand firms are registered with JDA as suppliers to the agency and the Self-Defense Forces.[51] This includes suppliers of more mundane items — shoes, clothing, etc. — and also higher technology firms that produce more advanced weapon systems. Mitsubishi Heavy Industries is by far the most important contractor, accounting for one-fourth to one-third of all defense production over the last several years (taken as a whole, the Mitsubishi group accounts for an even higher percentage). The top 10 contractors account for about 65 per cent of total outlays.

At the 'teeth end', Japan's defense contractors have gained from the government's technology, offset and diffusion policies. An important feature of the Japanese approach is that imported know-how has been channelled to specific contractors. The missile industry, for example, has benefitted from this form of industrial targeting. In missile production, a small nucleus of Japanese companies have combined foreign and domestic resources to develop both new and improved versions of existing missile systems. The ASM-1 anti-ship missile, which was developed as a replacement to the US-supplied Harpoon, emerged from this strategy.

The Defense Agency is using the technology from this missile in the current development of the SSM-1 surface to ship missile.[52] Military missile research, design, and production is proliferating into surface-to-air missiles, air-to-air missiles, anti-tank missiles, and even Cruise missiles.[53] Missiles thus represent a leading edge of Japan's effort to produce wholly domestic models of advanced weapons, as well as future research and development thrusts — perhaps even despite the current downturn in defense funding.

Most Japanese defense contractors are multifaceted companies, which produce mainly civilian goods. Defense production has fluctuated but as previously mentioned accounts for only a tiny proportion of Japan's total industrial output and defense related sales, representing small percentages of total sales for most companies.[54] For example, only 15 to 25 per cent of Mitsubishi Heavy Industries' total sales have been in military equipment over the past decade, even though it consistently has ranked as Japan's number one contractor over the same period.[55] Many companies continue to diversify and de-emphasise defense sales as the short-term prospects in the defense market darken (in contrast to the 1980s, when firms diversified in order to emphasise defense related sales).[56] On the one hand, this had led to concerns that licensed technology finds it way into commercial products. On the other, it means that few major contractors are solely dependent on defense related sales for their survival.

Defense sales have dominated certain sectors. For example, over 80 per cent of the value of Japanese aircraft production goes to the Self-Defense Forces. Defense sales also play an important role in electronics. Just over four per cent of total shipbuilding is in the defense sector, an insignificant figure in terms of its overall impact on the industry but important because of its stability and reliability during lean years. 'Dual use' technologies that 'spin on' from the commercial sector are becoming increasingly important in defense production strategies, as they are to the overall development of the Japanese economy.

The dominance of military sales has been cited by many outside analysts as evidence of Japan's larger plans to build its aircraft industry through offsets and licensed production programs. Past attempts to develop commercial aircraft have been largely unsuccessful, leaving Japan's industry dominated by the production of military aircraft.[57] In the 1980s the government and industry emphasised co-production and co-development with foreign firms, both on the military and civilian sides. Military production has given Japanese firms opportunities to develop airframes, avionics and jet engines. Electronics companies in particular have participated in aircraft production to gain an additional outlet for electronics technologies used mainly in civilian products. On the other side, Japanese technology specifically developed for military aircraft, like radar systems and airframe materials, could have potential applications to commercial aircraft as well as more advanced military aircraft like the FSX fighter.[58]

8.5 Specific Programs: Industry/Government Motives; Benefits to Japan

Offsets have been most noticeable in the aircraft industry, an area of high priority for Japanese government and industry since the Occupation authorities banished Japanese producers at the end of World War II. Partly as a matter of pride and partly as a matter of economic stimulus, both industry and government leaders viewed this sector as key to the future of Japan and a number of related industries. Military production at times has been viewed as one avenue to achieving the dream of bringing Japan back into the ranks of producers of world class aircraft.

There has been a lengthy debate concerning the long term intentions of industry and government regarding the use of military programs to stimulate the domestic aircraft industry. One view (Samuels and Whipple)[59] sees the emphasis on military production as a shift from earlier failures to launch independent commercial ventures, with military aircraft seen as technological stimulants that will pull domestic aircraft production along with related critical support indus-

tries. This view sees consistency in long term Japanese efforts, with government essentially a committed party to the development of a domestic aircraft industry almost at all costs.

Other analysts (e.g. Green)[60] see conflict throughout the postwar period, with industry and government seeking comparable goals, but often at odds with one another concerning the most effective means of achieving them. While the shades of difference in this view are not dramatically different from the earlier school of thought, the tactical differences between and within government and industry circles have often affected the choice of specific systems over the period.

Hall and Johnson[61] provided the classic analysis of the Japanese aircraft industry and the US role in developing it. Hall and Johnson illustrated the systematic approach of Japanese companies to absorb and disseminate technology from major US aircraft manufacturers throughout the fledgling Japanese industry. Certain characteristics of this long term technology 'pooling' process are worth noting. First, a select handful of Japanese companies were involved, each focusing on different elements of the industry or specialties within the aircraft. For example, Ishikawajima-Harima Heavy industries has been the 'designated producer' of engines in the industry, with Kawasaki assuming a secondary role. Mitsubishi Heavy Industries was from the outset the primary aircraft producer/systems integrator. Other companies focused on tail sections, avionics, wings, etc. Moreover, firms tended to cluster by aircraft type, with Mitsubishi focusing on fixed wing and Kawasaki and Fuji serving as the primary producers of rotary winged aircraft.

The second feature is that most US firms worked in isolation of one another *and* their Japanese collaborators. Few US firms had the integrated approach and perspective that characterised the Japanese approach during this period. Most worked in isolation, concerned primarily with their own short term profit perspectives, secure in the knowledge that the incremental information or assistance provided Japanese firms, in and of itself, would be insufficient to transform the Japanese firm into a major competitor. (Collective knowledge and experience was another matter.)

The third, and perhaps most important element, was that the US government for a long time had encouraged these transfers, and individual companies at the prime contractor level were well aware of the significance of their assistance to Japanese firms. The US government felt throughout most of the postwar period that Japan represented a special case in terms of military production and the assistance it should receive in producing military systems. While not blind to the potential competitive implications of these transfers, government officials for the most part have sided with transfers under the assumption that it was necessary to encourage transfer of production technology to Japan for a number of

reasons. These included: the fact that as a more pacifist nation, such offsets were required to encourage purchase and deployment of advanced weapons systems; the desirability of having firms in this forward deployed area familiar with US systems in the event of a conflict; and, the attractiveness of offsets to Japan as a means to assure long term political and military alliance with the United States.

While economic factors were not ignored, for the most part Japan was not viewed as a competitor or potential competitor through these and other programs for several reasons. First, production volumes were too small to achieve economies of scale and thus the efficiencies that came with it. Second, Japan by policy restricted its arms exports, a restriction that has grown stricter throughout the postwar period. This minimises the likelihood that the US would face its own equipment in the international marketplace or, worse, in the hands of a potential adversary. Third, even though Japanese companies have moved up the scale in terms of research, development and production capabilities, they have yet to master the art of systems integration sufficiently to challenge established weapons producers (although this is one of the most important objectives of the current FSX program).

This is not to say that Japanese firms have not tried. Indeed, just the opposite is true, with some successes noticeable in a number of areas. Japanese firms have attempted to assimilate foreign technology, modify it appropriately, and repackage it as an indigenous product. In many cases, the imported technologies, components and systems have provided the standard by which industry could judge its own progress and set its own objectives. Knowledge of US systems has assisted in the development of a number of domestic alternatives, although their effectiveness compared with their imported predecessors is debatable. In some instances, individual components and subsystems have been developed systematically, replacing their imported counterparts until the imported system resembles its original only in superficial appearance. This has transpired in the case of F-4 Phantom fighters, whose internal electronics have been replaced by indigenous components almost entirely. From the outside, the aircraft still resembles the aircraft license-produced from the US McDonnell-Douglas Corp., but on the inside, it now has become a virtually made-in-Japan aircraft. In other cases, whole substitutes have been developed, reflecting near comparable performance characteristics and objectives, but produced entirely by domestic firms.[62]

8.6 Benefits to the US: Short Term Profits

If offsets have been so disadvantageous to US industry and government, why do they remain in effect? Commercial considerations have been paramount in the

decisions of US *companies* to enter into co-production. Profits have been lucrative. Representative is the experience of the Raytheon Co., the designer of the Patriot missile, which stands to realise at least $776 million from its co-production deal, mostly clear profit since the US government funded the development of the missile.[63] Like other co-production programs, the Patriot program in Japan is likely to generate additional opportunities for system upgrades and thus additional income for Raytheon.

License fees and the lucrative upgrade business have rivalled or surpassed the profits companies could make through off-the-shelf sales without posing any problems associated with expanding production for comparatively small orders. In addition, US firms have been dissuaded from holding out for direct sales by their assessment of several factors: the Japanese government's commitment to progressive co-production of American weapons rather than purchase; the parallel policies of NATO governments favouring co-production; the occasional possibility of Japanese co-production deals with European competitors; and Japan's growing capabilities to produce similar, if less technologically sophisticated, systems without foreign participation.

8.6.1 Short Term Costs and Long Term Interests of Offsets to Japanese Industry and Government

The importance of the defense buildup strategy to Japanese industry — and government — is demonstrated by the willingness to pay a significant premium for local production. The Office of Management and Budget estimated in 1986 that Japan will spend approximately 55 to 80 per cent more by producing the Patriot system locally than it would have by buying the same number of units directly from Raytheon.[64] Cost differences in the US and Japanese produced F-15s have been placed at similar levels (although these may be suspect, given the life cycle costs associated with the program to Japanese buyers). The JDA looks to domestic production to increase its military prowess, provide a hedge against the decline of its principal ally and assure an autonomous military technology base. Industry sees domestic sales opportunities, export potential and bargaining leverage with foreign firms. Greater capabilities spurred industry and government ambitions for heavier reliance on indigenous development of new systems to realise these objectives. And as other missile development programs have demonstrated, neither government nor industry is likely to give up on a program once it has established bureaucratic momentum — witness the TAN-SAM program. The momentum and the leverage to continue offset concessions from the US have stalled over the last two years, leaving future strategies and objectives in doubt.

8.7 The Issue of Costs

On the surface, these programs have come at a cost. Most overseas estimates have concluded that the limited production of foreign systems in Japan has come at a penalty of at least 50 per cent in most systems, sometimes well beyond double the costs if they had been imported. The Nike-Ajax produced domestically, for example, would have cost 1.4 times the off-the-shelf purchase price had it been produced locally. More recently, US estimates have placed the cost of producing licensed versions of the US F-15 and F-16 (in the form of the FSX fighter support aircraft) at twice the US price. Once locked into a program, Japanese buyers, while not necessarily at the mercy of the US vendor, nevertheless have little room for negotiation and leverage. The ultimate costs of F-15s purchased from McDonnell-Douglas in fact approached the 2:1 ratio that the company claimed would result if the aircraft were license produced.

Japanese sources dispute these figures, sometimes with American evidence to support their claims. Hall and Johnson, for example, concluded that if economies of scale, finance and other factors were taken into account, Mitsubishi Heavy Industries probably could have manufactured the F-104 at a 10 to 25 per cent *saving* due to the company's relative efficiency vis-a-vis the US manufacturer (a theme articulated numerous times in commercial markets) and fewer manhours due to the effective absorption of Lockheed's learning from the program.[65] Japanese sources claim that from the standpoint of life cycle costs, licensed produced aircraft are no more expensive than their US counterparts (which also spend far more time on the ground than their Japanese counterparts in maintenance and repairs). When adding in costs associated with licensing the system, Japanese sources claim that local development and production may in fact be far less expensive.

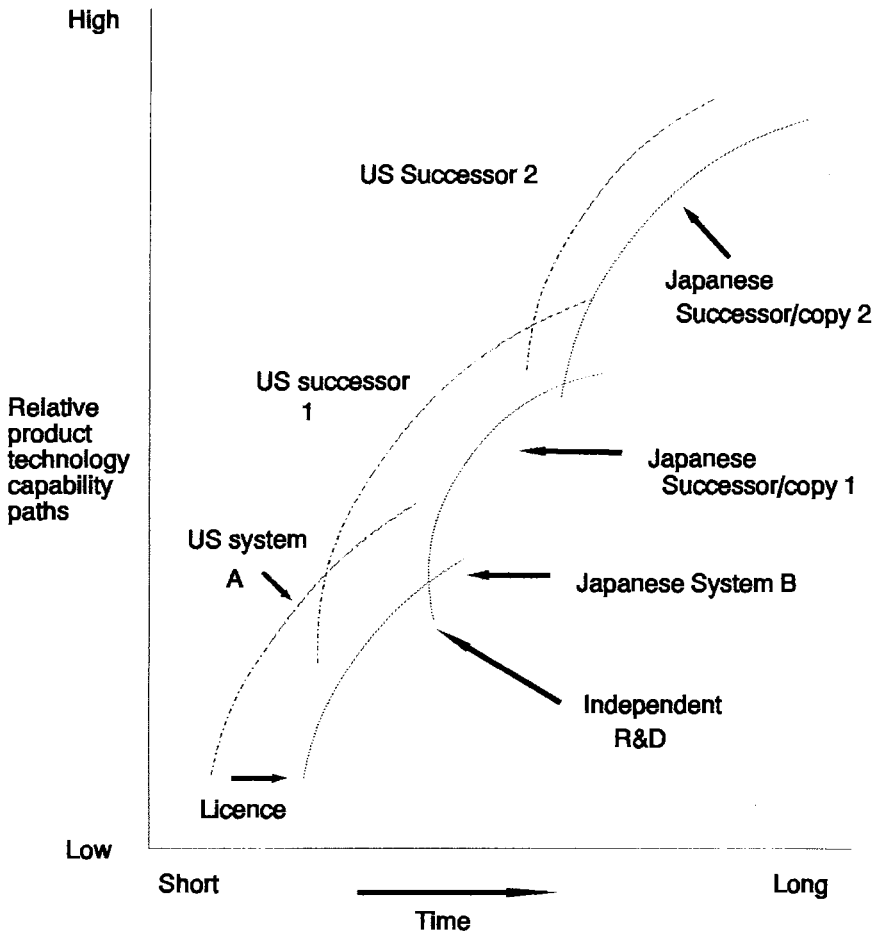
8.8 Developing Competitors: The Dilemmas of Cooperative Programs

Critics of cooperative programs between the United States and Japan insist that they help stimulate the development of competitors through transferring US technology to highly competent and committed Japanese firms that use such technology for development of indigenous weapons. Proponents of such programs, however, have insisted that at least a degree of technology transfers are needed to close a sale. Without such offsets, they insist, Japan would take one of three alternative courses: 1) wait it out until US firms are more forthcoming with transfers; 2) go to alternative suppliers (when feasible), particularly European firms, which are known for their more generous conditions of sales;

or, 3) develop domestic development programs — perhaps with the assistance of other countries — until a satisfactory system is developed.

The progression of US defense technology development to Japanese offset and finally the evolvement of Japanese indigenous systems is illustrated in Figure 2. This details the improvement pattern of Japanese technological

Figure 2: Japan's Offset Domestic Technology Development Cycles



capability through licensing and 'mirror-image' R&D programs. Japan's technology emulation efforts close the gap with the US/West in general, but by that time a US successor system has been developed, obliging the Japanese to play catch-up again. This process continues as long as Japan's defense budgets, and particularly, those of procurement and development, expand. Up until the 1990s, Japan's technology gap with the West was becoming wider. The trend is now uncertain and may even reverse, given that the contemporary public finance scenario is one of shrinking budgets, major programs ending and replacement decisions being delayed.

The dilemmas of coproduction and other programs involving a substantial degree of technology transfers are illustrated in Raytheon's experience with Japan in the Sidewinder air-to-air missile. Japan sought Raytheon's Sidewinder AIM-9B in the 1970s at a time when domestic development of a similar guidance system was a high priority. When it became evident that the Sidewinder guidance package was not available for release to Japan, the JDA embarked on a development program that resulted in the AAM-1, a Sidewinder replacement that was to be utilised on domestic F-1 fighter support aircraft. The AAM-1 was in line to become JDA's favoured air-to-air missile, replacing the US Sidewinder entirely. But according to one analysis of the Japanese defense industry, the domestic guidance development was temporarily suspended once the US indicated to the Japanese government that the more advanced Sidewinder AIM-9L would be available for local production in Japan. This option appealed to the JDA because it would give greater access to the Sidewinder guidance and would thus assist the long term goal of developing domestic counterparts. MHI completed an agreement with Raytheon to license produce the Sidewinder in Japan in 1980, and the JDA shifted its infrared guidance efforts from AAM-1 production to further research in the TRDI.[66]

MHI experience in Sidewinder manufacturing has now found its way into these development efforts. However, if the US government and Raytheon had not agreed to make the more advanced AIM-9L available for local production, it is also safe to assume that the United States could easily have been closed out of the market for infra red guided air-to-air missiles altogether since both Japanese industry and government appeared satisfied with the progress of its AAM-1 program until a clearly superior alternative was available.

The scenario is one that has been repeated in other sectors as well. A US firm develops a system, licenses part of it out to a Japanese producer, and ultimately ends up partially or totally dependent on the Japanese producer, who by this time has become the more efficient and less expensive producer of the component or complete system. Even though licensing technology might have helped retard domestic industry development in some cases, it also appears to be

contributing to competitive pressures in the long run. If this situation is widespread and continues unabated, then it does indeed cast a negative light on cooperative defense programs because they would be contributing to the strengths of a competitor at the expense of US industry. Furthermore, as more efficient and less expensive producers abroad offer components to US firms, it will be increasingly difficult for the United States to continue pressure on the Japanese government to refuse exporting military components, especially if US suppliers do not exist or are incapable of meeting demand for the component in question. The next logical step in this chain would be US encouragement that Japan make an exception in its arms export rules for the United States only, but that would go far in setting the precedent necessary to allow a more active presence by Japan in international arms markets.[67]

It is more likely that government and industry have been interested in military offsets for their benefits in *military* production. Throughout the 1980s, the Japanese government was in the process of developing a full line of advanced precision guided munitions, not simply a single missile system. The underlying strategy was to enhance domestic industrial capabilities and reduce dependency on the United States for future weapons programs. It is in these areas that the military specifications satisfied by offset concessions are likely to be immediately applicable.

The same conclusion can be drawn for transferring F-16 technology to Japanese industry for the FSX program. Some critics of the FSX project believed that F-16 technology would make its way to Japanese commercial aircraft development and production programs. Once again, there may be diversions of technology from FSX to non-military efforts, if only because of the commonality of production facilities, workers and managers. However, Japanese firms, MHI in particular, already have numerous opportunities with US commercial aircraft producers that allow considerable transfers of technology directly to potential competitors. As one study noted, 'Boeing has pursued a course that will materially and directly transfer technological capability to the Japanese civilian aerospace industry.'[68] Therefore, if the FSX project aids the domestic commercial aircraft industry in Japan, it will only supplement far more extensive programs already underway and likely to continue for years to come. F-16 transfers *are* directly applicable to industry's ability to design, manufacture and integrate another military aircraft, however.

This is not to deny Japan's interest in military technology transfers for their potential commercial benefits. But the wide variety of reasons for this interest in other military technology as described in the case studies bears repeating. For example, from a government policy standpoint, an additional thrust is on generating domestic sources of advanced technology in military systems and for

finding additional outlets for technological advances generated in the commercial sector — the 'spin-on' theory of defense production.[69] By utilising new or existing commercial technologies for other applications, military production can thus become a means of recouping research and development expenditures as well as a means of reducing unit costs in civilian sectors, but this depends on buoyant defense budgets — an unpredictable factor in the 1990s.

Regarding flowback of Japanese technologies to the US from Japan, it should be noted that the US government has been highly sceptical of Japan's willingness to release its own advanced technologies to the US.[70] Recent developments notwithstanding (such as the flowback of Japanese improvements on P-3C technologies to the US), it is safe to say that such scepticism remains strong.

Japanese analysts have noted many of the fundamental problems perceived in US-Japan technology transfers.[71] As a nation that depended heavily on technological inputs for growth and development, Japan historically and increasingly in the modern day has viewed technology as the key to the country's economic future, assets not to be distributed freely. Throughout the postwar period, on the other hand, the United States viewed technology transfers in a different light, more often than not in the context of its own military superiority *vis-a-vis* the former Soviet Union and as a commodity that was to be shared with its allies in the name of united deterrence of that perceived threat.

Hall and Johnson demonstrated that, at least for one major program and period of time, Japan was able to absorb foreign technology cost effectively, producing major systems at a lower cost than would have been possible through off-the-shelf purchases while enjoying the benefits to the economy as a whole derived from extensive technology transfers. Similar benefits were derived from participation in other programs, such as the Patriot surface to air missile program, F-15 and others (although the economics involved in those programs are less definitively determined than by Hall and Johnson for the F-104 program). Japan may be unique in this regard for several reasons. As noted earlier, the country was able to benefit in part from these transfers due to a pre-existing workforce with high skill and education levels, as well as mobility, flexibility and lower wage levels. US technology transfers have been steady and ramped up over the decades, moving to increasingly more advanced levels of production. Japan has benefitted from a virtually unrestrained flow of technology, in the sense that it has been steady and consistent over a nearly fifty year period, far more so than other Asian nations and many European ones. The United States consistently has treated Japan as an exceptional case from a policy standpoint, offering it production and technology offsets for advanced systems that it would not offer to other allies. For example, Japan remains the *only* country in the world to produce the F-15 outside of the United States, a remarkable exception

that is likely to remain unchanged for the history of the program. If Japan has been able to benefit from military offsets, it certainly has been due in part to the consistency and scale of such transfers.

8.9 The Future

The cost-effectiveness of offsets has come under scrutiny in Japanese budget drafting circles as part of a broader re-evaluation of military spending in the country. A number of factors have combined to make military production — and therefore offsets that accompany such production — less attractive than it was in the 1970–1990 period. These factors include far higher capital costs in Japan (compared with periods of negative real interest rates during Japan's 'bubble' period of economic growth); low profitability of most major heavy industrial companies; the greater transparency of military contracts in Japan (making it far more difficult to disguise overruns, under-the-table payments, etc.)

Part of the increased cost from defense programs can be attributed to the process through which the defense buildup has been funded. The JDA does not make progress payments like the US system for procurement and major R&D programs. Instead, marginal down payments are made, with the bulk of payments completed near or upon delivery of a system. This has enabled the JDA to have its cake and eat it, too, in that it could fund a substantial military buildup while maintaining total spending under 1 per cent of GNP, a political necessity in the postwar environment. One reason defense contractors could do this was because real interest rates and other capital costs were so low during the postwar period. Thus, companies and the JDA could afford the costs associated with delayed payments because they were marginal.

Under current conditions, money costs make this delayed payments scheme far more expensive and thus less attractive to both industry and government. This may be one (additional) reason that the Ministry of Finance is less than enthusiastic about funding more procurement and R&D programs (the ministry has a philosophical bias against defense spending in general).

Arthur Alexander predicted the ultimate decline of Japanese defense spending because of these and other economic, technological and experience factors.[72] Alexander concluded that defense acquisition and R&D expenditures were likely to cool off in the 1990s and that if the government was determined to pursue greater autonomy in defense production, it would face unexpected (and, by implication, unacceptable) cost increases. He also concluded that while Japanese industry has been adept at adapting US systems and developing 'indigenous' counterparts, Japan would remain dependent on the US for advanced systems for

years to come. Of course, this also implies that Japan will continue to look towards the US for offsets in cooperative defense programs (and that the United States will maintain its own pattern of developing advanced systems, subsequently making the technology available to its allies).

Alexander has some strong points and arguments, although they must be balanced against the dynamics of the procurement and policy process in Japan. Countervailing pressures remain that will force continued consideration of importation and indigenous development of advanced weapon and military systems for the foreseeable future. Among them are:

- Industry's continued interest in cost-effective importation of advanced technologies *per se* (the Samuels argument, although not quite as extreme)
- US pressures to assume greater burdens in defense
- Uncertainties surrounding the threat environment in the Asia/Pacific region
- The need to update and expand certain capabilities in response to new roles and missions (particularly UN peacekeeping)
- The right wing, which, while not the force that it once was, nevertheless is an ever present thorn in the side that continues to press for a strong Japan
- Potential political changes, resulting in a leadership more amenable to defense spending.

So, there are factors that favour continued, limited production of defense systems. In the short run, the situation will revert to that characterising the mid-1970s: occasional coproduction of certain systems, with no new, dramatic crises comparable to the FSX. The MLRS agreement reflects that trend, and it will likely remain that way for the coming procurement cycle. A further consideration is whether Japan will be able to diversify sources for new equipment in the future, minimising its dependence on the United States. US businessmen in Tokyo like to complain of having their hands tied in comparison with their European counterparts, and point alarmingly to the sale of three BAe aircraft to the Maritime Self-Defense Forces as evidence that the US is losing its foothold in Japan. This is debatable, for several reasons. The first is the necessity to maintain the security treaty, thus justifying (primarily) US purchases. The second is that most major programs are completed. Fielded systems means maintenance and upgrades, services that are likely to be provided by *domestic* firms, not US companies (or European ones, for that matter). Third, the high tech, 'sexy' systems Japan seeks remain in the US. Even if EF2000 literally took off, Japan would be more interested in the F-22 because it represents the best technology in the field. Thus Japan is more likely to be interested in funding a limited R&D

program in comparable technologies to give government negotiators leverage in gaining access to the F-22 somewhere down the road.

What is interesting is that there remains circles that continue to promote concepts such as small aircraft carriers, next generation aircraft programs (comparable to the US F-22 program), and other costly, very advanced commitments (MHI and the JDA continue to promote the idea of codeveloping a Hawk replacement, for example, and the government remains interested in advanced ballistic missile defense concepts). Some of these ideas are being circulated on behalf of the JDA by industry, clearly with industry's profit motives evident as well. Proponents of an expanded defense research, development, production and deployment capability remain within the country. The next few years should indicate whether they will continue to make these rumblings 'underground' for the next decade or so, or whether they will emerge as the mainstream in defense spending trends over the same period.

What is certain is that technology offsets will continue to play an important role in developing Japan's defense industrial base. The technology development strategy will continue to be the successful incrementalist approach followed to date, irrespective of whether defense technology absorption is driven by: ideology/philosophy; the continued process of 'catching up' with the West; efforts to foster indigenous industrialisation; the need to overcome permanent/sporadic technological deficiencies of the Japanese economy; or, as a short term benefit to Japan, to offsetthe political headaches associated with the US alliance. In conclusion, then, it can be stated with conviction that Japan's long-standing offset philosophy, supported by contemporary policy initiatives, has fostered a strong, technologically advanced and increasingly self-reliant defense-industrial base. In many respects, Japan's postwar 'model' of defense industrialisation is unique.

There is little doubt that, for instance, government promotion of dual-use strategic industries, R&D policy and, most importantly, the culturally intangible factor that drives Japan to seek technological dominance, have all contributed to the gradual but inexorable achievement of its defense industrial ambitions. Although Japan's defense budget in the final years of this decade will continue to be squeezed, defense production capability will not diminish; rather the opposite will occur, sponsored by the technological synergies (particularly in the electronics industries) of civil-military convergence. The defense environment in Japan, as elsewhere, has changed tremendously, but its commitment to domestic defense production has not abated. There will continue to be a Japanese defense industry in its own unconventional manner, and once major programs are completed (especially the FSX) the 'offset-development-diffusion' technology cycle easily could resume, post-2000.

Endnotes

1. Appreciation is expressed to Gregg Rubinstein, Arthur Alexander, Julia Burn and Mike Wright for comments on earlier drafts. Thanks are also due to Luisha Gulliver for assistance with the production of Figure 2.
2. US Congress, Office of Technology Assessment, **Arming Our Allies: Cooperation and Competition in Defense Technology** OTA-ISC-449 (Washington DC: US Government Printing Office, May 1990), p. 104.
3. See, R. Drifte, **Arms Production in Japan: The Military Applications of Civil Technology,** (Boulder, Col.: Westview Press, 1986).
4. Ibid., p. 3, and see also, 'Japanese Defense Industrialisation', (ed.) by A. Edgar and D. Haglund in R. Matthews and K. Matsuyama, **Japan's Military Renaissance**?, Macmillan (1993) pp. 138–9.
5. D.B. Friedman and R.J. Samuels, **How To Succeed Without Really Flying: The Japanese Aircraft Industry and Japan's Technology Ideology,** The MIT Japan Program, Center for International Studies, MIT (1992) p. 7.
6. Ibid., p. 8.
7. Cited in, M.J. Green, **Kokusanka: FSX and Japan's Search For Autonomous Defense Production,** The MIT Japan Program, Center for International Studies, MIT (1992) p. 25.
8. See, Shintaro Ishihara's controversial statements in his book, **The Japan That Can Say No,** Simon & Schuster (1991). Mr Sakurauchi spoke in January 1992 of a global economic race, noting disparagingly that the US acted as Japan's subcontractor.
9. M.J. Green, *op.cit.*, pp. 34 and 41.
10. D.B. Friedman and R.J. Samuels, *op.cit.*, p. 8.
11. On this point, see J. Richard Walsh, 'Technonationalism in US-Japanese Security Relations: The FSX Controversy', **Armed Forces & Society,** vol. 19, no. 3 (Spring 1993) pp. 377–91.
12. Interview with Takashi Nishioka, Head of Mitsubishi's Aerospace Business, **Jane's Defence Weekly,** (April 24, 1993), p. 32.
13. D.B. Friedman and R.J. Samuels, *op.cit.*, p. 23.

14. For a discussion of this point, see Arthur Alexander, **Of Tanks and Toyotas: An Assessment of Japan's Defense Industry,** RAND N-3542-AF (1993) p. 21.

15. 'How Britain's Aircraft Industry Has Come Close To Stalling Speed', **The Times** (July 22, 1993).

16. See US Department of Defense, **Critical Technologies Plan,** Committee on Armed Services, US Congress (March 15, 1990).

17. D.B. Friedman and R.J. Samuels, *op.cit.*, p. 39, fn. 105.

18. As a proportion of national output (2.9 per cent) Japan's R&D spending is now the highest in the world. See 'Public Paucity in the Land of Plenty', **Financial Times** (September 3, 1991).

19. M.W. Chinworth, **Inside Japan's Defense,** Brassey's (US) Inc. (1992) p. 39. It should be noted that most license fees (which include payments paid by Japanese subcontractors to US subcontractors or subsystem/component licensed production, as well as R&D recovery charges that were levied by the US government until recently) to Japan are included in procurement contracts, not as part of the R&D budget, since they have been incurred in coproduction or licensed production programs. Any fees associated with technology transferred to a research or development program would be included as part of the R&D program's expenses, but most of these expenses have been marginal until the advent of the FSX program. Prior to this, the costs had been limited usually to those associated with transfer of a data exchange package or comparable set of documents/samples. Fees for various aspects of the F-16 that have been charged by General Dynamics/Lockheed as part of the FSX joint development program come under the research budget for Japan, since this budget funds the entire program. Some suspicions have been raised that other parts of the budget have absorbed similar costs in the past as well, and may do so again in the future, depending on the nature of the program. For example, it is speculated that the computer upgrade program for base defense (the so-called BADGE system) was covered entirely under facilities budgets, not under procurement contracts. If that were the case, any royalty or license fees paid by Japanese contractors/government to foreign companies under that program for technology would have also fallen under the facilities budget.

20. Ibid., p. 44.

21. Ibid., pp. 35–37.
22. K. Ebata and P. Beaver, 'Japan To Build Own Design Helicopter — OH-X Project', **Jane's Defence Weekly** (September 7, 1991) p. 407.
23. Japan Defense Agency, **Defense of Japan 1970** (Tokyo: Japan Defense Agency, October 1970), p. 33. The first defense white paper was largely the work of the then JDA Director General and later Prime Minister Yasuhiro Nakasone.
24. Japan Defense Agency, **Defense of Japan 1976** (Tokyo: Japan Defense Agency, 1976), p. 125.
25. Japan Defense Agency, **Defense of Japan 1976** (Tokyo: Japan Defense Agency, 1976), p. 126.
26. Japan Defense Agency, **Defense of Japan 1980** (Tokyo: Japan Defense Agency, 1980), p. 183.
27. Japan Defense Agency, **Defense of Japan 1980** (Tokyo: Japan Defense Agency, 1980), p. 187.
28. Japan Defense Agency, **Defense of Japan 1988** (Tokyo: Japan Times, 1988), p. 135, 136.
29. Japan Defense Agency, **Defense of Japan 1987** (Tokyo: Japan Times Co., Ltd., 1987), p. 140.
30. Japan Defense Agency, **Defense of Japan 1988** (Tokyo: Japan Times Co., Ltd., 1988), p. 136.
31. Japan Defense Agency, **Defense of Japan 1989** (Tokyo: Japan Times Co., Ltd., 1989), p. 184.
32. Japan Defense Agency, **Defense of Japan 1991** (Tokyo: Japan Times Co., Ltd., 1991), p. 89.
33. Japan Defense Agency, **Defense of Japan 1992** (Tokyo: Japan Defense Agency, 1992), p. 97.
34. Japan Defense Agency, **Defense of Japan 1992** (Tokyo: Japan Defense Agency, 1992), p. 83.
35. The 1976 National Defense Plan Outline details the basic force structure and policy goals behind Japanese defense budgets. It assumed a continued state of detente between the United States and the Soviet Union as one of its fundamental tenants. Even though tensions between the two countries accel-

erated then reduced between 1976 and the present, defense planners in Japan argue that reductions in present forces should not be made since its force levels are just now achieving the levels proposed in 1976, when detente was a given. Instead, planners feel that present forces should at least be supported at their present size and level of capability.

36. US Congress, Senate Committee on Armed Services, "United States-Japan Security Relationship — The Key to East Asian Security and Stability." Report of the Pacific Study Group, 96th Congress, 1st session. (Washington DC, US Government Printing Office, 1979), pp. 22–27.

37. Asahi Shimbun (Tokyo), March 28, 1981; the London **Times**, March 31, 1981. See also the statement by Assistant Secretary of Defense Francis West before the House Subcommittee on Asian and Pacific Affairs, March 1, 1982.

38. Ibid., West's statement, March 1, 1982.

39. Japan Defense Agency, **Defense of Japan 1993** (Tokyo: Japan Times Co. Ltd.), p. 283.

40. Japan Defense Agency, **Defense of Japan 1979** (Tokyo: Japan Defense Agency, October 1979), pp. 36–37.

41. US Congress, Office of Technology Assessment, **Global Arms Trade: Commerce in Advanced Military Technology and Weapons**, OTA-ISA-460, (Washington DC: US Government Printing Office, June 1991), p. 8.

42. US Strategic Bombing Survey, **The Japanese Aircraft Industry**, Washington DC, 1947, p. 4; quoted in W.W. Lockwood, **The Economic Development of Japan** (Princeton, NJ: Princeton University Press, 1954), p. 331.

43. Daniel L. Spencer, "Military Transfer: International Techno-Economic Transfers via Military By-Products and Initiative Based on Cases From Japan and Other Pacific Countries," Defense Technical Information Center, Defense Logistics Agency, AD6606537, March 1967, pp. 32–35.

44. Daniel L. Spencer, op.cit., p. 54.

45. Society of Japanese Aerospace Companies, Inc., **Aerospace Industry in Japan, 1987–88**, pp. 3–13.

46. US General Accounting Office, **US Military Co-production Programs Assist Japan in Developing its Civil Aircraft Industry**, p. 1.

47. Michael W. Chinworth, "Industry and Government in Japanese Defense Procurement: The Case of the Patriot Missile System," MIT-Japan Science and Technology Program Working Paper 88–04, p. 21.

48. Chinworth, "Patriot Missile System", pp. 24–25.

49. Reinhard Drifte, "Japan's Growing Arms Industry," Geneva, P.S.I.S. Occasional Papers Number 1/85, 1985, pp. 75–76.

50. US General Accounting Office, "US Military Co-production Programs Assist Japan in Developing its Civil Aircraft Industry," p. 7.

51. Japan Defense Agency, Chotatsu Jisshi Hombu no Gaikyo (Overview of the Central Procurement Office), July 24, 1989, p. 9. There are 2,287 contractors registered with the CPO, of which 1,401 — slightly over 61 per cent — are classified as small and medium sized businesses.

52. Japan Defense Agency, **Defense of Japan 1988** (Tokyo: Japan Times Co., 1988), pp. 138–139.

53. "Japan Uses SSM-1 Expertise to Develop Cruise Missile," **Aviation Week**, March 21, 1988, p. 59.

54. **Boei Nenkan 1989**, p. 480. This figure might understate defense's contribution to the overall economy because of the degree of dual use technologies and products utilised for JDA purposes, particularly in the electronics sector.

55. **Japan Company Handbook** (Tokyo: Toyo Keizai Shimposha, 1988), p. 726; Jieitai Sobi Nenkan (Tokyo: Asagumo Shimbunsha, 1989), p. 524, 526.

56. **Nikkei News Bulletin**, December 30, 1988, "Fujitsu to Boost Defense-Related Business." For additional information about the Japanese defense industry, see Michael W. Chinworth, "Japan's Defense Industry," **JEI Reports**, No. 1A, January 9, 1987 (Pt I) and No. 7A, February 20, 1987 (Pt II).

57. Richard J. Samuels and Benjamin Whipple, "Defense Production and Industrial Development: The Case of Japanese Aircraft," MIT-Japan Science and Technology Program Working Paper 88–09, pp. 3–4. In addition to collaboration on military aircraft, Japanese firms have entered into joint ventures with the Boeing Co. for the Boeing 7J7 and the V-2500 international aircraft engine consortium led by Rolls-Royce and Pratt and Whitney. Nevertheless, the commercial aircraft industry remains relatively small compared to US and Western European counterparts.

58. This was a hotly disputed issue. For a range of views, see Richard F. Grimmett and Larry A. Niksch, "FSX Fighter Agreement With Japan," CRS Issue Brief, updated August 22, 1989; John D. Moteff, "FSX Technology: Its Relative Utility to the United States and Japanese Aerospace Industries," CRS Report for Congress, April 12, 1989; "US-Japan FSX Codevelopment Program," prepared testimony of Frank C. Conahan, Assistant Comptroller General, National Security and International Affairs Division, General Accounting Office, before the Committee on Science, Space and Technology, May 11, 1989; Michael W. Chinworth, "Strategic Technology Management in Japan: Commercial-Military Comparisons," **ONR Scientific Bulletin**, April–June, 1989, pp. 41–58.

59. See, Samuels and Whipple, *op.cit.*

60. See, M.J. Green, 'Kokusanka: FSX and Japan's Search For Autonomous Defense Production', **MIT-Japan Science and Technology Program Working Paper 90–09**, May 1990.

61. See, G.R. Hall and R.E. Johnson, "Aircraft Co-Production and Procurement Strategy," RAND Report R-450-PR, May 1967.

62. For details of upgrade programs, refer to various annual issues of Japan Defense Agency **Defense of Japan**, (Tokyo, Japan Times Co., Ltd.) and **Jieitai Sobi Nenkan** (Tokyo: Asagumo Shimbunsha).

63. US Department of the Army; Office of Management and Budget, "Second Annual Report on the Impact of Offsets in Defense-Related Exports, December 1986, pp. 11–29.

64. OMB, December 1986, pp. 11–29.

65. Hall and Johnson, *op.cit.* The authors concluded that "in fact, no premium was paid. The Japanese obtained the planes at a lower cost than they would have paid in the United States" (p. 157). Among the reasons cited for this situation were Japan's (at the time) lower labour rates. This advantage has long since evaporated.

66. Koichiro Yoshihara, **Nihon no Heiki Sangyo** (Tokyo: Shakai Shisosha, 1988) pp. 124–125; 130–131.

67. The Office of Technology Assessment examined the proliferation of weapons producers due to technology transfers in its report **Global Arms Trade**, OTA-ISA-460, (Washington, DC: US Government Printing Office, June 1991).

68. **Arming Our Allies**, p. 82. For a more extensive discussion of the pitfalls and successes in civil-military integration, see **Arming Our Allies**, pp. 77–83; Jacques S. Gansler, **Affording Defense** (Cambridge, MA: MIT Press, 1989), pp. 273–282, 312–313.

69. **Nihon no Sentaku** (**Japan's Choices**) (Tokyo: Ministry of International Trade and Industry, 1988), Chapter 3; **Defense of Japan 1976**, pp. 95, 125–126; **Defense of Japan 1988**, pp. 136–138; **Nihon no Sentaku**, pp. 112–116.

70. Comments by General Accounting Office on OMB, December 1986 report, contained in OMB, December 1986, Appendix C, p. C-3.

71. See, for example, Naruhiko Ueda, "Gijutsu Kokuboron," **Kokubo**, July 1990, Vol. 39, No. 7, pp. 56–60.

72. See, Arthur Alexander, *op.cit.*